Brine Plot and Data Entry Java Applet

by John R. Victorine

Introduction

The Brine Plot web app has 2 sources for importing well data, 1) the user's PC or 2) the Kansas Geological Survey (KGS) ORACLE Database. The Brine Plot & Data Entry Web Application was created to provide a means to manually insert the brine data or to import brine data from the Kansas Geological Survey Database or to import/export brine data from/to ASCII Files, i.e., Log ASCII Standard (LAS) version 3.0, Comma Separated Values (CSV) and Extensible Markup Language (XML) Files. The web application also provide a number of standard brine plots to present the most common Anions and Cations as a Piper Diagram and Brine Sample Plot, which displays a Stiff and Collins Bar Diagrams.

Stiff Diagram: The Stiff diagram is a graphical representation of brine fluid, first developed by H.A.Stiff[1] in 1951. It is usually plotted without the labeled axis and is useful making visual comparison of waters with different characteristics. The patterns tend to maintain its shape upon concentration or dilution.

Collins Bar Diagram: Collins diagrams (Collins 1923)[2] present the relative major ion composition in percent milli-equivalent per liter. Both the cations and anions have a total of 100 %. The bar diagram used in the Brine Sample Plot, the cations are plotted on the left and the anions are plotted on the right.

Piper Diagram: The Piper diagram plots the major ions as percentages of milli-equivalents in two base triangles. The total cations and the total anions are set equal to 100% and the data points in the two triangles are projected onto an adjacent grid. This plot reveals useful properties and relationships for large sample groups. The main purpose of the Piper diagram is to show clustering of data points to indicate samples that have similar compositions.

Concentration Plot: Box and whiskers plot showing the distributions of the measured concentrations. Boxes extend from the 25th to the 75th percentile, horizontal bars inside the boxes represent the median and the mean, vertical line to the 5th and 95th percentile and the maximum and minimum observations presented as crosses.

To access Profile go to http://www.kgs.ku.edu/stratigraphic/BRINE/. At the top of the web page there is a menu "Main Page|Description|Applet|Help|Copyright & Disclaimer|". Select the "Applet" menu option a "Warning - Security" Dialog will appear. The program has to be able to read and write to the user's PC and access the Kansas Geological Survey (KGS) Database and File Server, ORACLE requires this dialog.

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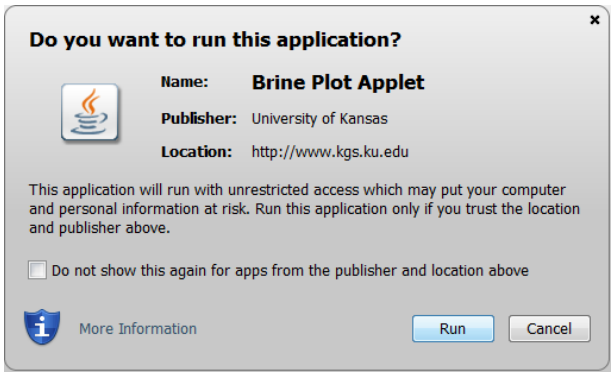
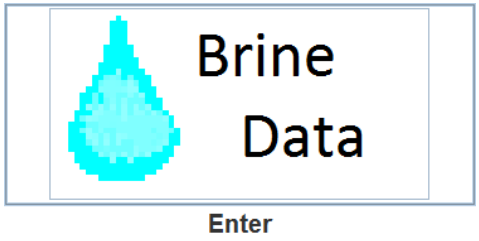
[1] Stiff, H.A., Jr., 1951, The interpretation of chemical water analysis by means of patterns: Journal of Petroleum Technology, v. 3. no. 10, p. 15-17.
COLLINS, W.D. (1923): Graphic presentation of water analysis. Ind. Eng. Chem., 15: 394 p.

[2] COLLINS, W.D. (1923): Graphic presentation of water analysis. Ind. Eng. Chem., 15: 394 p.
Piper, Arthur M.: A graphic procedure in the geochemical interpretation of water-analyses, Transactions, American Geophysical Union, Volume 25, Issue 6, p. 914-928



The program does not save your files to KGS, but allows you to access the KGS for well information that may be missing in your Kansas logs. The program does not use Cookies or any hidden software it only reads the LAS and CSV files for the Profile Session and writes a LAS 3.0 File to your PC to save your Profile Session and the well data imported. The blue shield on the warning dialog is a symbol that the Java web app is created by a trusted source, which is the University of Kansas. Select the "Run" Button, which will show the Brine Plot "Enter" Panel illustrated below,



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Loading Well Data

Click the "Brine Data Enter" Icon Button, which will show the "Load Data" Dialog. The dialog below displays an example of the Marshall 1 (15-191-00003) well data loaded from the "Load Brine Data" icon button. The radio buttons & icon buttons in the Data Source Panel assists the user in loading well data into the Brine Plot & Data Entry Applet.

KGS (Database) Panel
This panel allows the user to search the KGS Brine Data Database Table for Brine Data. The Kansas Brine Data Records date back to 1940's and 1950's. The records are not directly linked to other KGS Well Data tables, but in many cases many of the brine data information records can be tied to a well in the Well Header database table.

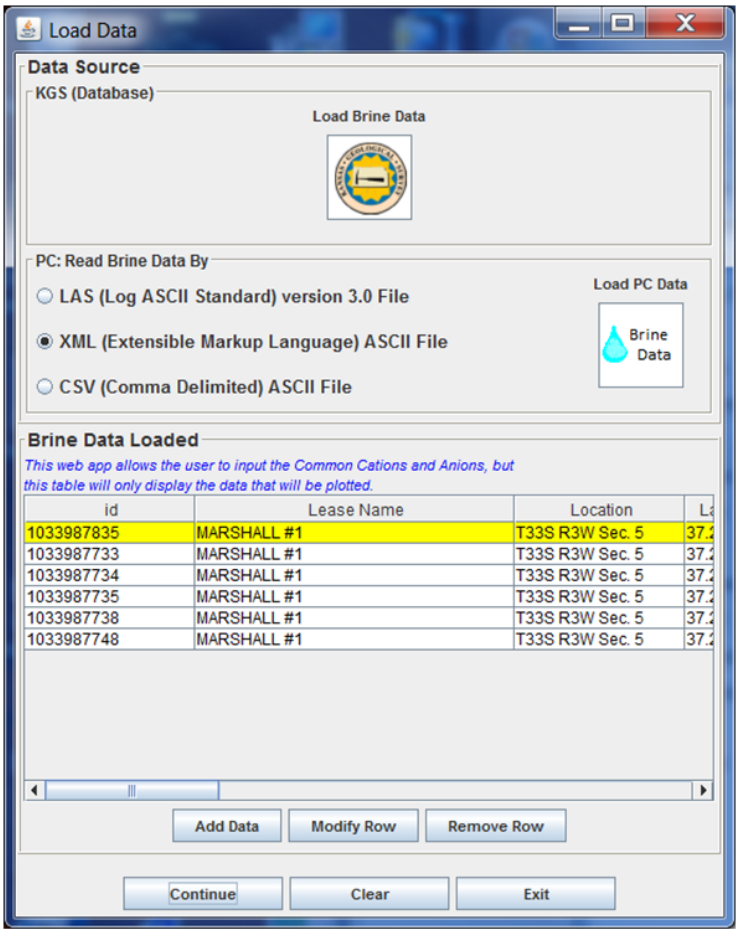
PC: Read Brine Data By Panel
This panel allows the user read in brine data by 3 file types

1. Log ASCII Standard (LAS) version 3.0
2. Comma Separated Values (CSV) ASCII File
3. Extensible Markup Language (XML) ASCII File

Brine Data Loaded Table
This panel hold the records that will be plotted (See below).

Table Buttons:
Add Data – The user can and brine data record by opening the Brine Data Entry Dialog.
Modify Row – The user can modify the brine data record by opening the Brine Data Entry Dialog with the selected brine record to be modified.
Remove Row – The user can remove a brine record from the table.

Load Data Dialog Buttons
Continue – Transfers the Brine Data in the table to the Brine Data Plot Control Dialog.
Clear – clears the Brine Data Loaded Table.
Exit – Exit Dialog.



Data Source Panel

The Data Source Panel provides two methods of importing data into the Brine Data & Data Entry Web App. The Kansas Geological Survey (KGS) Database and the user's PC. The "Load Brine Data" icon button assists the user in locating a set of brine data for selected counties in Kansas. The data are based on archived materials from the Kansas Geological Survey, with measured well data from the 1940's to 1950's. The "Load PC Data" icon button along with the 3 radio buttons assists the user to load Brine data by 3 possible ASCII File methods,

1. The Log ASCII Standard (LAS) version 3.0.
2. Comma Separated Values (CSV).
3. Extensible Markup Language (XML) Files.

The LAS version 3.0 reads a specific data section, i.e. ~IQ_Brine. The ~IQ_Brine data sections are specific to the GEMINI Tools User created data sections. The Canadian Well Logging Society created standard data sections for the LAS version 3.0 file, i.e. Log, Tops, Core, Drilling, Inclinometry, Test, and Perforations. The "IQ_" pre-pended to other data types signals the user that these types are created by/for the GEMINI Tools web apps. They follow the basic standards by the Canadian Well Logging Society for user created data sections. If the user has the ability to read the LAS version 3.0 file then they should be able to read and parse the data from the LAS version 3.0 file. The GEMINI Tools were designed around the LAS version 3.0 file for IO, but the GEMINI Tools web apps can also read other ASCII file types.

The CSV (Comma Separated Values) radio button under the "PC: Read Brine Data By" panel are expecting a general type of data presentation. Although the order of the specific data columns is not important, the "Mnemonics" of the data column is. The CSV Search Dialog will use the first two lines of the CSV file to automatically match the file column data mnemonics with the web app curve mnemonics and the units of the brine data, but if the program does not recognize the file data mnemonic then it will leave it blank and expect the user to match the file data mnemonic to the web app curve mnemonics, this will be explained later.

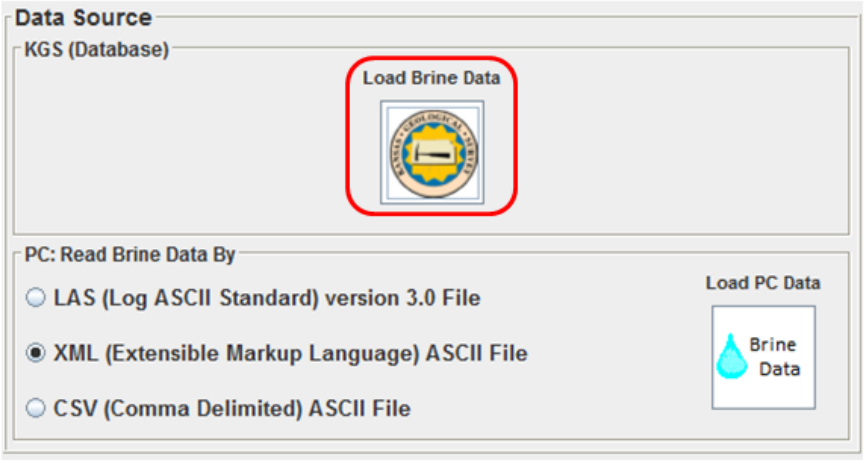
The Extensible Markup Language (XML) radio button under the "PC: Read Brine Data By" panel are expecting a specific Document Type Definition (DTD) to read the file. The DTD is used in retrieve both the data coming from the Kansas Geological Survey Database or as the output from the Brine Data & Data Entry Java Web App. The DTD will be presented later.

Data Loaded Panel

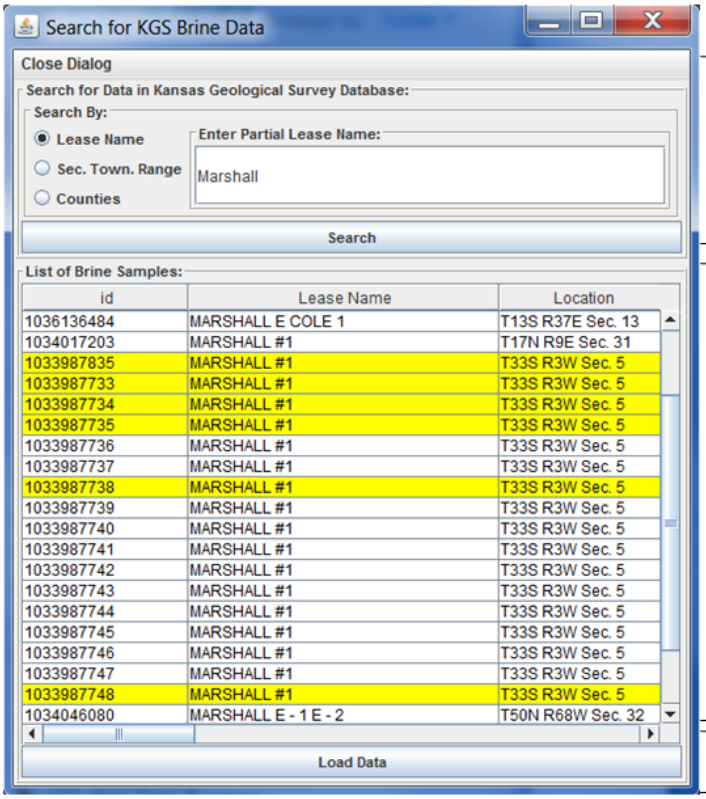
The Brine Data Loaded Panel provides a visual feedback that the brine data was loaded, by the individual samples listed in the "Brine Data Loaded" table. The user can add unknown brine data, modify the data or remove the data within the table. When the user selects the "Continue" button the data is transferred to the Brine Data Plot Control dialog, where each sample can be plotted separately or in groups.

KGS (Database) - Importing Brine Data

The Kansas Geological Survey (KGS) has a good collection of brine data stored in the ORACLE Database. In this example the user will download the well data available from the KGS Brine Database. The ORACLE Database is accessed by making Stored Procedure PL/SQL calls to the ORACLE Database from which an Extensible Markup Language (XML) data stream is created containing the well & brine data that is passed back to the web app making the request.



Left Click on the "Load Brine Data" Icon Button in the Data Source Panel of the Load Data Dialog.



Search for Brine Data in KGS Database
Search By:
•**Lease Name** – The user can search for well data by lease partial phrase, i.e. "Marshall", which will look for all wells with the phrase "Marshall" in the lease name.
• **Section Township Range** – Search for a list of Wells by a specific area.
• **Counties** – Search for a list of Brine Data within counties available in Brine Database Table.

List of Brine Data for wells that match the search criteria

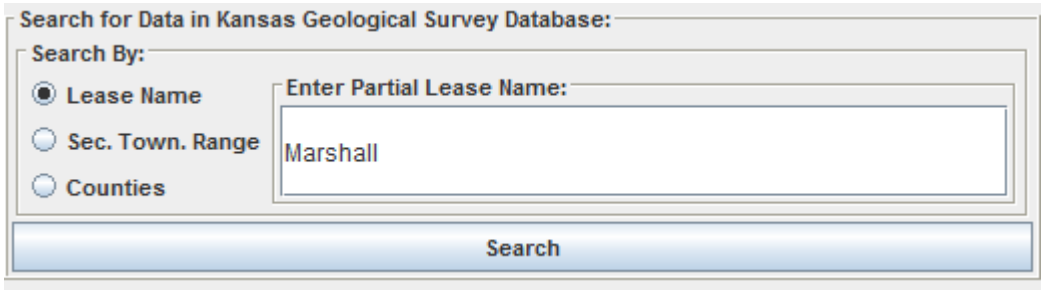
Note: the "List of Brine Samples" Table is set up to make multiple selections of data using the "Ctrl" Key on the keyboard with left click of mouse. Sell the highlighted brine samples for the MARSHALL #1 Well.

Load Data Button – transfers the selected brine data to the calling web app.

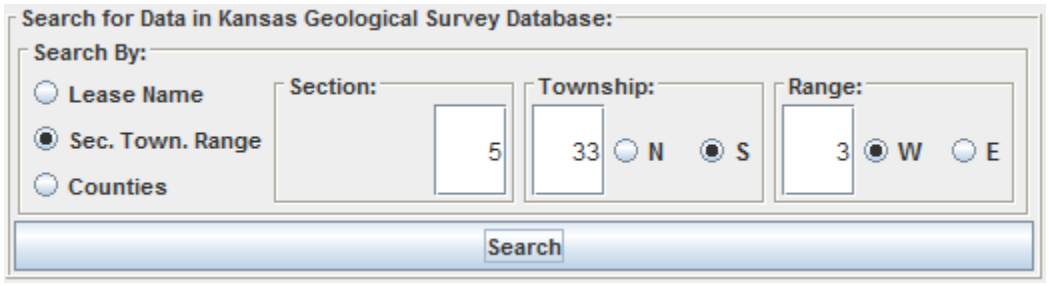
This will display the "Search for KGS Brine Data" Dialog, see above image. This dialog allows the user to search the KGS database for brine data. In this example, the well of interest will be the Marshall #1 this well contains all the brine samples that can be retrieved from the KGS Database.

As the Summary image suggests there are 3 methods for searching for the well data within this dialog,

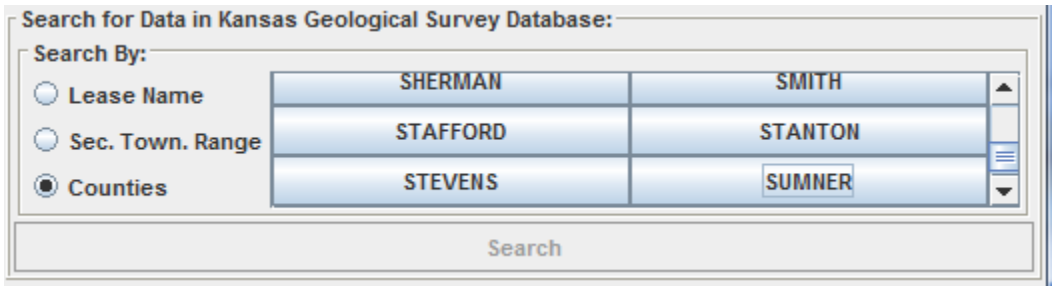
- By Partial Lease Name – The stored procedure used to retrieve the list of brine samples from the KGS Database allows the user to enter a partial phrase, in this example Marshall. The program places a '%' in front and back of the phrase and sends the request to the Database, i.e. "%Marshall%".



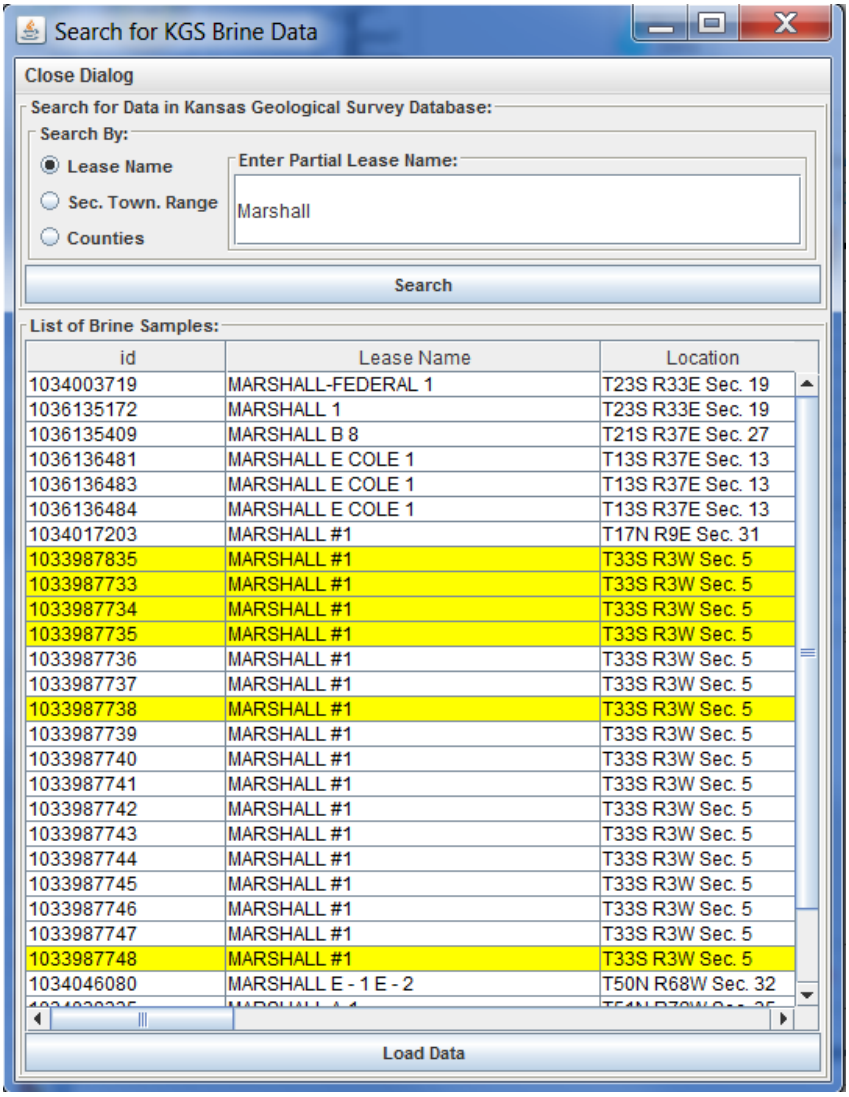
- By Township Range Section – This search is for brine samples in Kansas by, e.g. to look for the Marshall #1 brine samples, enter Section as 5, Township as 33 set the S (South) Radio button and Range as 3 set the W (West) Radio button.



- By County – This panel allows the user to search for brine samples by counties with brine data in the database table, e.g. select the SUMNER County Button.



The user only needs to enter the above data and select the "Search" Button to display the list of brine data samples in the Kansas Database that match the search criteria. In the image below the Lease Name "Marshall" was entered to search for all brine samples for wells in Kansas with the Phrase Marshall in it. The user searches through the list until they find the well of interest. In this example 6 brine samples are highlighted for the Marshall #1 well.



To download the brine data select the "Load Data" Button.

Note: The user needs to hit the "Ctrl" Key on the Keyboard at the same time as they left click with the mouse to select the brine samples for the Marshall #1. In this case there are a number of overlapping samples so only the above samples were selected for viewing. The Brine Data database table is not connected to the Well Headers Table in the Database. For most part the brine data database table holds data from the 1940's and the 1950's. The user will need to search the KGS Mast List of Oil and Gas Wells in Kansas web page (http://www.kgs.ku.edu/Magellan/Qualified/index.html). The brine data samples belong to the Marshall 1 (15-191-00003) Township 33S, Range 3W and Section 5, Sumner County, Kansas.

Importing PC Data - Download Well Data to PC

Download either the ASCII Text Files directly or the Zip files extracting the contents into a directory. The problem with the ASCII Text Files being downloaded directly from a web page is that the web page will alter the contents so it does not retain the basic structure and add HTML text to the file. The preferred method if you have Zip or WinZip is to download the zip files to your PC and extract.

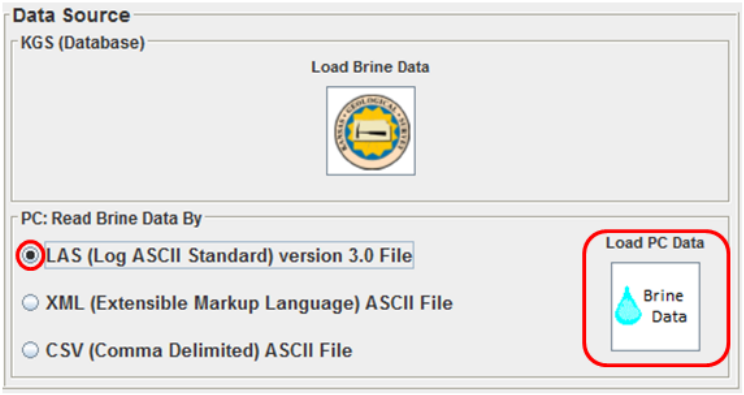
Well Data: Wellington KGS 1-32, Sumner County, Kansas

Type	ASCII Text Files
LAS 3.0	http://www.kgs.ku.edu/Gemini/Tools/documentation/Wellington_KGS_1-32_LAS3.las
CSV	http://www.kgs.ku.edu/Gemini/Tools/documentation/Wellington-KGS-1-32_Brine.csv
XML	http://www.kgs.ku.edu/Gemini/Tools/documentation/Wellington-KGS-1-32-Brine-XML.xml

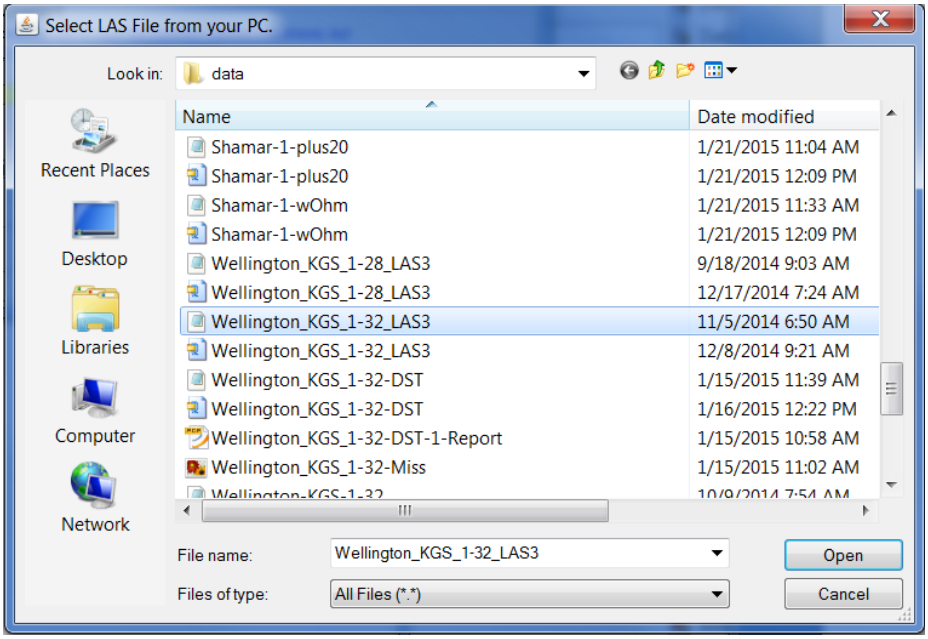
Type	Zip Files
LAS 3.0	http://www.kgs.ku.edu/Gemini/Tools/documentation/Wellington_KGS_1-32_LAS3.zip
CSV	http://www.kgs.ku.edu/Gemini/Tools/documentation/Wellington-KGS-1-32_Brine.zip
XML	http://www.kgs.ku.edu/Gemini/Tools/documentation/Wellington-KGS-1-32-Brine-XML.zip

Importing PC Data – Log ASCII Standard (LAS) version 2.0 File

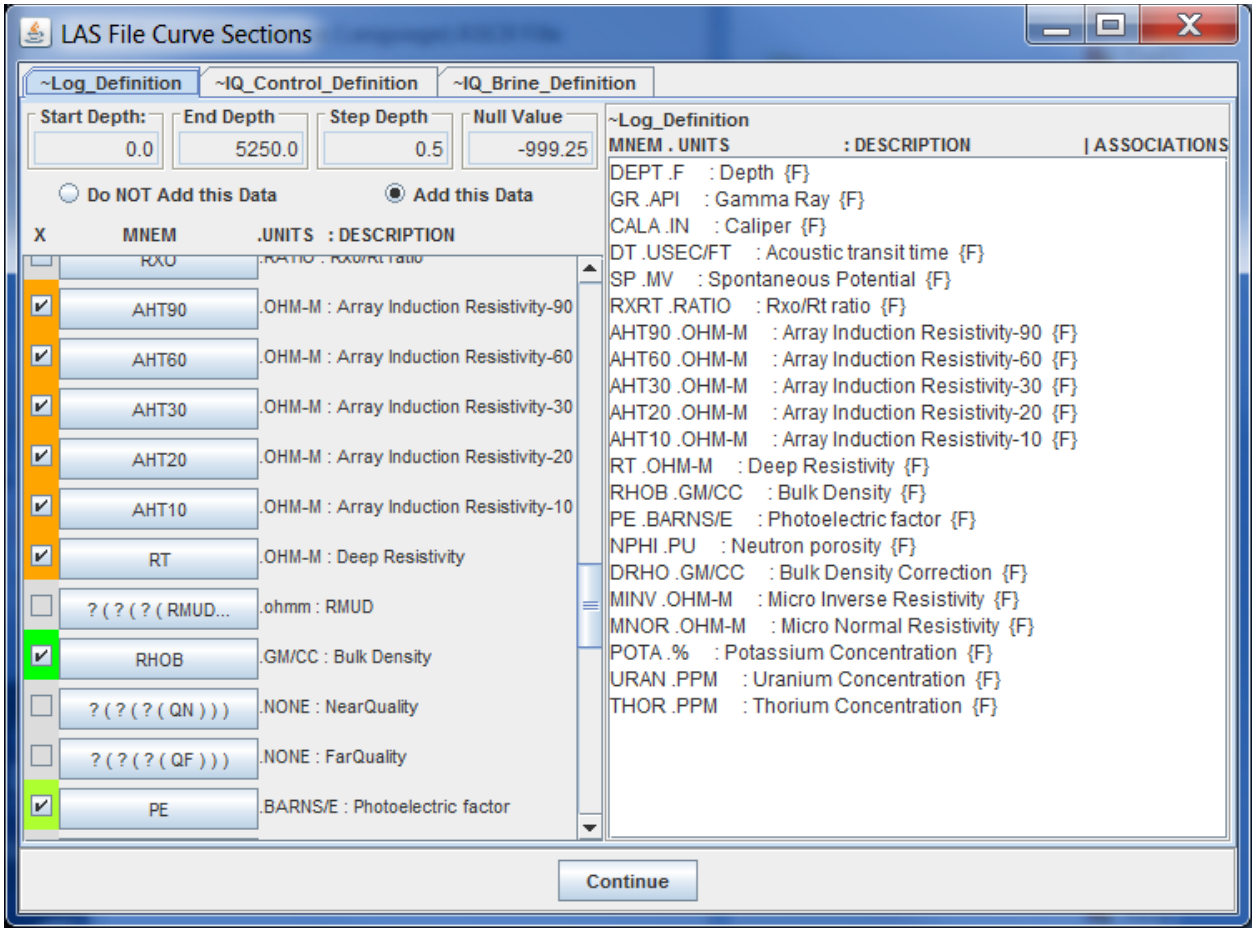
Most of the web apps will use the same input dialogs to import Log ASCII Standard (LAS) version 2.0 or 3.0 files. The Load Data Dialog is basically the same for most of the Web Apps, except they only load a subset of the total data types. In this example a LAS version 2.0 file is being imported into the web app.



Select the "LAS (Log ASCII Standard) version 3.0 File" radio button and then Left Click on the "LAS File" Icon Button in the Data Source Panel of the Load Data Dialog. This will display the "Select LAS File from your PC" Dialog. This dialog allows the user to search their PC for the file of interest. In this example it is the LAS version 3.0 file Wellington-KGS-1-32_LAS3.las, highlighted below. Select the Open button to display the "LAS File Curve Sections" Dialog.



The “LAS File Curve Sections” Dialog allows the user to map unknown LAS Curve Mnemonics to the KGS “Standard” Curve Mnemonics so they will be plotted in the Profile Plot. This program reads the “LAS Tool Curve Mnemonics map to KGS Standard Mnemonics” XML File (http://www.kgs.ku.edu/software/gemini/data/las_standard_tools.xml), which will automatically maps the Curve Mnemonics from the LAS file to one of 31 KGS “Standard“ Curve Mnemonics. If the user is satisfied with the automatic curve selections, which are checked and color coded, they only need to select the “Continue” Button at the bottom of the Dialog to import the file.

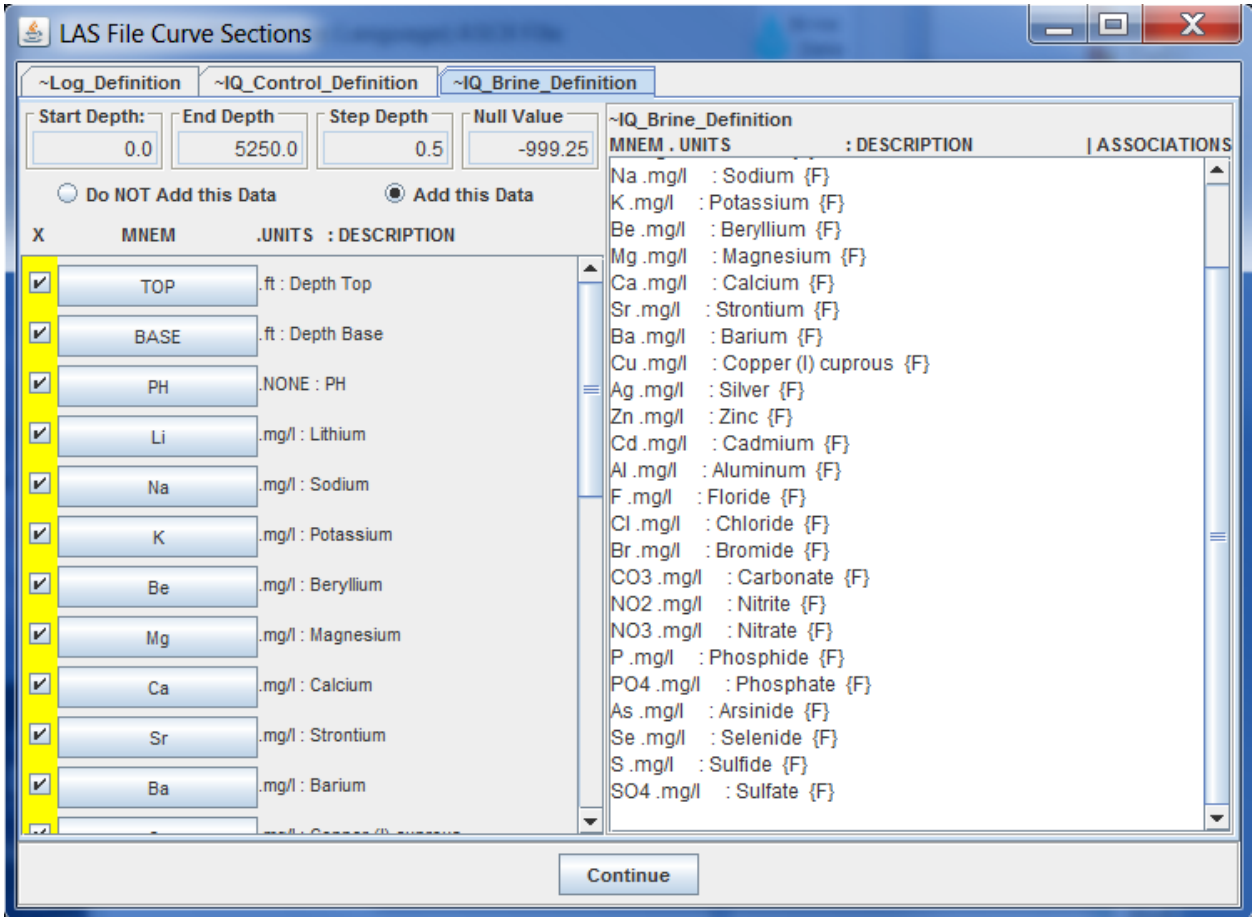


Notice that some of the check boxes are colored with different colors, which shows that the curves were automatically selected, but also to represent the curve type by color.The Curves are colored by type (data units) as follows,

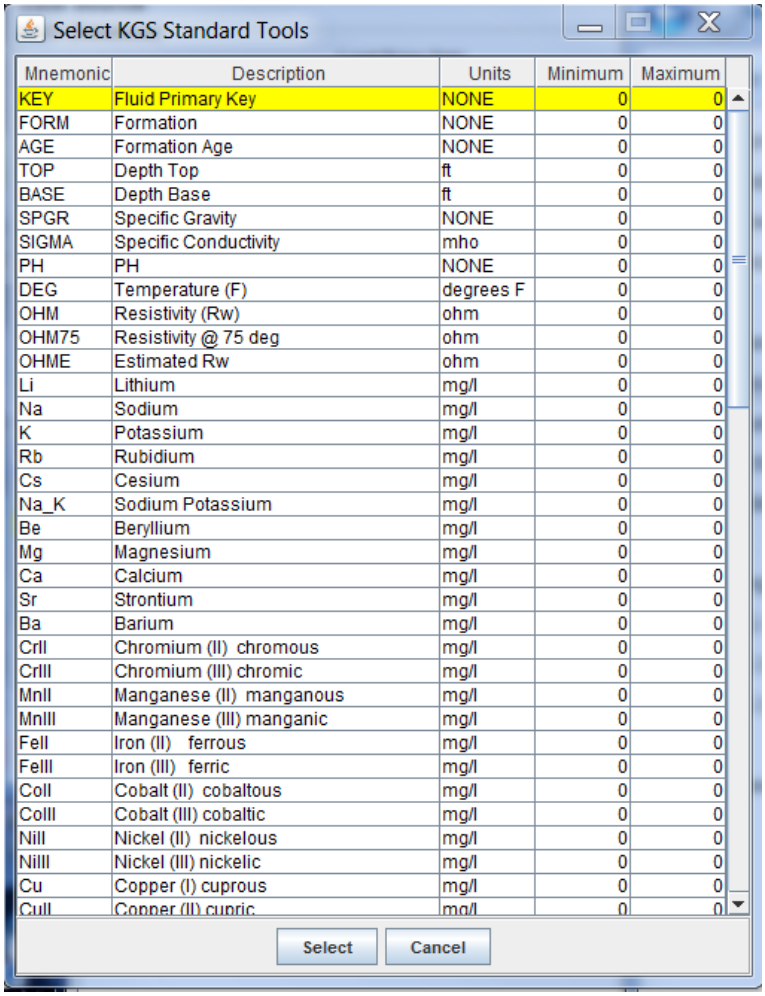
- Orange - OHM-M or Resistivity Logs
- Cyan – PU or porosity Logs, Neutron Porosity, Density Porosity, etc.
- Greenish yellow – BARNS/E or Photoelectric Factor Logs
- Green – GM/CC or Bulk Density Log
- Forest Green – USEC/FT or the Acoustic Transit Time Log
- Red – API, PPM or “%” as Radioactive logs, Gamma Ray, Spectral Gamma Ray, etc.
- Blue – MD or Permeability Logs
- Brown – F, FT or IN or Depth

- Middle yellow – FRAC, or other log curve types.
- Dark Violet – UNI or Unknown Linear Curves
- Medium Violet – UNL or Unknown Logrithum Curves

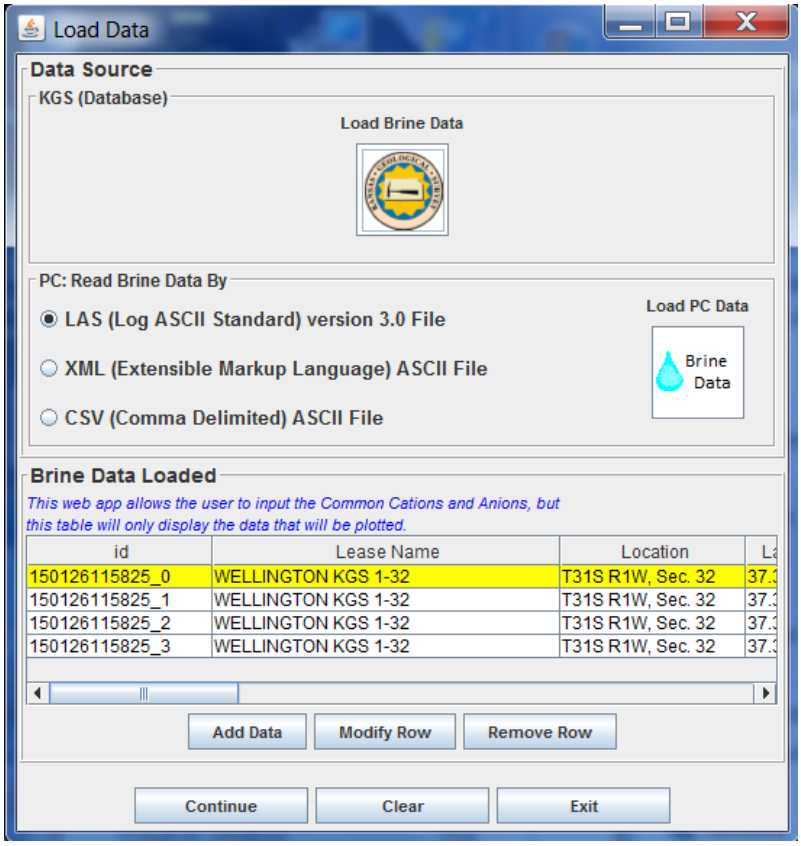
The color coding of the selected curves were added to also help the user visually recognize that a curve was selected or not. This web app is not concerned with the Log data, it will only read the Brine Data. The "X" column shows yellow check boxes and all the curves are recognized by the Brine Data LAS Read. The LAS 3.0 file used to read the brine data in this example was created by the Profile Web App. It should be noted that the write LAS 3.0 file is the same for all GEMINI Tools web apps. If the original LAS 3.0 file has other well data that data will be ignored, until the user saves the data imported into the web app.



Click on the "~IQ_Brine_Definition" tab at the top of the "LAS File Curve Sections" dialog to view the Brine Curves. If any of the log curves are missing or not defined, click on the "MNEM" Column button to open the "Select KGS Standard Tools" dialog to select the right brine data mnemonic.



The user only needs to select the correct Mnemonic and then click on the “Select” button to transfer the brine data curve to the “~IQ_Brine_Definition” tab panel. Select the “Continue” button on the “LAS File Curve Sections” Dialog to transfer the brine data to the “Brine Data Loaded” table on the “Load Data” dialog.

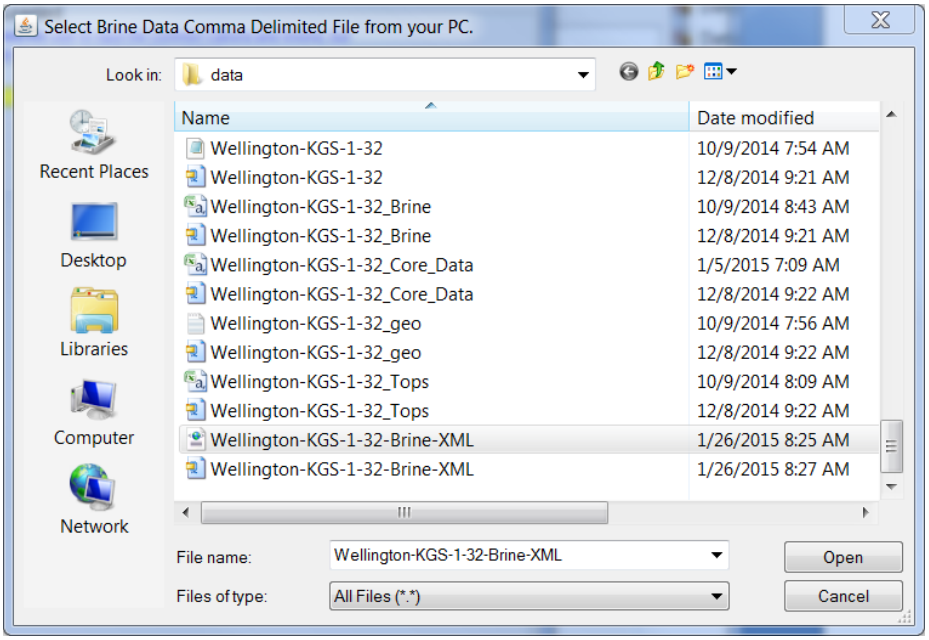


The user only needs to click on the “Continue” button to send the brine data to the “Brine Plot Control” dialog.

Importing PC Data – Brine XML (Extensible Markup Language) ASCII File.

This web app allows the user to save and read Brine Data as Extensible Markup Language (XML) file. The data that is retrieved from the Kansas Geological Survey database is retrieved as a XML data stream that is parsed and loaded into the Brine Plot & Data Entry web app. This program allows the user to save the data as a XML file, which uses the same Document Type Definition (DTD) to format the data.

Select the "XML (Extensible Markup Language) ASCII File" radio button and then left click on the "Brine Data" Icon Button in the Data Source Panel of the Load Data Dialog. This will display the "Select Brine Data Comma Delimited File from your PC" Dialog. This dialog allows the user to search their PC for the file of interest. In this example it is the Brine XML file Wellington-KGS-1-32-Brine-XML.xml, highlighted below.



Brine Data Extensible Markup Language (XML) Document Type Definition (DTD).

The Brine Data DTD defines the contents of the XML File.
The DTD for the Brine Data is as follows,

```
<?xml version="1.0"?>
<!DOCTYPE fluid_data [
<!ELEMENT fluid_data (columns*,
data*)+>
<!ELEMENT columns (column*)>
<!ATTLIST columns records CDATA
#REQUIRED>
<!ELEMENT column EMPTY>
<!ATTLIST column mnemonic CDATA
#REQUIRED
          name    CDATA #REQUIRED
          unit    CDATA #REQUIRED
          type    CDATA #REQUIRED>
<!ELEMENT data (row*)>
<!ATTLIST data records CDATA
#REQUIRED>
<!ELEMENT row EMPTY>
<!ATTLIST row  KEY    CDATA #IMPLIED
```

Well Header Information →

```
API    CDATA #IMPLIED
NAME   CDATA #IMPLIED
FIELD  CDATA #IMPLIED
LOC    CDATA #IMPLIED
COUNTY CDATA #IMPLIED
STATE  CDATA #IMPLIED
LAT    CDATA #IMPLIED
LONG   CDATA #IMPLIED
KB     CDATA #IMPLIED
GL     CDATA #IMPLIED
DF     CDATA #IMPLIED
TGT    CDATA #IMPLIED
SRC    CDATA #IMPLIED
DATE   CDATA #IMPLIED
```

Other Measured Data →

```
FORM   CDATA #IMPLIED
AGE    CDATA #IMPLIED
TOP    CDATA #IMPLIED
BASE   CDATA #IMPLIED
SPGR   CDATA #IMPLIED
SIGMA  CDATA #IMPLIED
PH     CDATA #IMPLIED
DEG    CDATA #IMPLIED
OHM    CDATA #IMPLIED
OHM75  CDATA #IMPLIED
OHME   CDATA #IMPLIED
```

Cations

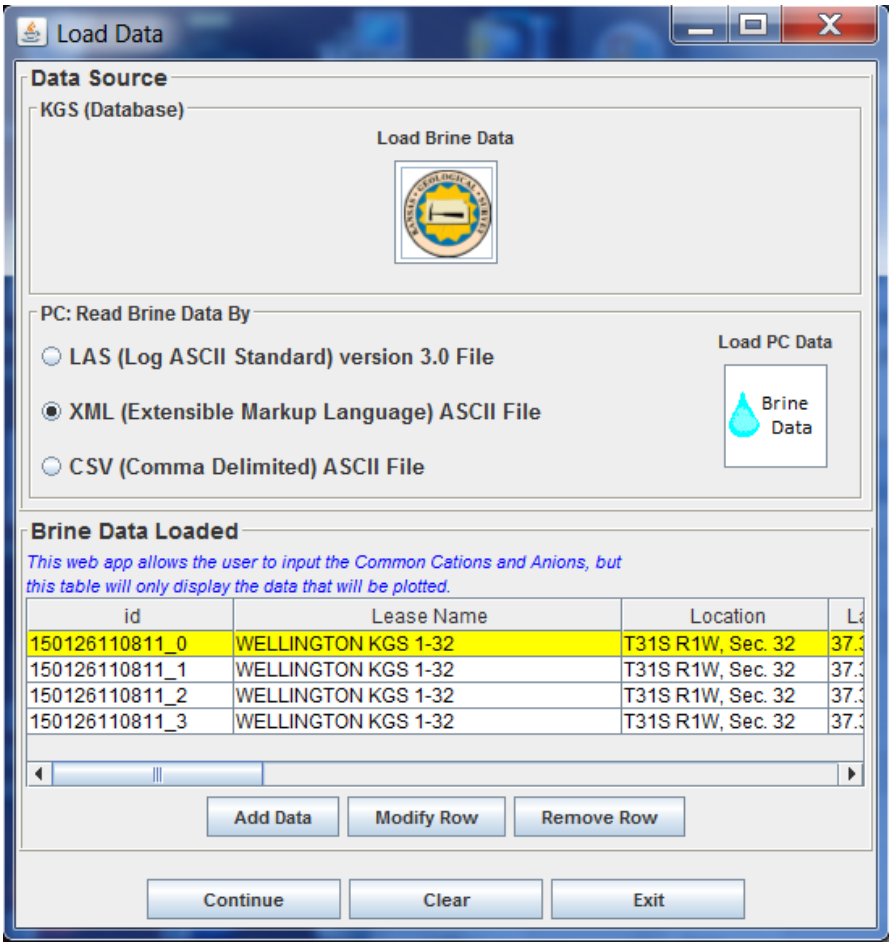
```
Li     CDATA #IMPLIED
Na     CDATA #IMPLIED
K      CDATA #IMPLIED
Rb     CDATA #IMPLIED
Cs     CDATA #IMPLIED
Na_K   CDATA #IMPLIED
Be     CDATA #IMPLIED
Mg     CDATA #IMPLIED
Ca     CDATA #IMPLIED
Sr     CDATA #IMPLIED
Ba     CDATA #IMPLIED
CrII   CDATA #IMPLIED
CrIII  CDATA #IMPLIED
MnII   CDATA #IMPLIED
MnIII  CDATA #IMPLIED
FeII   CDATA #IMPLIED
FeIII  CDATA #IMPLIED
CoII   CDATA #IMPLIED
CoIII  CDATA #IMPLIED
NiII   CDATA #IMPLIED
NiIII  CDATA #IMPLIED
Cu     CDATA #IMPLIED
CuII   CDATA #IMPLIED
Ag     CDATA #IMPLIED
Au     CDATA #IMPLIED
AuIII  CDATA #IMPLIED
Zn     CDATA #IMPLIED
Cd     CDATA #IMPLIED
Hg     CDATA #IMPLIED
HgII   CDATA #IMPLIED
Al     CDATA #IMPLIED
SbIII  CDATA #IMPLIED
SbV    CDATA #IMPLIED
BiIII  CDATA #IMPLIED
BiV    CDATA #IMPLIED
SnII   CDATA #IMPLIED
SnIV   CDATA #IMPLIED
PbII   CDATA #IMPLIED
PbIV   CDATA #IMPLIED
NH4    CDATA #IMPLIED
```

Anions

```
F      CDATA #IMPLIED
Cl     CDATA #IMPLIED
Br     CDATA #IMPLIED
I      CDATA #IMPLIED
OH     CDATA #IMPLIED
BO3    CDATA #IMPLIED
CO3    CDATA #IMPLIED
HCO3   CDATA #IMPLIED
ClO    CDATA #IMPLIED
ClO2   CDATA #IMPLIED
ClO3   CDATA #IMPLIED
ClO4   CDATA #IMPLIED
CN     CDATA #IMPLIED
NCO    CDATA #IMPLIED
OCN    CDATA #IMPLIED
SCN    CDATA #IMPLIED
N      CDATA #IMPLIED
N3     CDATA #IMPLIED
NO2    CDATA #IMPLIED
NO3    CDATA #IMPLIED
CrO4   CDATA #IMPLIED
Cr2O7  CDATA #IMPLIED
MnO4   CDATA #IMPLIED
P      CDATA #IMPLIED
PO4    CDATA #IMPLIED
HPO4   CDATA #IMPLIED
H2PO4  CDATA #IMPLIED
As     CDATA #IMPLIED
Se     CDATA #IMPLIED
S      CDATA #IMPLIED
HS     CDATA #IMPLIED
SO3    CDATA #IMPLIED
HSO3   CDATA #IMPLIED
S2O3   CDATA #IMPLIED
SO4    CDATA #IMPLIED
HSO4   CDATA #IMPLIED

SOLID  CDATA #IMPLIED
TDS    CDATA #IMPLIED>]>
```

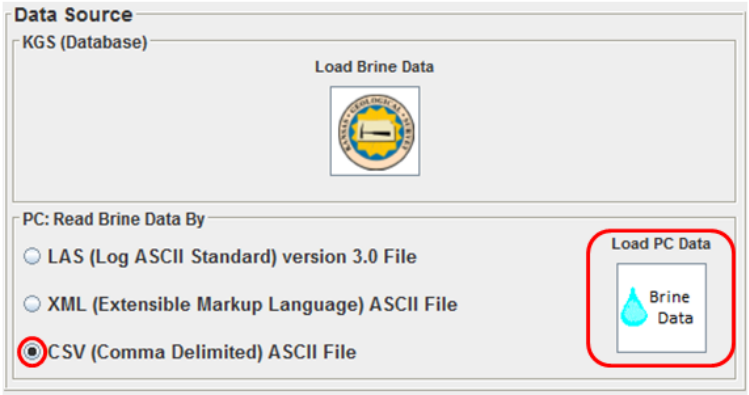
The XML (Extensible Markup Language) ASCII File Read & Parse routines expect the brine data to fit the above DTD (Document Type Definition), otherwise the data will not parse correctly. Select the Open button to load the brine data directly to the "Brine Data Loaded" table.



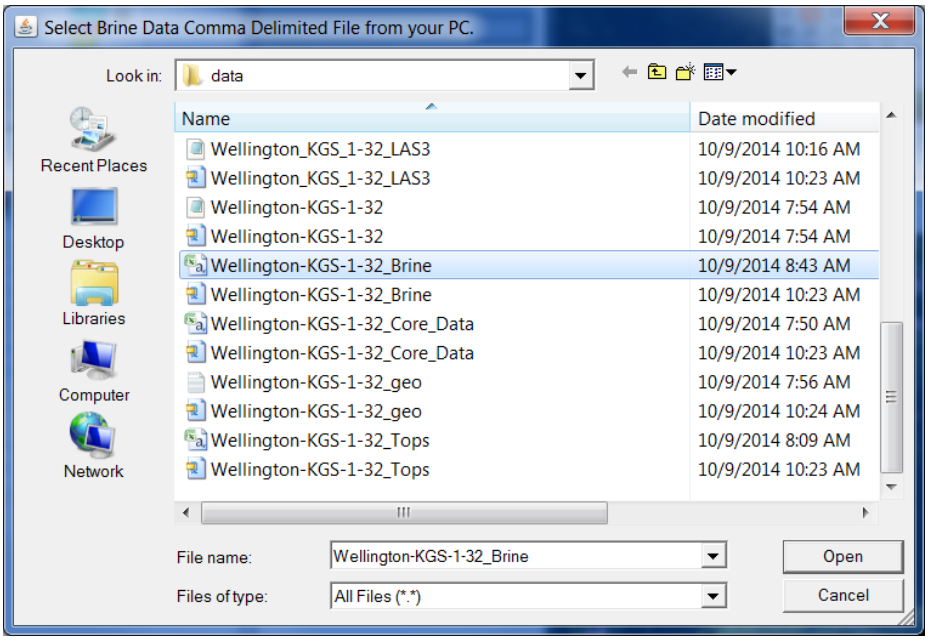
The user only needs to click on the "Continue" button to send the brine data to the "Brine Plot Control" dialog.

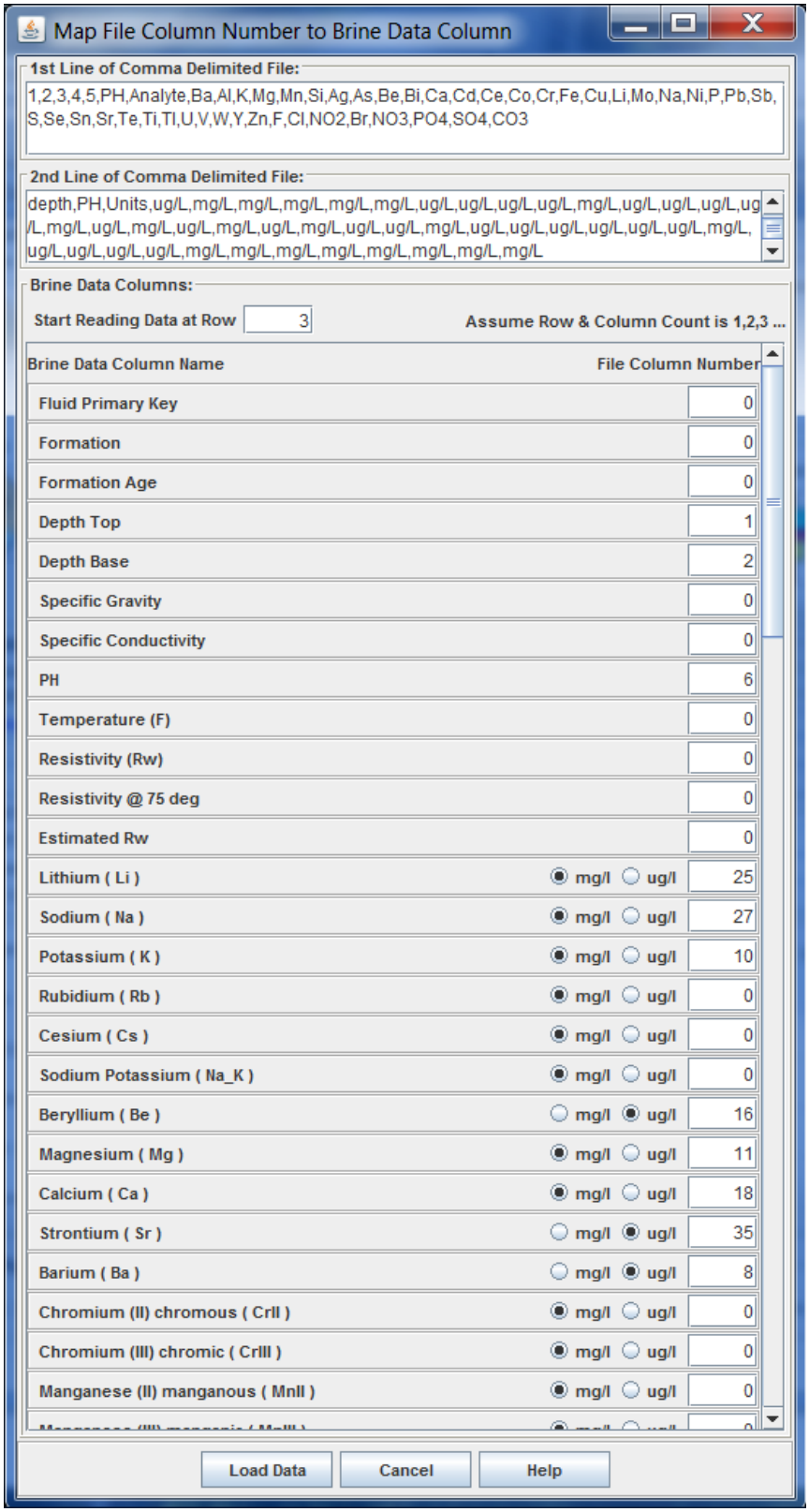
Importing PC Data – Brine CSV (Comma Separated Values) ASCII File.

Most of the web apps will use the same input dialogs to import Brine CSV (Comma Separated Values) file. The Load Data Dialog is basically the same for most of the Web Apps, except they only load a subset of the total data types. In this example a Brine CSV file is being imported into the web app.



Select the "CSV (Comma Delimited) ASCII File" radio button and then left click on the "Brine Data" Icon Button in the Data Source Panel of the Load Data Dialog. This will display the "Select Brine Data Comma Delimited File from your PC" Dialog. This dialog allows the user to search their PC for the file of interest. In this example it is the Brine CSV file Wellington-KGS-1-32_Brine.csv, highlighted below. Select the Open button to display the "Map File Column Number to Brine Column" Dialog.





The "Map File Column Number to Brine Data Column" Dialog allows the user to map the file columns number to the web app brine data structure. In this example the file has the file data columns in line one of the Brine Data CSV File and line two of the Brine Data CSV File has the data units. In this case the chosen file columns match the Brine Mnemonics for the brine data structure for most part. The File Column Number is automatically assigned to the Brine Data Column Names. The user only needs to select the "Load Data" Button to parse the Brine Data into the web app. This dialog has the data units as radio buttons to represent mg/l (milligrams/liter) and ug/l (micrograms/liter). The dialog will convert all data to mg/l.

Brine Data CSV (Comma Separated Values) File Structure.

The Wellington KGS 1-32 Brine Data CSV example has two introduction lines, the first line is the file data columns and the second line is the column units for the brine data, illustrated below,

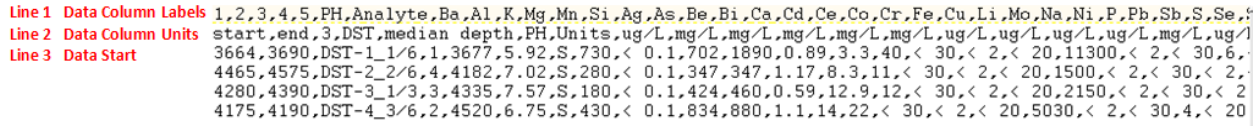


Figure: Partial Contents of Wellington-KGS-1-32_Brine.csv File.

The "Map File Column Number to Brine Data Column" Dialog allows the user to map the data in the Brine Data CSV File to the web app data structure variables. The program first reads the first and second line of the CSV File looking for the data column headers. The lines are each parsed to single out the data column headers and to match those headers to the brine data structure. The program then assigns the column number to the Brine Data Column Name starting at column 1,2,3, … if the file column name used matches the expected brine column name. Next the program then searches both lines for the units and automatically sets the radio button to ug/l if it sees ug/l text for the column otherwise it assumes mg/l. The Column Names matrix used to parse the file column variables are listed below,

Common Anions			
Formula	**Chemical Name**	**Formula**	**Chemical Name**
F	Fluoride	NO2	Nitrite
Cl	Chloride	NO3	Nitrate
Br	Bromide	CrO4	Chromate
I	Iodine	Cr2O7	Dichromate
OH	Hydroxide	MnO4	Permanganate
BO3	Borate	P	Phosphide
CO3	Carbonate	PO4	Phosphate
HCO3	Bicarbonate	HPO4	Monohydrogen Phosphate
ClO	Hypochlorite	H2PO4	Dihydrogen Phosphate
ClO2	Chlorite	As	Arsenide
ClO3	Chlorate	Se	Selenide
ClO4	Per chlorate	S	Sulfide
CN	Cyanide	HS	Hydrogen Sulfide
NCO	Cyanate	SO3	Sulphite
OCN	Isocyanate	HSO3	Hydrogen Sulphite
SCN	Thicyanite	S2O3	Thiosulphate
N	Nitride	SO4	Sulfate
N3	Azide	HSO4	Bisulfate

Common Cations					
Formula	**Chemical Name I**	**Chemical Name II**	**Formula**	**Chemical Name I**	**Chemical Name II**
Alkali Metal			**IB**		
Li	Lithium		Cu	Copper(I)	cuprous
Na	Sodium		CuII	Copper(II)	cupric
K	Potassium		Ag	Silver	
Rb	Rubidium		Au	Gold	aurous
Cs	Cesium		AuIII	Gold(III)	auric
Na_K	Sodium Potassium		**IIB**		
Alkali Earth Metal			Zn	Zinc	
Be	Beryllium		Cd	Cadmium	
Mg	Magnesium		Hg	Mercury(I)	mercurous
Ca	Calcium		HgII	Mercury(II)	mercuric
Sr	Strontium		**IIIA**		
Ba	Barium		Al	Aluminum	
VIB			**IVA**		
CrII	Chromium(II)	chromous	SnII	Tin(II)	stannous
CrIII	Chromium(III)	chromic	SnIV	Tin(IV)	stannic
VIIB			PbII	Lead(II)	plumbous
MnII	Manganese(II)	manganous	PbIV	Lead(IV)	plumbic
MnIII	Manganese(III)	manganic	**VA**		
VIIIB			SbIII	Antimony(III)	antimonous
FeII	Iron(II)	ferrous	SbV	Antimony(V)	antimonic
FeIII	Iron(III)	ferric	BiIII	Bismuth(III)	bismuthous
CoII	Cobalt(II)	cobaltous	BiV	Bismuth(V)	bismuthic
CoIII	Cobalt(III)	cobaltic	**Other**		
NiII	Nickel(II)	nickelous	NH4	Ammonium	
NiIII	Nickel(III)	nickelic			

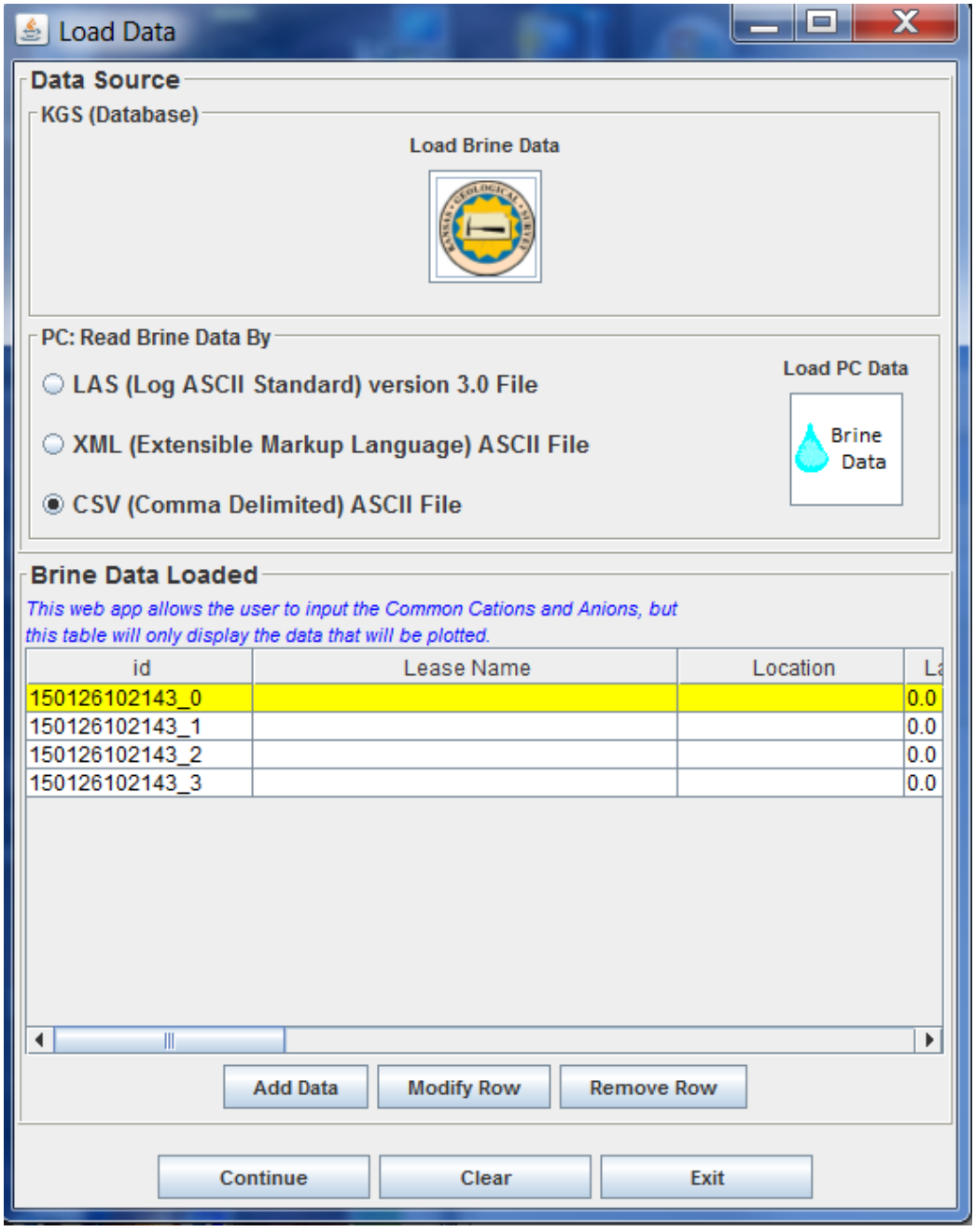
Other Variables			
Mnemonic	**Description**	**Mnemonic**	**Description**
FORM	Formation	**Other Measured Well Data**	
AGE	Formation Age	SPGR	Specific Gravity
Depth Range of Sample		SIGMA	Specific Conductivity
TOP	Depth Top	PH	PH
BASE	Depth Base	DEG	Temperature (F)
		OHM	Resistivity (Rw)
		OHM75	Resistivity at 75 deg
		OHME	Estimated Rw

Other Variables II			
Mnemonic	**Description**	**Mnemonic**	**Description**
Well ID		**Other Well Info**	
NAME	Well Name	FIELD	Field
API	API-Number	**Depth Information**	
Location		KB	Kelly Bushing
COUNTY	County	GL	Ground Level
STATE	State	DF	Derrick Floor
LOC	Location	TGT	TGT
LAT	Latitude	SRC	source
LONG	Longitude		

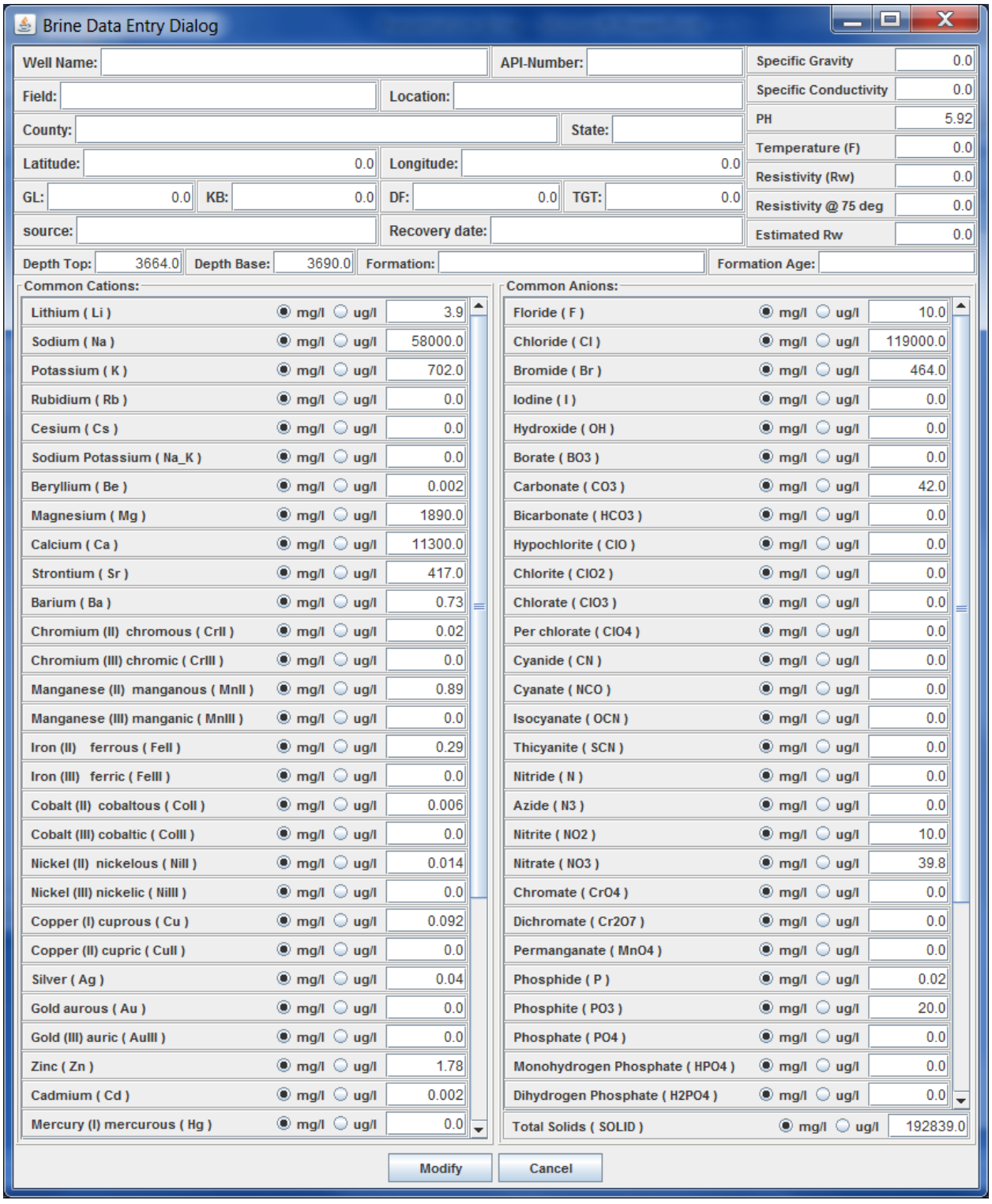
The Wellington KGS 1-32 Brine Data CSV File example above line 1 has many of the available brine name variables. The program was able to map many column headers to the brine data structure, but not all, e.g.

No	Label	Match	Brine Data Name		No	Label	Match	Brine Data Name
1	start	*	Depth Top		26	Na	*	Sodium
2	end	*	Depth Base		27	Ni	?	Nickel(II) or Nickel(III)
3	3	?	""		28	P	*	Phosphide
4	DST	?	""		29	Pb	?	Lead(II) or Lead(Iv)
5	median depth	?	""		30	Sb	?	Antimony(III) or Antimony(V)
5	PH	*	PH		31	S	*	Sulfide
6	Analyte	?	""		32	Se	?	Selenium (N/A)
7	Ba	*	Barium		33	Sn	?	Tin(II) or Tin(IV)
8	Al	*	Aluminum		34	Sr	*	Strontium
9	K	*	Potassium		35	Te	?	Tellurium (N/A)
10	Mg	*	Magnesium		36	Ti	?	Titanium (N/A)
11	Mn	?	Manganese(II) or Manganese(III)		37	Tl	?	Thallium (N/A)
12	Si	?	Silicon (N/A)		38	U	?	Uranium (N/A)
13	Ag	*	Silver		39	V	?	Vanadium (N/A)
14	As	*	Arsenide		40	W	?	Tungsten (N/A)
15	Be	*	Beryllium		41	Y	?	Yttrium (N/A)
16	Bi	?	Bismuth(III) or Bismuth(IV)		42	Zn	*	Zinc
17	Ca	*	Calcium		43	F	*	Fluoride
18	Cd	*	Cadmium		44	Cl	*	Chloride
19	Ce	?	Cerium (N/A)		45	NO2	*	Nitrite
20	Co	?	Cobalt(II) or Cobalt(III)		46	Br	*	Bromide
21	Cr	?	Chromium(II) or Chromium(III)		47	NO3	*	Nitrate
22	Fe	?	Iron(II) or Iron(III)		48	PO4	*	Phosphate
23	Cu	*	Copper(I)		49	SO4	*	Sulfate
24	Li	*	Lithium		50	CO3	*	Carbonate
25	Mo	?	Molybdenum (N/A)		26	Na	*	Sodium

When the user selects the “Load Data” Button on the “Map File Column Number to Brine Data Column” Dialog the data is parsed into the Brine Plot & Data Entry web app, where the contents of the Brine Data CSV file name is loaded into the “List of Brine Samples” table.



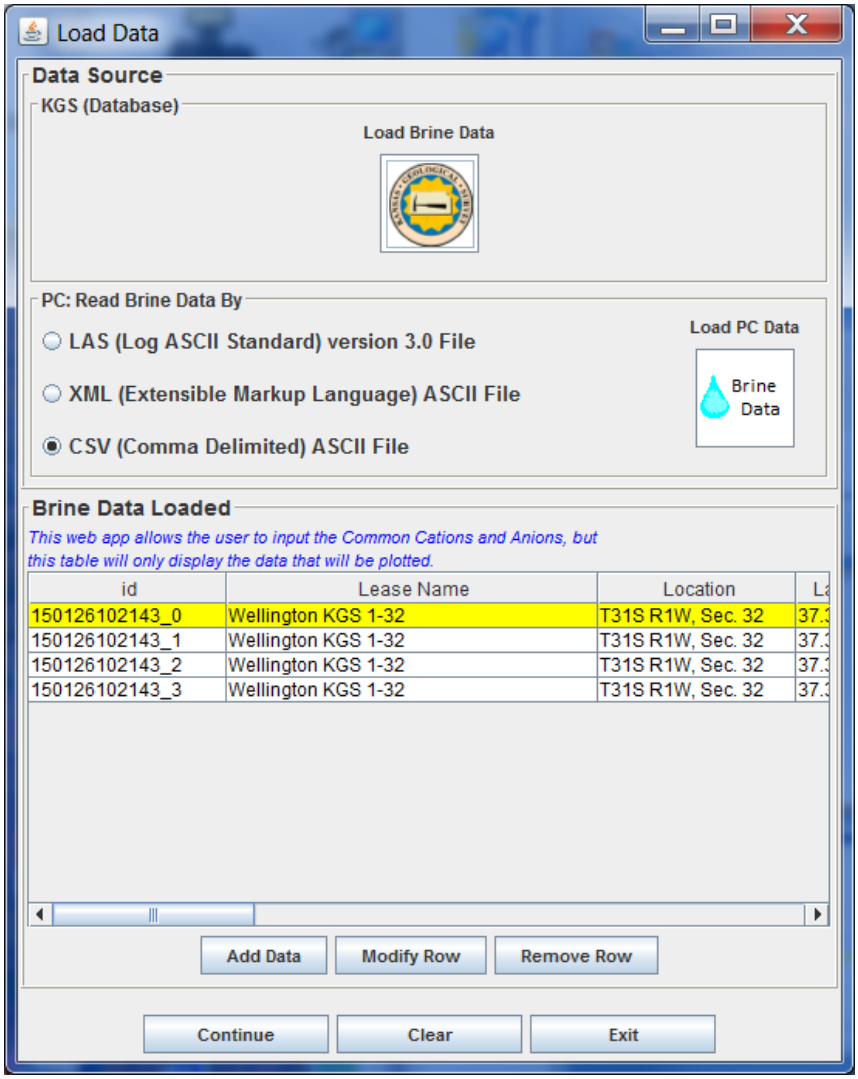
Notice the header information in the “Brine Data Loaded” table is not present for all the brine samples. Highlight the first sample and click on the “Modify Row” button to display the “Brine Data Entry” dialog.



This dialog allows the user to edit the brine data and to fix any problems that may be present. In this case the header information of this sample is not present.

Well Name:	Wellington KGS 1-32			API-Number:	15-191-22591			Specific Gravity	0.0
Field:	Wellington			Location:	T31S R1W, Sec. 32			Specific Conductivity	0.0
County:	Sumner					State:	KS	PH	5.92
Latitude:	37.315444			Longitude:	-97.442414			Temperature (F)	58.0
GL:	1259	KB:	1272	DF:	0.0	TGT:	0.0	Resistivity (Rw)	0.650
source:	Berexco			Recovery date:	9 January 2011			Resistivity @ 75 deg	0.0
								Estimated Rw	0.0
Depth Top:	3664.0	Depth Base:	3690.0	Formation:	Mississippian			Formation Age:	

The user can add the missing data, i.e. the well name, api-number, location, latitude, longitude, etc. The user can then select the "Modify" button to transfer the data back to the "Brine Data Loaded" dialog. The user can move through each sample adding the same information until all samples have the header information.

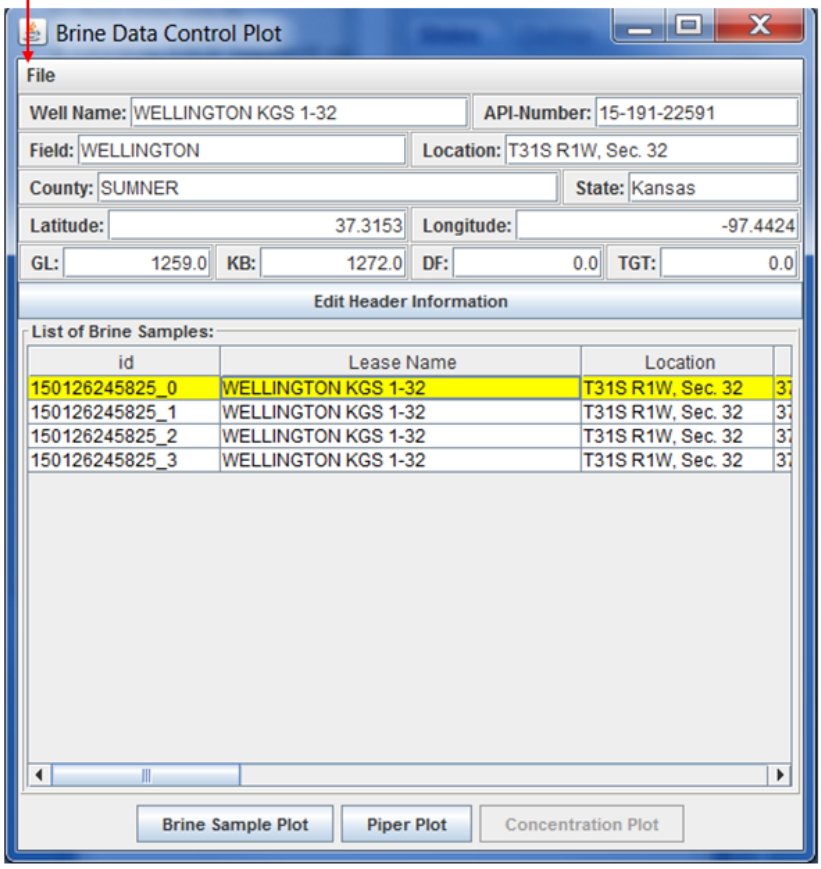


The user only needs to click on the "Continue" button to send the brine data to the "Brine Plot Control" dialog.

Brine Data Control Plot Dialog

File Menu

- Save as LAS version 3.0 File — *LAS - Log ASCII Standard*
- Save as XML File — *XML - Extensible Markup Language*
- Save as CSV File — CSV - Comma Separated Values
- Close – Close Dialog



Well Header Information Panel
This panel shows the brine data well information data, i.e., Name of the well , Location and Depth Information.

List of Brine Samples Table
This tables displays the data that will appear in the Brine Plots (See Below)

Brine Plot Buttons Panel
These buttons will automatically enable when the user selects one or more brine records.

Single Sample Plots:

Stiff Diagram: The Stiff diagram is a graphical representation of brine fluid, first developed by H.A.Stiff in 1951. It is usually plotted without the labeled axis and is useful making visual comparison of waters with different characteristics. The patterns tend to maintain its shape upon concentration or dilution.

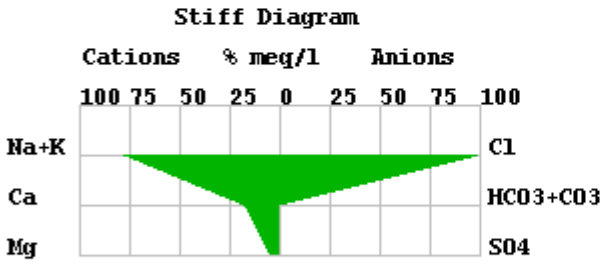
Collins Bar Diagram: Collins diagrams (Collins 1923) present the relative major ion composition in percent milli-equivalent per liter. Both the cations and anions have a total of 100 %. The bar diagram used in the Brine Sample Plot, the cations are plotted on the left and the anions are plotted on the right.

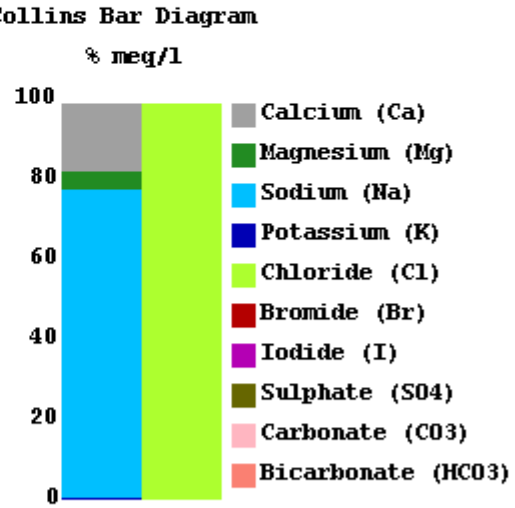
Brine Sample Plot

Well: WELLINGTON KGS 1-32 (15-191-22591)

State: Kansas
County: SUMNER
Field: WELLINGTON
Formation:
Depth: 3664.0 - 3690.0
Latitude: 37.3153
Longitude: -97.4424

Unit	Ca	Mg	Na	K	Cl	Br	I	SO4	HCO3	CO3
mg/l	11300.0	1890.0	58000.0	702.0	119000.0	464.0		703.0		42.0
meq/l	563.87	155.55	2522.83	17.95	3356.84	5.8		14.63		1.39
% meq/l	17.29	4.77	77.38	0.55	99.35	0.17		0.43		0.04



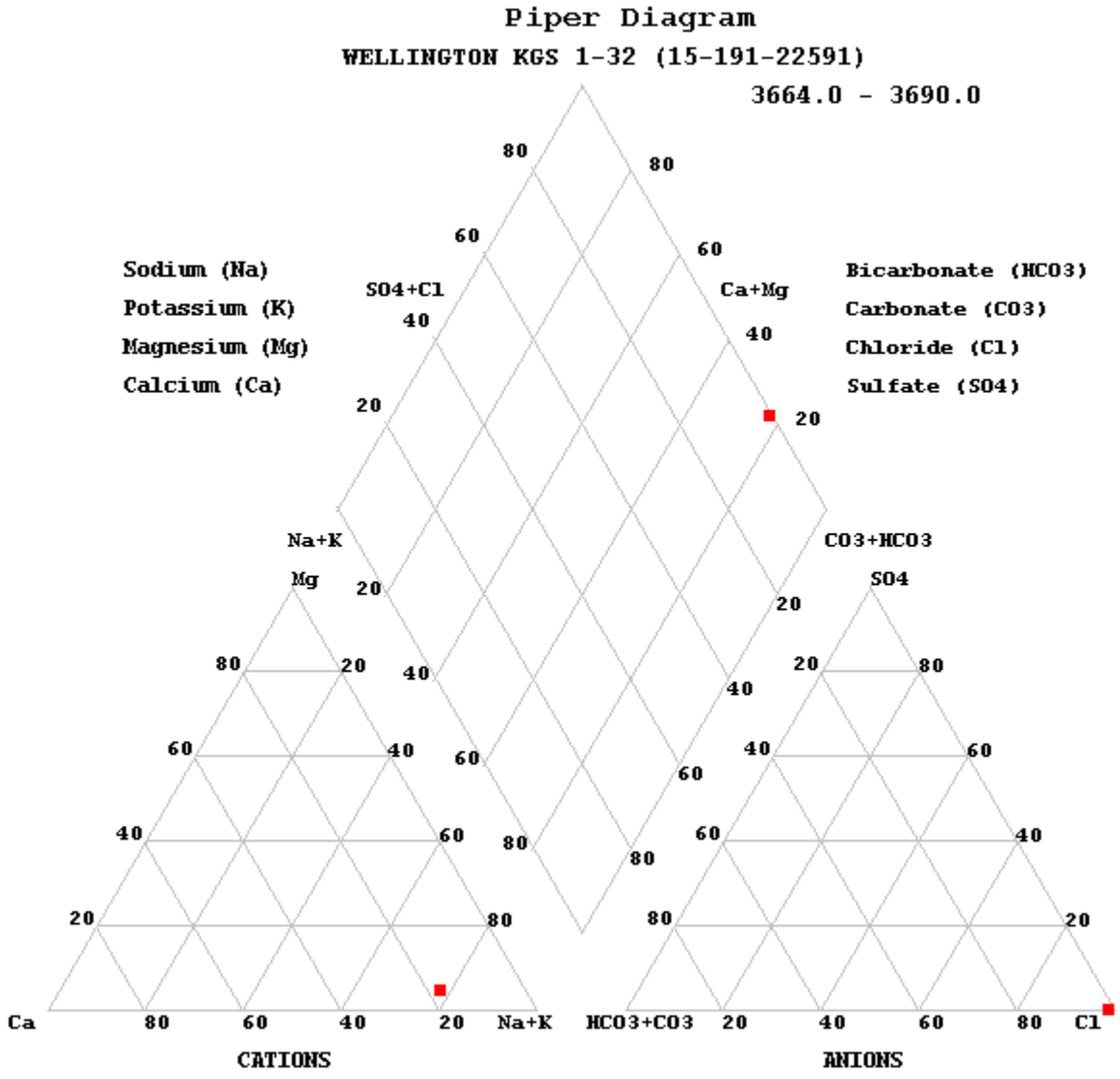


General Analysis

PH: 5.92
Temp. F deg:
Specific Gravity:
Rw:
Rw @ 75 F deg:
Est. Rw:

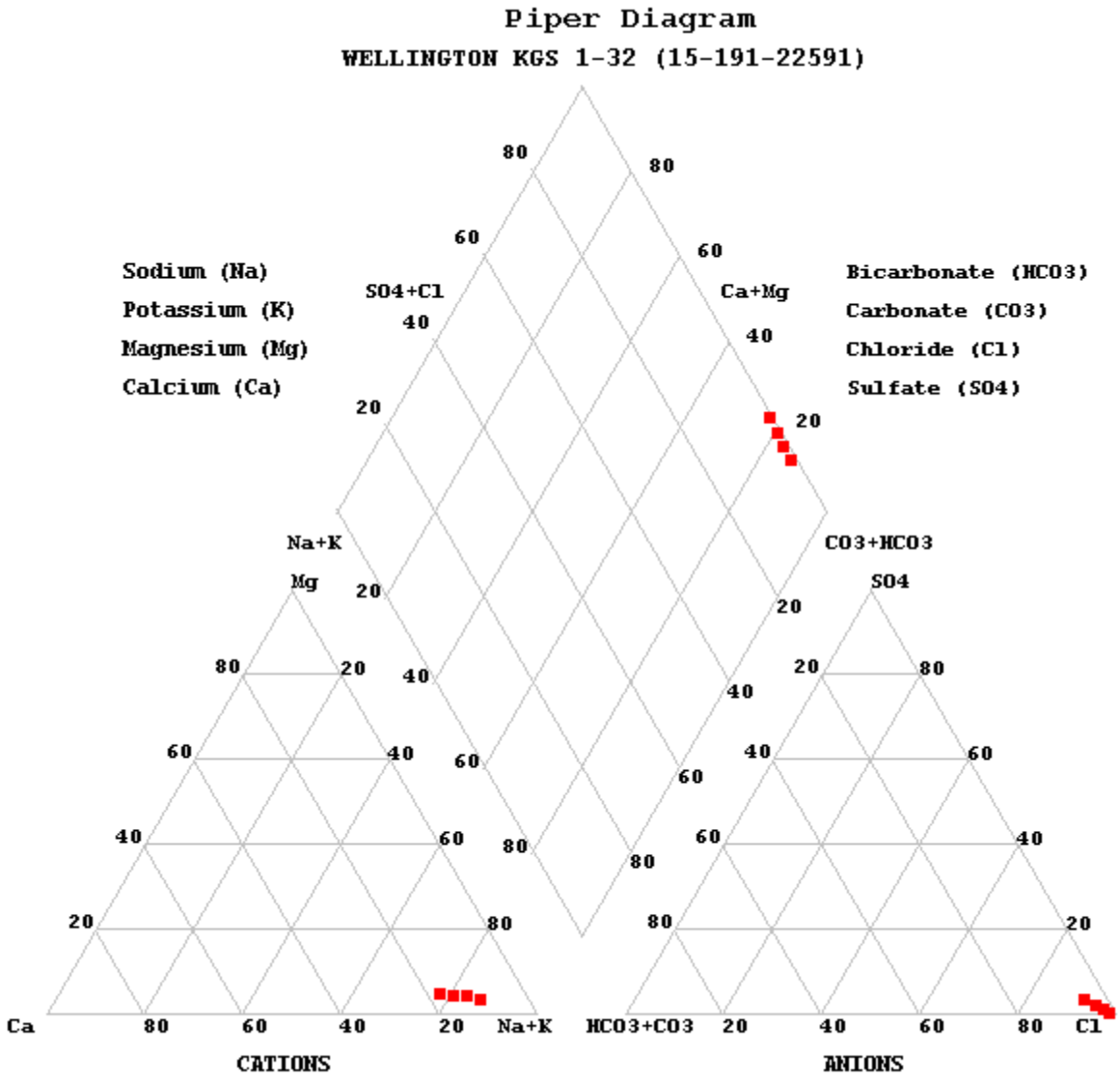
Total Dissolved Solids: 192837.5 mg/l

Piper Diagram: The Piper diagram plots the major ions as percentages of milli-equivalents in two base triangles. The total cations and the total anions are set equal to 100% and the data points in the two triangles are projected onto an adjacent grid. This plot reveals useful properties and relationships for large sample groups. The main purpose of the Piper diagram is to show clustering of data points to indicate samples that have similar compositions.

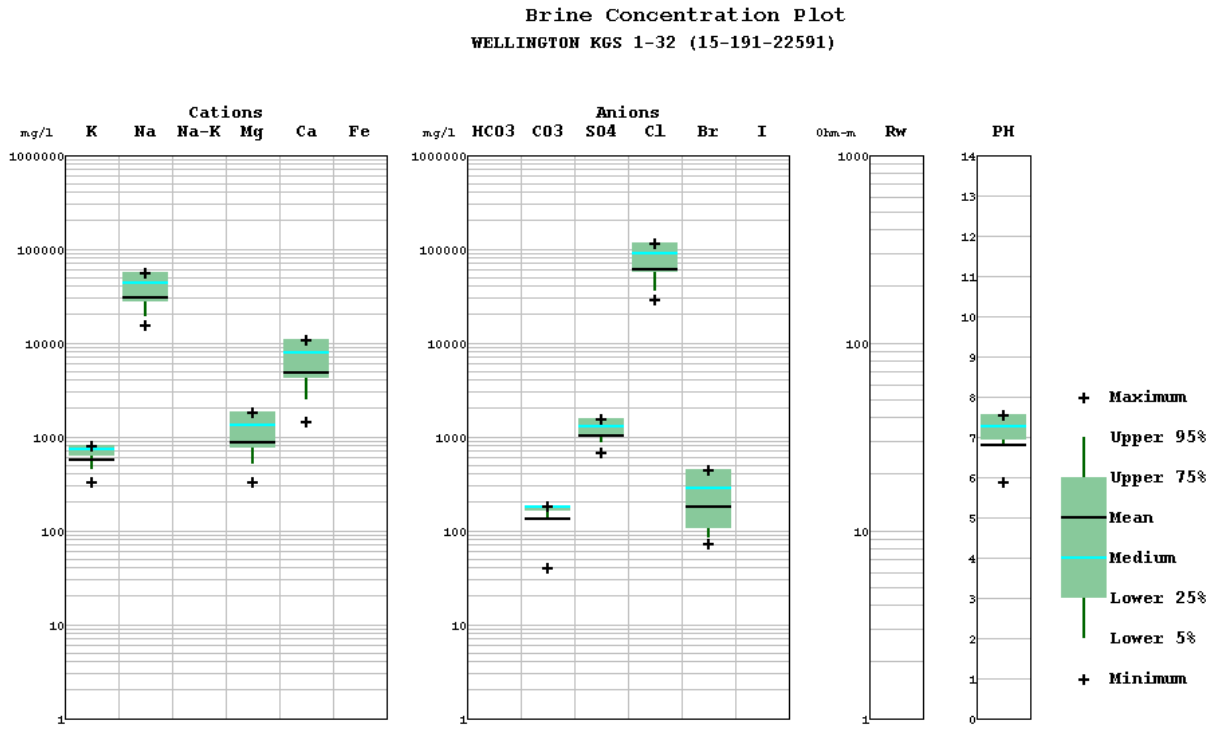


Multiple Samples Plots:

Piper Diagram: The Piper diagram plots the major ions as percentages of milli-equivalents in two base triangles. The total cations and the total anions are set equal to 100% and the data points in the two triangles are projected onto an adjacent grid. This plot reveals useful properties and relationships for large sample groups. The main purpose of the Piper diagram is to show clustering of data points to indicate samples that have similar compositions.

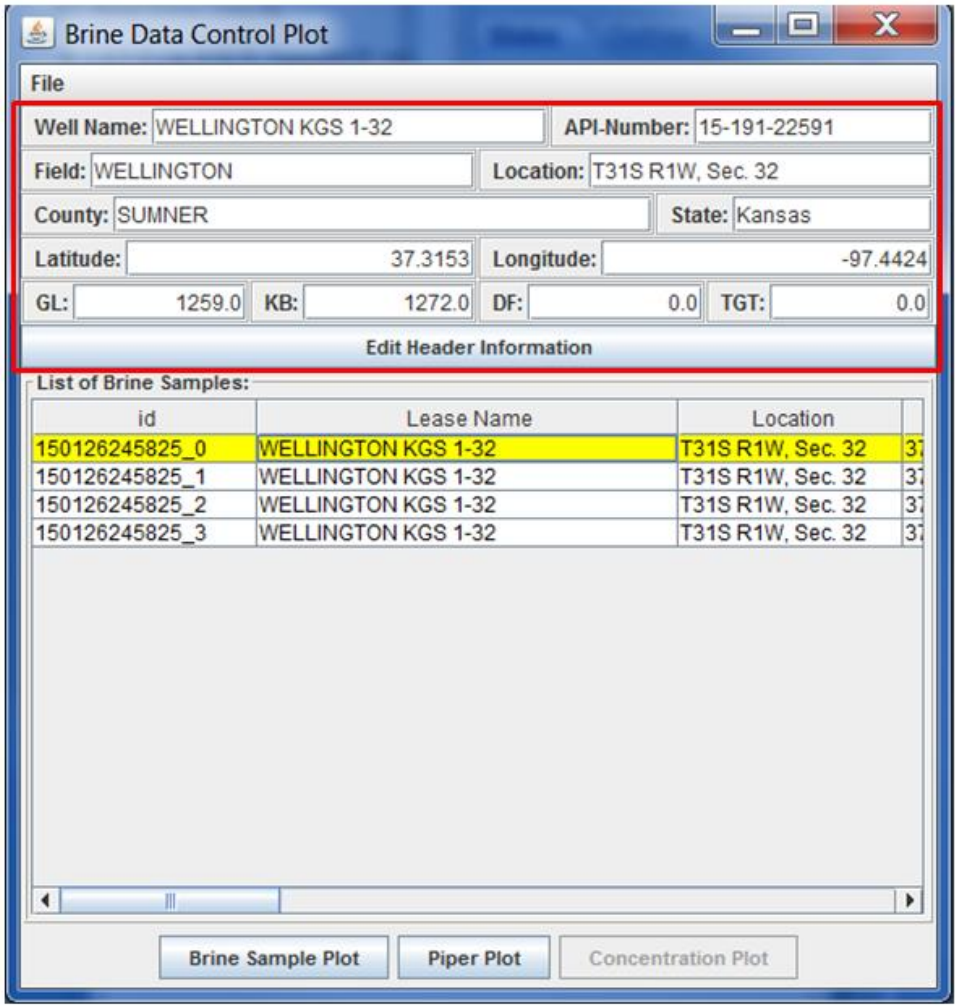


Concentration Plot: Box and whiskers plot showing the distributions of the measured concentrations. Boxes extend from the 25th to the 75th percentile, horizontal bars inside the boxes represent the median and the mean, vertical line to the 5th and 95th percentile and the maximum and minimum observations presented as crosses.



Edit Header Information Dialog

The Well Header Information Summary is displayed in the “Header Information” Panel on the Profile Control Dialog as well as at the top of the Profile Plot.



The user can select the “Edit Headers Information” Button to display the Edit Header Information Dialog. The data displayed holds the initial information stored in the Log ASCII Standard (LAS) file and the Geologist Report ASCII Delimited file if the user loads the files from their PC. If the user loads the Log ASCII Standard (LAS) File from the KGS Server then the Well Header Information is automatically downloaded from the KGS Well Header Database Table.

Search KGS Database for Well Header Information Button
Displays a "Search for Data on KGS Server" Dialog that allows the user to .

Identification Panel
KGS & PC Primary KEY – Identification Numbers for the well
API-Number – API Number of Well
Well Status - Status, i.e. OIL, GAS, etc.
Name – Lease Name & Number

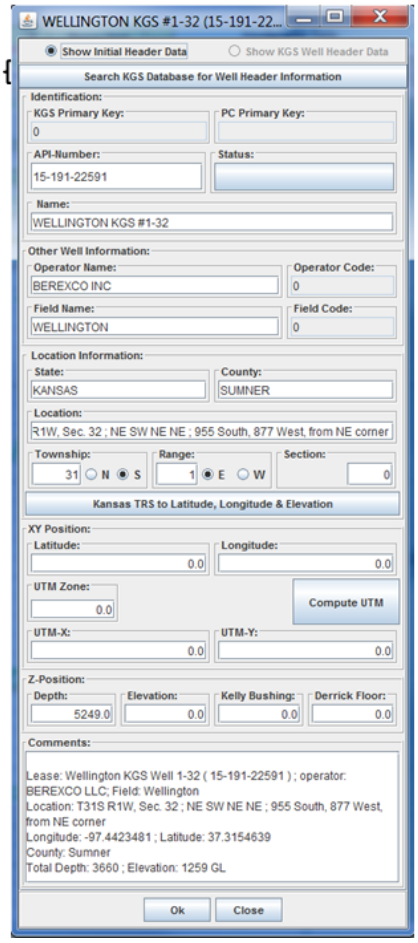
Other Well Information Panel
Operator Name & KGS Database KEY
Field Name & KGS Database KEY

Location Information Panel
State Name
County Name
Location
Township Range Section

XY Position
Latitude
Longitude
UTM Zone
UTM X Position
UTM Y Position

Z-Position
Depth – Total Depth of Well
Elevation – by Ground Level
Elevation – by Kelly Bushing
Elevation – by Derrick Floor

Comments – User Comments, not saved to the LAS version 3.0.



Header Information Source Buttons:
- **Show Initial Header Data** – Shows the Header Information initially loaded into Program.
- **Show KGS Well Header Data** – Shows the Header Information loaded from KGS Database.

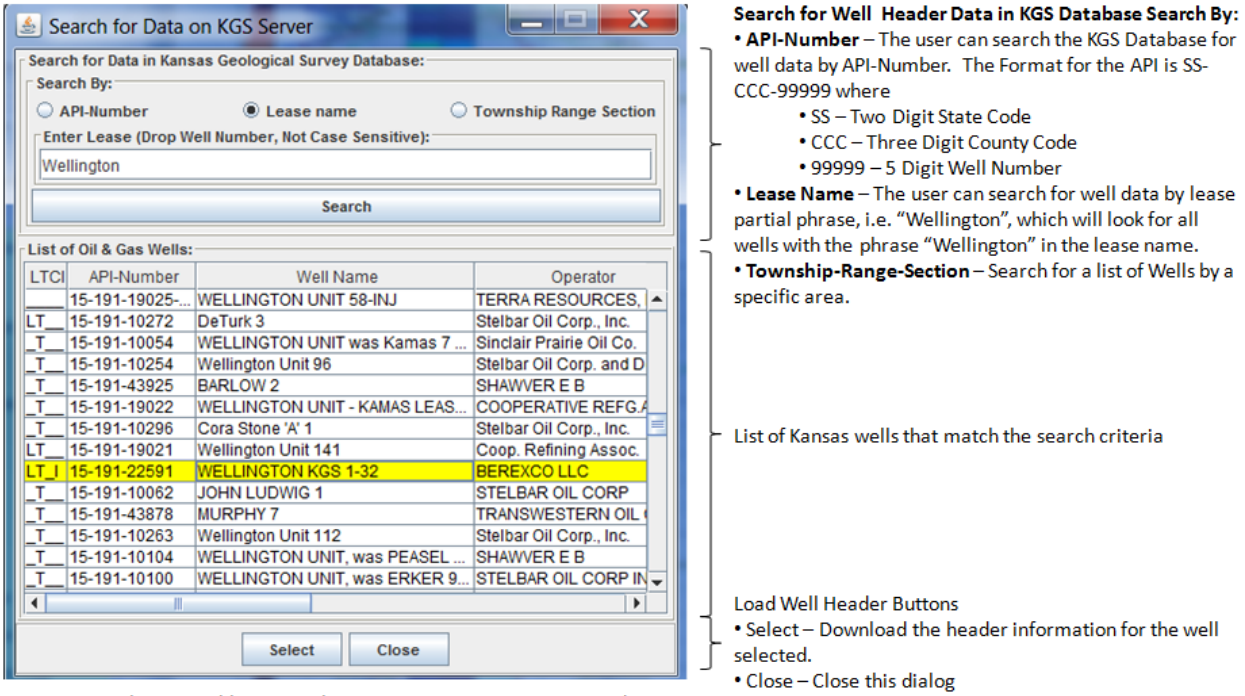
Buttons:
Status – Displays "Select Status of Data" Dialog, user searches for the well status list for status of well.
Kansas TRS to Latitude, Longitude & Elevation – The buttons calls a KGS database routine to compute the Latitude, Longitude and Elevation from the Township, Range and Section.
Compute UTM – This button calls a UTM Java Math Package to convert Latitude & Longitude into UTM X, Y Coordinates.
OK – Transfer Data Values to Program
Close – Close this Dialog

NOTE: Initially the Basic Header information is loaded from the LAS version 2.0 file and other fields like Comments, Location are loaded from the Geologist Report Header Section.

The Header Information Dialog displays the contents of the header information data structure. The user can edit the fields and select the "Ok" Button to transfer the information back to the Profile Program and any summary information will be updated in the Profile Control and Plot.

As this example illustrates there are missing fields in the header information data. The user can select the "Search KGS Database for Well Header Information" Button, which will display a "Search for Data on KGS Server" Dialog that will allow the user to build a query that will download all wells that match the query.

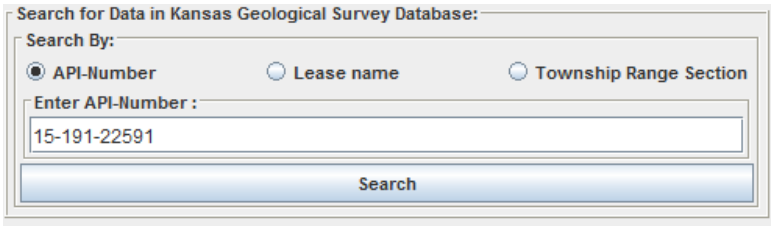
This will display the "Search for Data on KGS Server" Dialog, see image below. This dialog allows the user to search the KGS database for well header data. In this example, the well of interest will be the Wellington KGS 1-32.



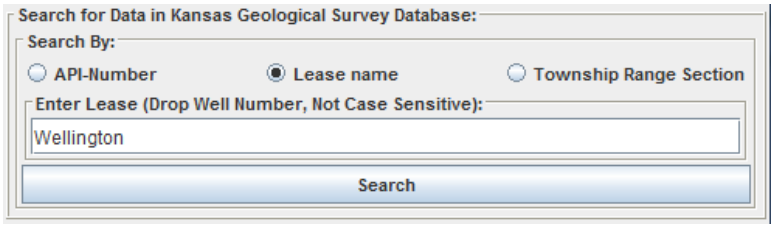
NOTE: LTCI Column in Table: L-LAS Files; T-Formation Tops; C-Measured Core Data; I-Core Images

As the Summary image suggests there are 3 methods for searching for the well header information within this dialog,

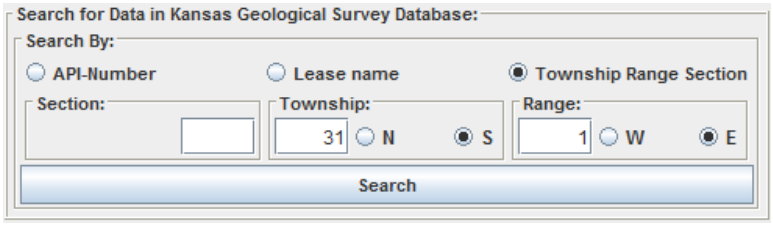
- By API-Number – KGS has a specific format for the API-Number, i.e.SS-CCC-99999 where SS is the state code for Kansas 15, CCC is the county code for Wellington KGS 1-32 it is 191 for Sumner County and the 5-Digit Well Number for the Wellington KGS 1-32 is 22591.



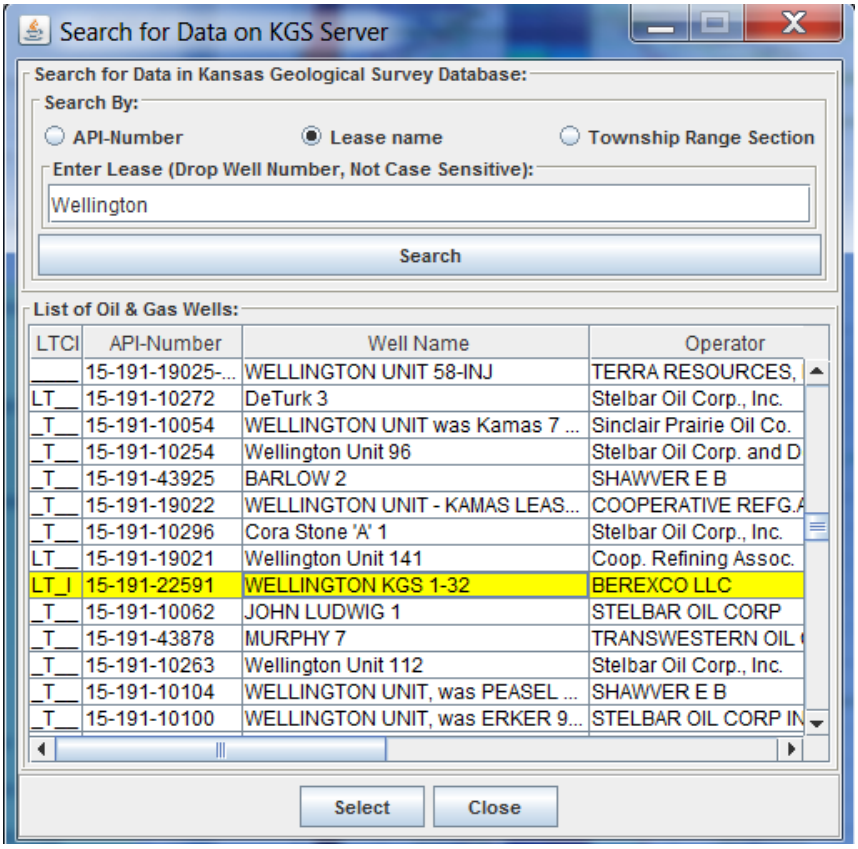
- By Partial Lease Name – The stored procedure used to retrieve the well header information allows the user to enter a partial phrase, in this example Wellington. The program places a '%' in front and back of the phrase and sends the request to the Database, i.e. "%Wellington%".



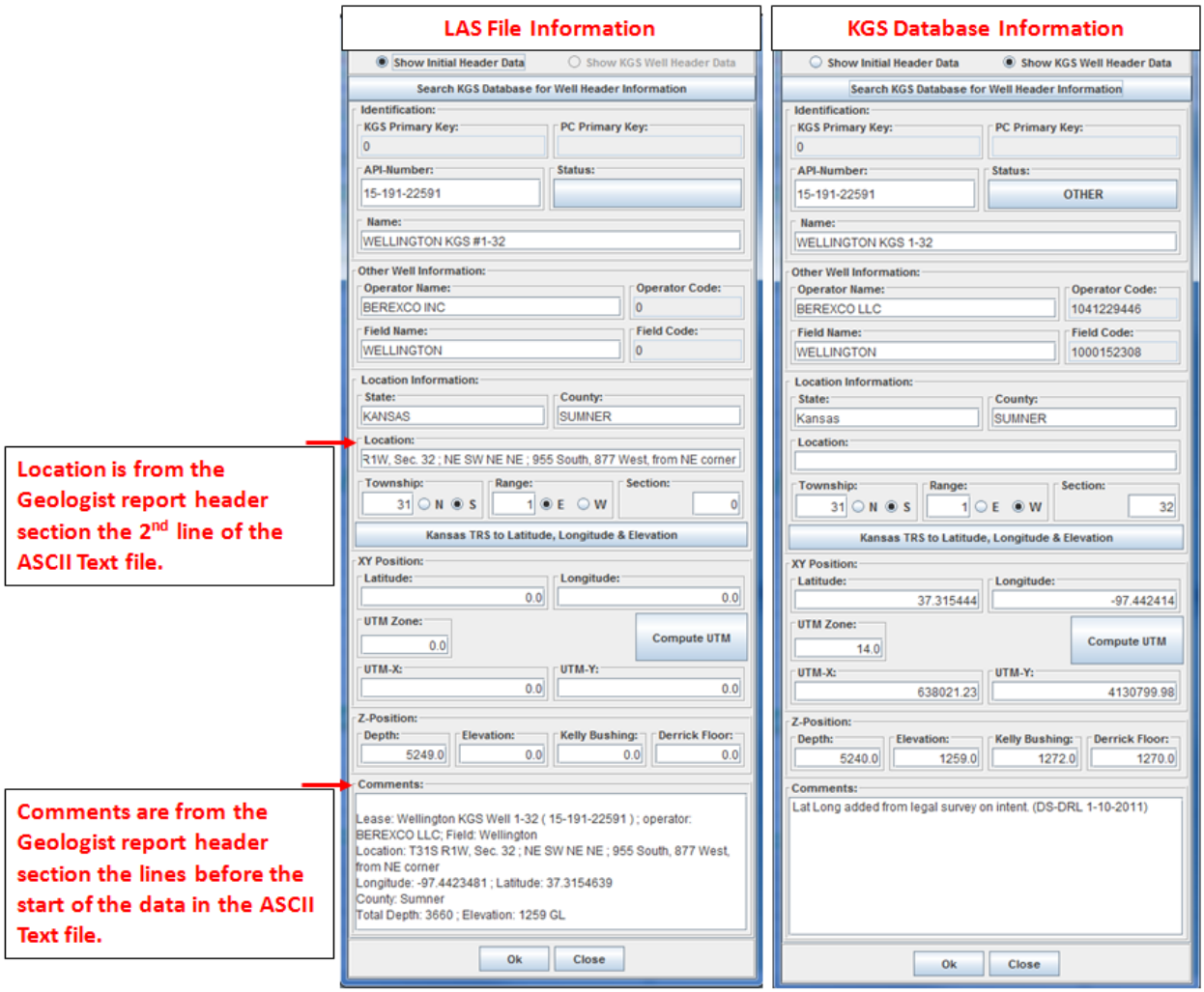
- By Township Range Section – This search is by location in Kansas, this search also allows the user to enter just the Township and Range to search for wells, e.g. to look for the Wellington KGS 1-32, enter Township as 31 set the S (South) Radio button and Range as 1 set the E (East) Radio button.



The user only needs to enter the above data and select the "Search" Button to display the list of Wells in the Kansas Database that match the search criteria. In the image below the Lease Name "Wellington" is entered to search for all wells in Kansas with the Phrase Wellington in it. The user searches through the list until they find the well of interest. In this example it is the Wellington KGS 1-32, which is highlighted.



The user clicks on the "Select" button to transfer the header information to the Edit Header Information Dialog.



The "Show KGS Well Header Data" radio button will become enabled if the KGS well header information has been downloaded. The user can move between the initial header information by selecting the "Show Initial Header Data" radio button the KGS well header information by selecting the "Show KGS Well Header Data" radio button.

There a number of buttons on the panel that will allow the user to change or compute data in the header information. The "Kansas TRS to Latitude, Longitude & Elevation" Button computes the latitude, longitude and elevation from the township, range and section by making an Oracle PL/SQL Stored Procedure, e.g.

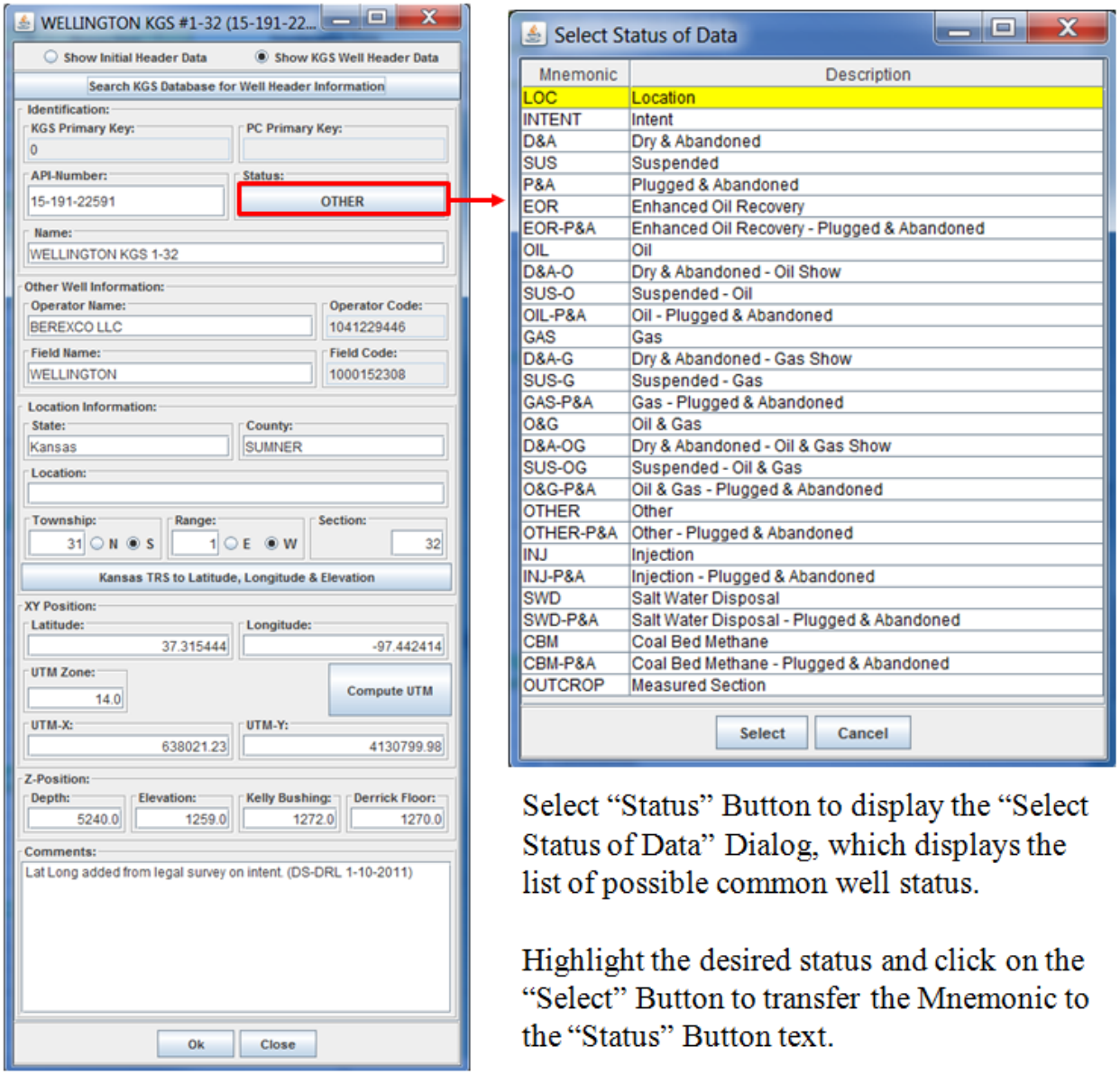
http://chasm.kgs.ku.edu/ords/iqstrat.TRS2LL_pkg.getXML?iTownship=31&sTownship=S&iRange=1&sRange=E&iSection=32

The call will return a XML with the latitude, longitude and ground level elevation.

```
<?xml version="1.0"?>
<!DOCTYPE headers [
<!ELEMENT headers (data*)>
<!ATTLIST headers records CDATA #IMPLIED>
<!ELEMENT data (info*,
                other?,
                loc?,
                xy?,
                z?,
                comments?,
                misc?,
                cnt?)>
<!ELEMENT info  EMPTY>
<!ATTLIST info  kid   CDATA #IMPLIED
                well_kid   CDATA #IMPLIED
                key   CDATA #IMPLIED
                type  CDATA #IMPLIED
                api   CDATA #IMPLIED
                name   CDATA #IMPLIED
                status CDATA #IMPLIED
                error  CDATA #IMPLIED>
<!ELEMENT other EMPTY>
<!ATTLIST other operator  CDATA #IMPLIED
                oper_kid  CDATA #IMPLIED
                field     CDATA #IMPLIED
                field_kid CDATA #IMPLIED>
<!ELEMENT loc EMPTY>
<!ATTLIST loc state     CDATA #IMPLIED
              state_cd  CDATA #IMPLIED
              county    CDATA #IMPLIED
              county_cd CDATA #IMPLIED
              loc       CDATA #IMPLIED
              town      CDATA #IMPLIED
              town_dir  CDATA #IMPLIED
              range     CDATA #IMPLIED
              range_dir CDATA #IMPLIED
              section   CDATA #IMPLIED>
<!ELEMENT xy  EMPTY>
<!ATTLIST xy  latitude  CDATA #IMPLIED
              longitude CDATA #IMPLIED
              zone      CDATA #IMPLIED
              utm_x     CDATA #IMPLIED
              utm_y     CDATA #IMPLIED>
<!ELEMENT z   EMPTY>
<!ATTLIST z   depth     CDATA #IMPLIED
              gl        CDATA #IMPLIED
              kb        CDATA #IMPLIED
              df        CDATA #IMPLIED>
<!ELEMENT comments (#PCDATA)>
<!ELEMENT misc EMPTY>
<!ATTLIST misc user      CDATA #IMPLIED
               access    CDATA #IMPLIED
               source    CDATA #IMPLIED
               date      CDATA #IMPLIED>
<!ELEMENT cnt EMPTY>
<!ATTLIST cnt  las       CDATA #IMPLIED
               tops      CDATA #IMPLIED
               core      CDATA #IMPLIED
               images    CDATA #IMPLIED>]>
<headers records="1">
  <data>
    <loc town="31" town_dir="S" range="1" range_dir="E" section="32" />
    <xy latitude="37.311703" longitude="-97.339619" />
    <z gl="1277" />
  </data>
</headers>
```

The “UTM” Button will compute the UTM XY coordinates from the latitude & longitude. The analysis uses A Working Manual by John P. Snyder, U.S. Geological Survey Professional Paper 1395, USG Printing Office, Washington, DC, 1987 (http://pubs.er.usgs.gov/djvu/PP/PP_1395.pdf).

The Status button allows the user to change the well status.



Select “Status” Button to display the “Select Status of Data” Dialog, which displays the list of possible common well status.

Highlight the desired status and click on the “Select” Button to transfer the Mnemonic to the “Status” Button text.

Select the “Ok” Button to update the Header Information in Brine Plot Control dialog. The “Header Information” Summary Panel in the Control Dialog will change if any of the fields were modified, e.g. the latitude, longitude, status, depth and elevation and the Profile Plot.

Save Well Data as Log ASCII Standard (LAS) version 3.0 File

The LAS (Log ASCII Standard) is rapidly becoming the accepted industry standard for electronic transmission of digital wire-line logs. Earlier digital formats were commonly coded in binary (such as LIS) and so required specialized software to read them. The LAS standard was introduced by the Canadian Well Logging Society (http://www.cwls.org/) in 1989 to standardize the organization of digital log curve information for personal computer users. It did this very successfully and the standard became popular worldwide. Version 1.2 was the first version and was followed in September 1992 by version 2.0 to address some inconsistencies. A more versatile version LAS 3.0 was released in 1999 however at present LAS 2.0 remains the dominant product. LAS 3.0 clarify several of the poorly defined specifications of LAS 2.0 and provide expanded data storage capabilities, but have seen limited implementation.

The GEMINI Tools programs will read either a Log ASCII Standard (LAS) version 2.0 or 3.0 file and version 1.2 but the Well Information Section is backward in data definition and will not be parsed correctly in the GEMINI Tools web apps.

The sections defined for the LAS 2.0 standard are as follows (http://www.cwls.org/wp-content/uploads/2014/09/LAS_20_Update_Jan2014.pdf):

- **"~V"** (also known as "~VERSION INFORMATION SECTION") is a required section; has formatting requirements; must be the first section; identifies the version number and whether data is in "wrapped" or "un-wrapped" mode.
- **"~W"** (also known as "~WELL INFORMATION SECTION") is a required section; has formatting requirements; is preferably the second section; contains information on the well name, location, and start and stop values of the data in this file.
- **"~C"** (also known as ~CURVE INFORMATION SECTION") is a required section; has formatting requirements; contains curve mnemonics and their definitions in the order that they appear in the data section.
- **"~P"** (also known as ~PARAMETER INFORMATION SECTION") is an optional section; has formatting requirements; contains information on parameters or constants relevant to the wellbore such as mud resistivity, wire line engineer, truck number, elevation data, etc.
- **"~O"** (also known as "~OTHER") is an optional section; has no formatting requirements; contains other information or comments.
- **"~A"** (also known as ~ASCII LOG DATA") is a required section; has formatting requirements; is the last section in the file and also referred to as the data section. The index of the data columns is either Depth or Time. The index values always appear in the first column and each column of data must be separated by at least one space (ASCII 32). All values in the ASCII log data section must be floating point or integer (long) values. Other formats such as Text or Exponential values are not supported.

LAS 3.0 (http://www.cwls.org/wp-content/uploads/2014/09/LAS_3_File_Structure.pdf) will be used to save the well data for the GEMINI Tools web apps since it can hold all the well data in one file. You can even think of LAS 2.0 as a subset of LAS 3.0 since the LAS 2.0 is only

concerned with the LOG Data. Note this section includes some of the referenced LAS 3 File Structure PDF; see the above URL for the complete LAS 3.0 File structure.

The **~Version** and **~Well** sections must appear in every LAS 3.0 file as the first and second sections respectively.

Other sections are grouped by data type. Each group consists of two or three sections; a **Parameter Data** section (optional for all but Log data), a **Column Definition** section, and a **Column Data** section, in that order.

For example, core analysis data would have the following three sections:

~Core_Parameter
~Core_Definition
~Core_Data.

At least one group or data type of either the defined LAS 3.0 data types or a user defined type must exist in every LAS 3.0 file.

The **Column Definition** and the **Column Data** sections for each data type are matched sets and must both appear in that order. The corresponding **Parameter Data** section is optional (except for Log data), but if used must appear before the corresponding **Column Definition** Section.

LAS 3.0 defines six specific well related data types and their root Section Title names. They are:

~Ascii or ~Log
~Core
~Inclinometry
~Drilling
~Tops
~Test

Additional data types can be defined by the user and content rules discussed elsewhere in the document may define other section titles.

Stand alone user defined **Parameter Data** sections can be included. Care must be taken to use standalone **Parameter Data** sections only when the data contained does not fit into any of the other defined data types.

When used, the section order of each set of the three sections for each data type must be Parameter, Definition, and then Data.

Blank lines and comment lines can appear within **Column Data** sections, but can only appear BEFORE the first **Column Data** line of that section, or after the LAST **Column Data** line of that section.

The names of each channel can optionally appear above each channel as a comment line immediately before, after or on the section title line of that section if space allows.

Note: Do not use the ~Other section recognized by LAS version 2.0. It is no longer allowed in LAS 3.0. Any data that can be stored in this section must now be stored properly in a user defined **Parameter Data** or **Column Data** section.

The LAS version 3.0 file has the potential to hold all the well data that was collected, i.e. multiple log data files, core data, tops data, DST data, Perforation data, Cuttings Report data, etc. As an example the Newby 2-28R has log, core, tops, perforation data as well as the PfEFFER data created from the log analysis tool, PfEFFER-java. You can view the file at the following URL addresses,

LAS 3.0 Example File: http://www.kgs.ku.edu/Gemini/Tools/documentation/ Wellington_KGS_1-32_LAS3.las

LAS 3.0 in WinZip File: http://www.kgs.ku.edu/Gemini/Tools/documentation/ Wellington_KGS_1-32_LAS3.zip

Standard LAS 3.0 Data Sections for the Wellington_KGS_1-32_LAS3.las

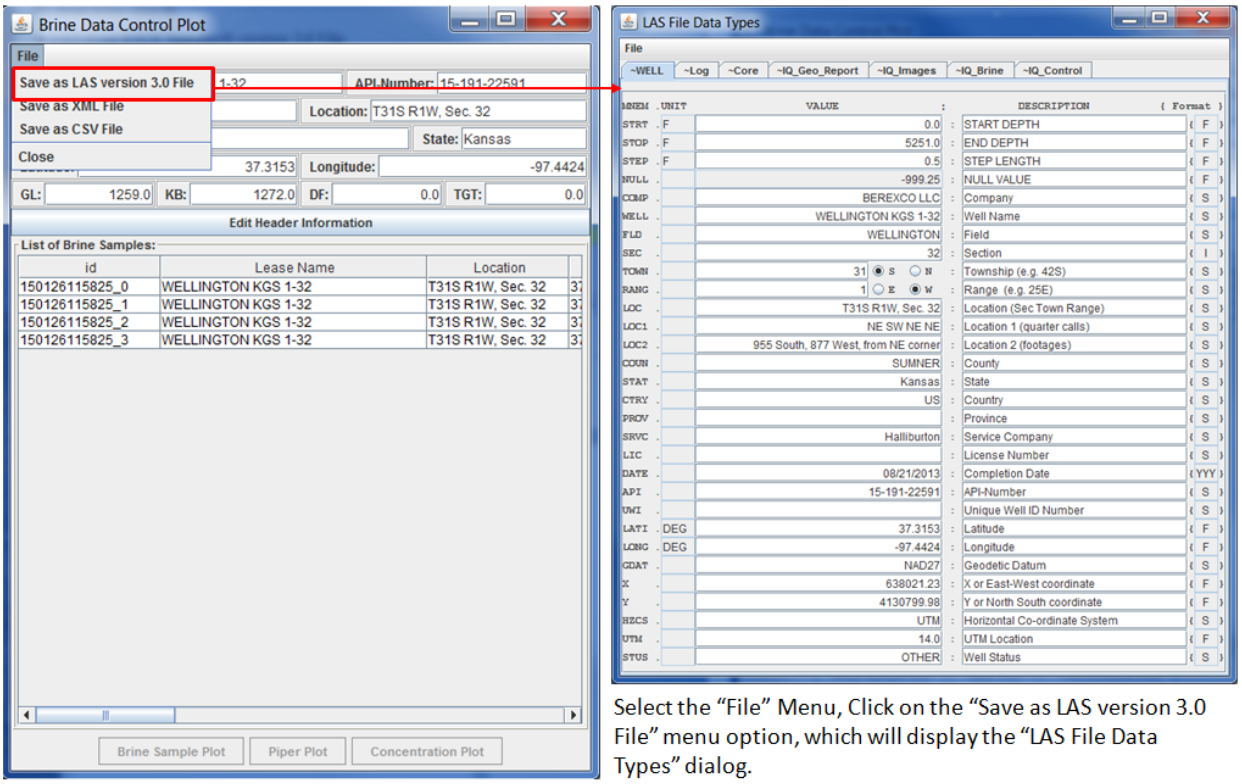
- ~Version - Version Section
- ~Well - Well Header Information Section
- ~Log - Log Data Section – for single log data file, see LAS 3.0 PDF reference below for multiple log data runs.
    - ~Parameter
    - ~Curve
    - ~ASCII, which must be the last section in the LAS File if the Log data is present.
- ~Core - Core Data Section
    - ~Core_Parameter
    - ~Core_Definition
    - ~Core_Data | Core_Definition
- ~Tops - Formation Top (Stratigraphic Units) Picks Data Section
    - ~Tops_Parameter
    - ~Tops_Definition
    - ~Tops_Data | Tops_Definition

GEMINI Tools Defined LAS 3.0 Data Sections for the Wellington_KGS_1-32_LAS3.las

- ~IQ_Control - Recreate the Profile Plot Data Section
    - ~IQ_Control_Parameter
    - ~IQ_Control_Definition
    - ~IQ_Control_Data | IQ_Control_Definition
- ~IQ_Geo_Report – This data holds the geologist cuttings report/core description
    - ~ IQ_Geo_Report _Parameter
    - ~ IQ_Geo_Report _Definition
    - ~ IQ_Geo_Report | IQ_Geo_Report_Definition
- ~IQ_Images – This data holds the file location of Core Image JPEG images.
    - ~ IQ_Images _Parameter
    - ~ IQ_Images _Definition
    - ~ IQ_Images | IQ_Images_Definition
- ~IQ_Brine – This data holds the measured brine data.
    - ~ IQ_Brine _Parameter

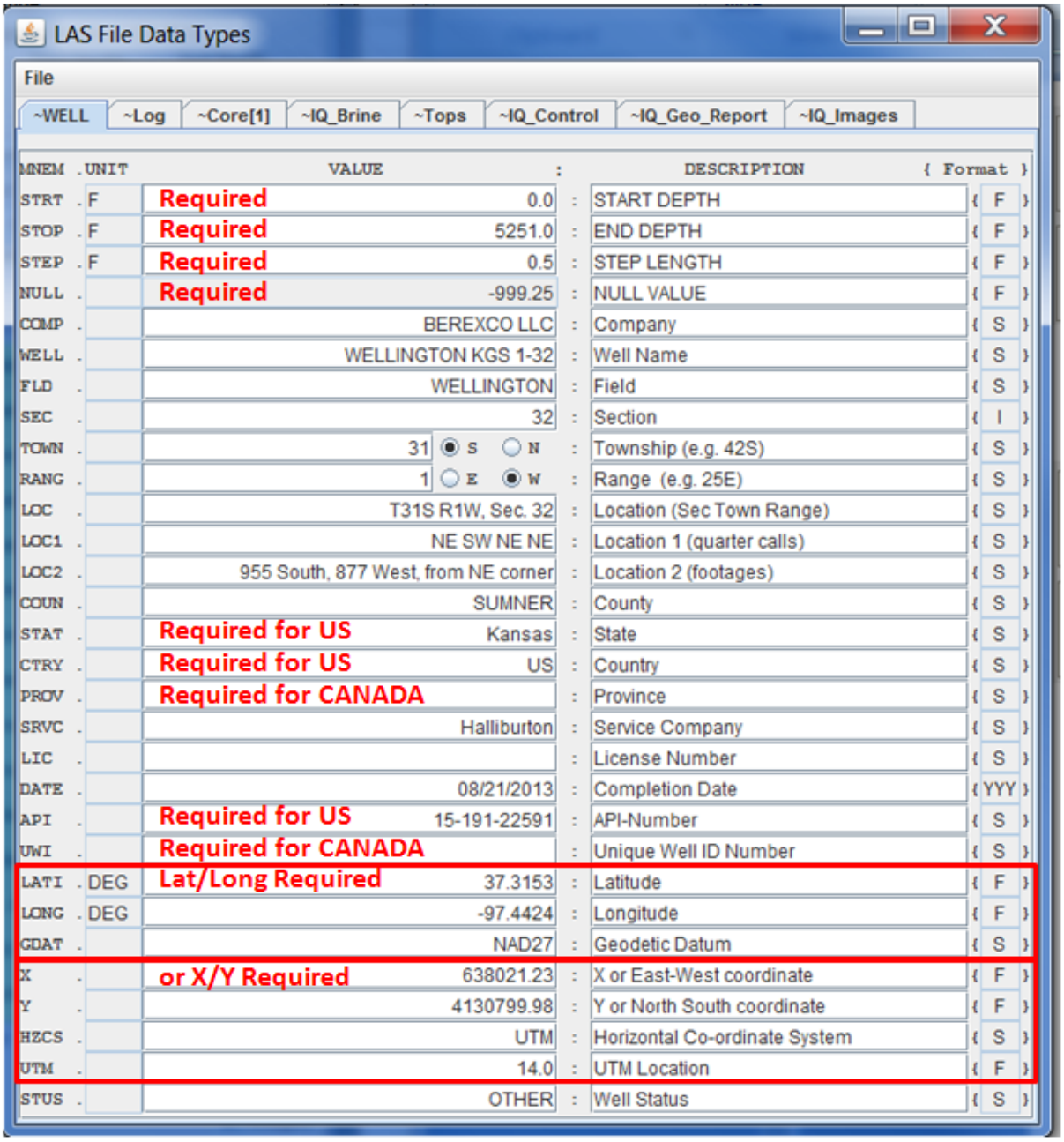
- ~ IQ_Brine _Definition
- ~ IQ_Brine | IQ_Brine_Definition

- ~IQ_Las_Parameter - Selected LAS Curves – This Parameter Section was designed to remember the Log Curves selected by the user so the user does not have to map LAS File Curve Mnemonics to KGS Standard Tool Mnemonics when they run this file with other GEMINI Tools.



Select the "File" Menu, Click on the "Save as LAS version 3.0 File" menu option, which will display the "LAS File Data Types" dialog.

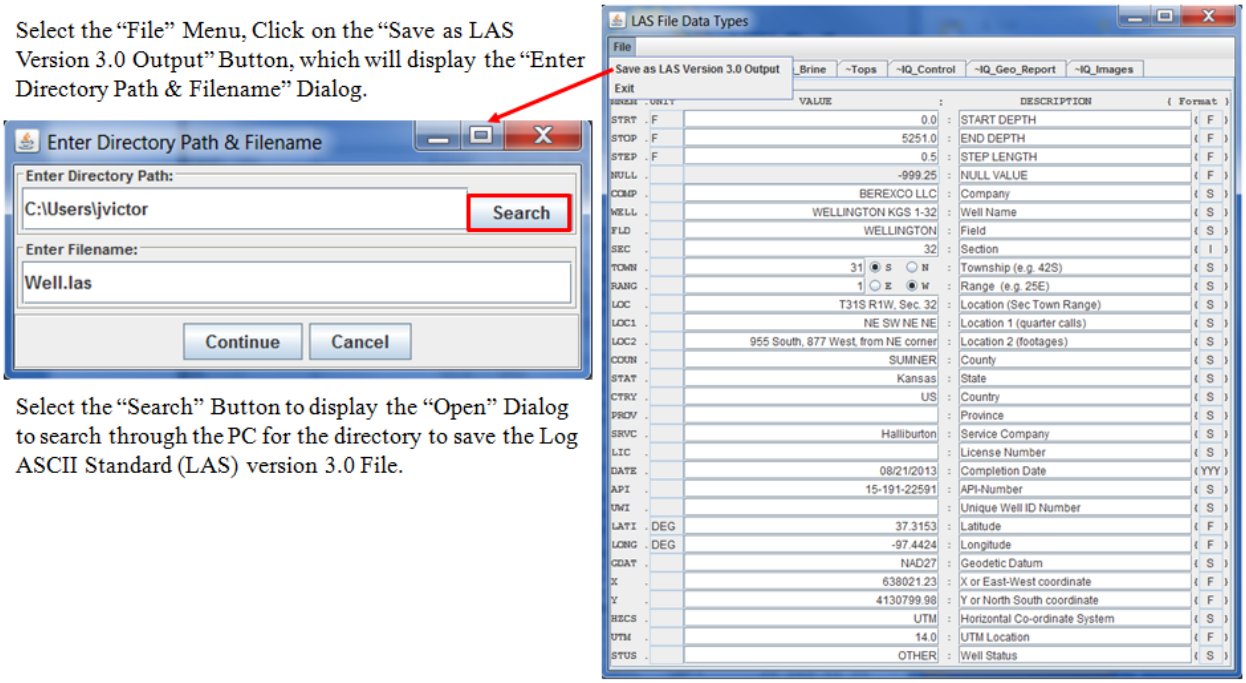
The Tabs at the top identifies the data that will be saved to the Log ASCII Standard (LAS) version 3.0 File. This example saves the well info, log data, core data, brine data, tops data, profile plot control data, cuttings/core description and core image file locations on the KGS Server. The "LAS File Data Types" Dialog allows the user to modify the well header data that is being saved to the LAS version 3.0 file. Also noted in the two images are identified "required" fields for a valid LAS file. The GEMINI Tools Web Apps doesn't care that the LAS file is not valid, just that the data follows the basic rules for the well data sections in the LAS 3.0 file.


LAS File Data Types
File
~WELL
~Log
~Core[1]
~IQ_Brine
~Tops
~IQ_Control
~IQ_Geo_Report
~IQ_Images
MNEM . UNIT VALUE : DESCRIPTION { Format }
STRT . F Required 0.0 : START DEPTH { F }
STOP . F Required 5251.0 : END DEPTH { F }
STEP . F Required 0.5 : STEP LENGTH { F }
NULL . Required -999.25 : NULL VALUE { F }
COMP . BEREXCO LLC : Company { S }
WELL . WELLINGTON KGS 1-32 : Well Name { S }
FLD . WELLINGTON : Field { S }
SEC . 32 : Section { I }
TOWN . 31 S N : Township (e.g. 42S) { S }
RANG . 1 E W : Range (e.g. 25E) { S }
LOC . T31S R1W, Sec. 32 : Location (Sec Town Range) { S }
LOC1 . NE SW NE NE : Location 1 (quarter calls) { S }
LOC2 . 955 South, 877 West, from NE corner : Location 2 (footages) { S }
COUN . SUMNER : County { S }
STAT . Required for US Kansas : State { S }
CTRY . Required for US US : Country { S }
PROV . Required for CANADA : Province { S }
SRVC . Halliburton : Service Company { S }
LIC . : License Number { S }
DATE . 08/21/2013 : Completion Date { YYY }
API . Required for US 15-191-22591 : API-Number { S }
UWI . Required for CANADA : Unique Well ID Number { S }
LATI . DEG Lat/Long Required 37.3153 : Latitude { F }
LONG . DEG -97.4424 : Longitude { F }
GDAT . NAD27 : Geodetic Datum { S }
X . or X/Y Required 638021.23 : X or East-West coordinate { F }
Y . 4130799.98 : Y or North South coordinate { F }
HZCS . UTM : Horizontal Co-ordinate System { S }
UTM . 14.0 : UTM Location { F }
STUS . OTHER : Well Status { S }

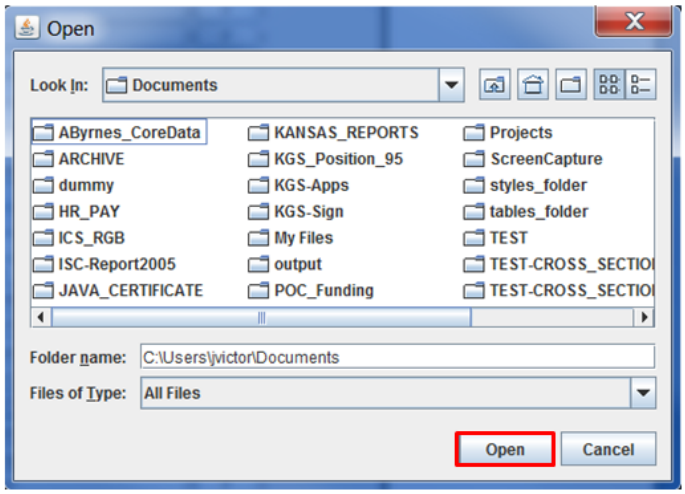
~Log_Parameters

MNEM	.UNIT	VALUE	:	DESCRIPTION	{ Format }	Association
PDAT		Required GL	:	Permanent Data	{ S }	
APD	F	Required 13.0	:	Above Permanent Data	{ F }	
DREF		Required KB	:	Depth Reference (KB,DF,CB)	{ S }	
EREF	F	Required 1272.0	:	Elevation of Depth Reference	{ F }	
RUN		Required 1	:	Run Number	{ F }	
TDL	F	5240.0	:	Total Depth Logger	{ F }	
TDD	F	5240.0	:	Total Depth Driller	{ F }	
CSGL	F	607.0	:	Casing Bottom Logger	{ F }	
CSGD	F	607.0	:	Casing Bottom Driller	{ F }	
CSGS	IN	8.625	:	Casing Size	{ F }	
CSGW	LB		:	Casing Weight	{ F }	
BS	IN	7.875	:	Bit Size	{ F }	
MUD		Water Based Mud	:	Mud type	{ S }	
MUDS		Flow Line	:	Mud Source	{ S }	
MUDD	gm/cc	9.0	:	Mud Density	{ F }	
MUDV	s/qt	48.0	:	Mud Viscosity (Funnel)	{ F }	
FL	cc	9.2	:	Fluid Loss	{ F }	
PH		10.0	:	PH	{ F }	
RM	OHM-M	0.65	:	Resistivity of Mud	{ F }	
RMT	DEG-F	58.0	:	Temperature of Mud	{ F }	
RMF	OHM-M	0.55	:	Resistivity. of Mud Filtrate	{ F }	
RMFT	DEG-F	58.0	:	Temperature of Mud Filtrate	{ F }	
RMC	OHM-M	0.75	:	Resistivity of Mud Cake	{ F }	
RMCT	DEG-F	58.0	:	Temperature of Mud Cake	{ F }	
TMAX	DEG-F	125.0	:	Maximum Recorded Temp.	{ F }	
TIMC	DATE		:	Date/Time Circulation Stopped	{ D/M/YYY }	
TIML	DATE	02/09/2011	:	Date/Time Logger Tagged Bottom	{ M/YYYY }	
UNIT		10546696	:	Logging Unit Number	{ F }	
BASE		Liberal, KS	:	Home Base of Logging Unit	{ S }	
ENG		J.Bosh	:	Recording Engineer	{ S }	
WIT		L.Watney	:	Witnessed By	{ S }	

Select the "File" Menu, Click on the "Save as LAS Version 3.0 Output" Button, which will display the "Enter Directory Path & Filename" Dialog.

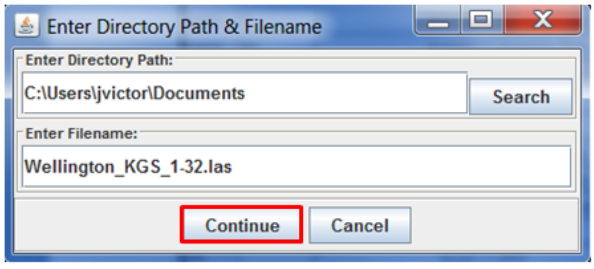


Select the "Search" Button to display the "Open" Dialog to search through the PC for the directory to save the Log ASCII Standard (LAS) version 3.0 File.



Search the PC for the directory that the LAS version 3.0 File will be saved to. Select "Open" Button to transfer the Directory path to the "Enter Directory Path" text field in the "Enter Directory Path & Filename" Dialog.

Change the file name in the ", e.g. "Wellington_KGS_1-32.las, then select the "Continue" Button to save the Wellington KGS 1-32 well data to the LAS version 3.0 file.



Save Brine Data as Extensible Markup Language (XML) ASCII File

The Save as XML File process automatically writes the brine data into a Extensible Markup Language (XML) file using the Document Type Definition (DTD), see the DTD below,

```
<?xml version="1.0"?>
<!DOCTYPE fluid_data [
<!ELEMENT fluid_data (columns*,
data*)+>
<!ELEMENT columns (column*)>
<!ATTLIST columns records CDATA
#REQUIRED>
<!ELEMENT column EMPTY>
<!ATTLIST column mnemonic CDATA
#REQUIRED
          name    CDATA #REQUIRED
          unit    CDATA #REQUIRED
          type    CDATA #REQUIRED>
<!ELEMENT data (row*)>
<!ATTLIST data records CDATA
#REQUIRED>
<!ELEMENT row EMPTY>
<!ATTLIST row  KEY    CDATA #IMPLIED
```

Well Header Information →

```
API    CDATA #IMPLIED
NAME   CDATA #IMPLIED
FIELD  CDATA #IMPLIED
LOC    CDATA #IMPLIED
COUNTY CDATA #IMPLIED
STATE  CDATA #IMPLIED
LAT    CDATA #IMPLIED
LONG   CDATA #IMPLIED
KB     CDATA #IMPLIED
GL     CDATA #IMPLIED
DF     CDATA #IMPLIED
TGT    CDATA #IMPLIED
SRC    CDATA #IMPLIED
DATE   CDATA #IMPLIED
```

Other Measured Data →

```
FORM   CDATA #IMPLIED
AGE    CDATA #IMPLIED
TOP    CDATA #IMPLIED
BASE   CDATA #IMPLIED
SPGR   CDATA #IMPLIED
SIGMA  CDATA #IMPLIED
PH     CDATA #IMPLIED
DEG    CDATA #IMPLIED
OHM    CDATA #IMPLIED
OHM75  CDATA #IMPLIED
OHME   CDATA #IMPLIED
```

Cations

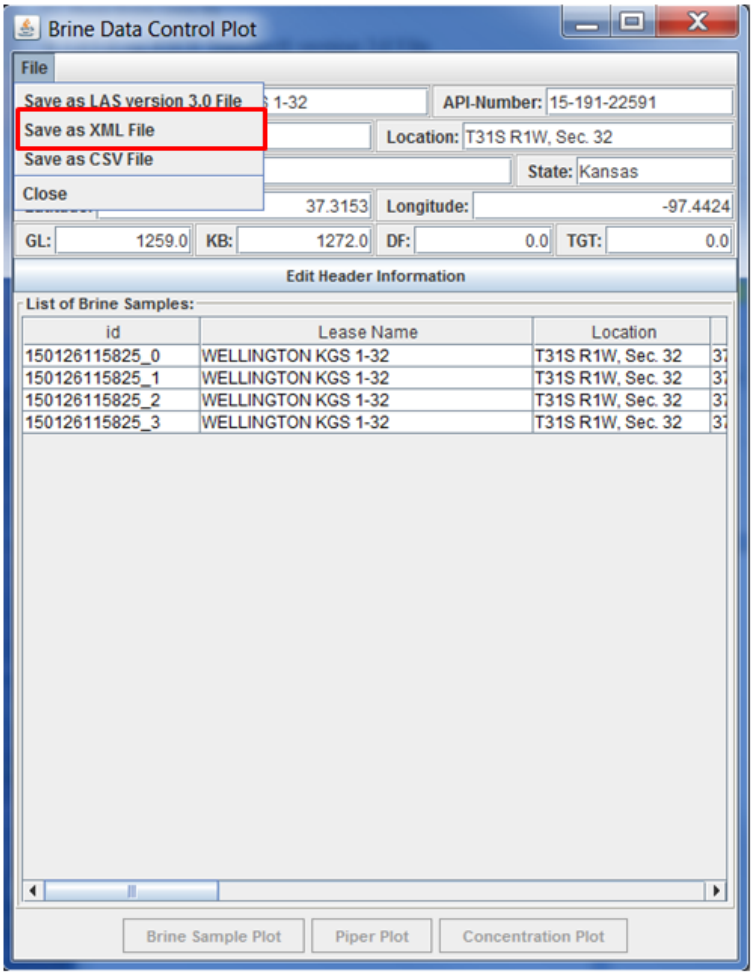
```
Li     CDATA #IMPLIED
Na     CDATA #IMPLIED
K      CDATA #IMPLIED
Rb     CDATA #IMPLIED
Cs     CDATA #IMPLIED
Na_K   CDATA #IMPLIED
Be     CDATA #IMPLIED
Mg     CDATA #IMPLIED
Ca     CDATA #IMPLIED
Sr     CDATA #IMPLIED
Ba     CDATA #IMPLIED
CrII   CDATA #IMPLIED
CrIII  CDATA #IMPLIED
MnII   CDATA #IMPLIED
MnIII  CDATA #IMPLIED
FeII   CDATA #IMPLIED
FeIII  CDATA #IMPLIED
CoII   CDATA #IMPLIED
CoIII  CDATA #IMPLIED
NiII   CDATA #IMPLIED
NiIII  CDATA #IMPLIED
Cu     CDATA #IMPLIED
CuII   CDATA #IMPLIED
Ag     CDATA #IMPLIED
Au     CDATA #IMPLIED
AuIII  CDATA #IMPLIED
Zn     CDATA #IMPLIED
Cd     CDATA #IMPLIED
Hg     CDATA #IMPLIED
HgII   CDATA #IMPLIED
Al     CDATA #IMPLIED
SbIII  CDATA #IMPLIED
SbV    CDATA #IMPLIED
BiIII  CDATA #IMPLIED
BiV    CDATA #IMPLIED
SnII   CDATA #IMPLIED
SnIV   CDATA #IMPLIED
PbII   CDATA #IMPLIED
PbIV   CDATA #IMPLIED
NH4    CDATA #IMPLIED
```

Anions

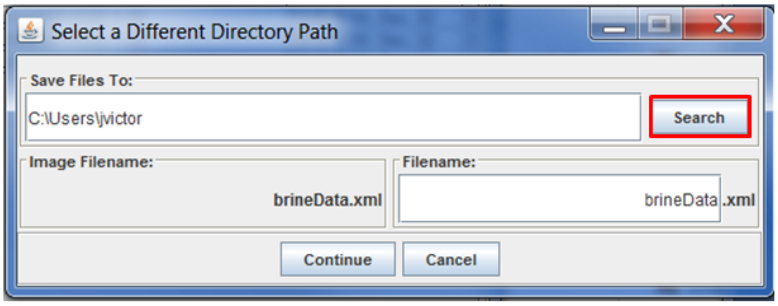
```
F      CDATA #IMPLIED
Cl     CDATA #IMPLIED
Br     CDATA #IMPLIED
I      CDATA #IMPLIED
OH     CDATA #IMPLIED
BO3    CDATA #IMPLIED
CO3    CDATA #IMPLIED
HCO3   CDATA #IMPLIED
ClO    CDATA #IMPLIED
ClO2   CDATA #IMPLIED
ClO3   CDATA #IMPLIED
ClO4   CDATA #IMPLIED
CN     CDATA #IMPLIED
NCO    CDATA #IMPLIED
OCN    CDATA #IMPLIED
SCN    CDATA #IMPLIED
N      CDATA #IMPLIED
N3     CDATA #IMPLIED
NO2    CDATA #IMPLIED
NO3    CDATA #IMPLIED
CrO4   CDATA #IMPLIED
Cr2O7  CDATA #IMPLIED
MnO4   CDATA #IMPLIED
P      CDATA #IMPLIED
PO4    CDATA #IMPLIED
HPO4   CDATA #IMPLIED
H2PO4  CDATA #IMPLIED
As     CDATA #IMPLIED
Se     CDATA #IMPLIED
S      CDATA #IMPLIED
HS     CDATA #IMPLIED
SO3    CDATA #IMPLIED
HSO3   CDATA #IMPLIED
S2O3   CDATA #IMPLIED
SO4    CDATA #IMPLIED
HSO4   CDATA #IMPLIED

SOLID  CDATA #IMPLIED
TDS    CDATA #IMPLIED>]>
```

The user does not have to anything more than to define the Directory Path and Filename of the XML File. NOTE: the brine data will be saved in units of (mg/l).

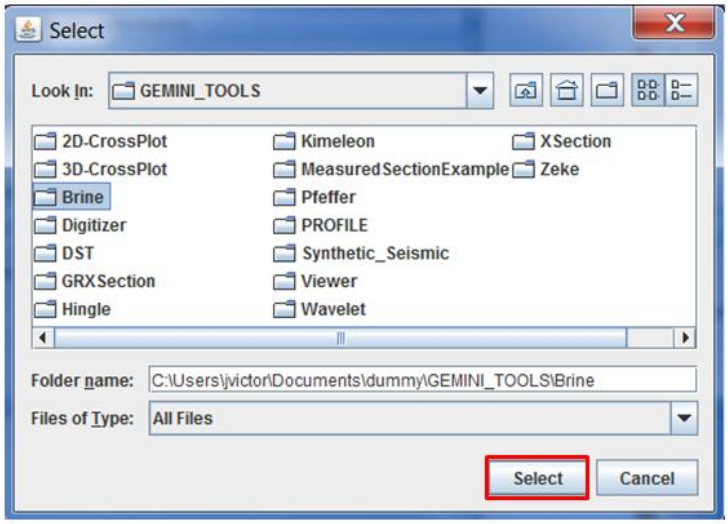


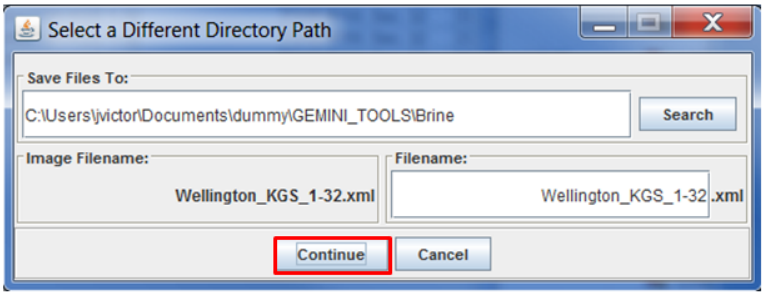
Select the "File" Menu, Click on the "Save as XML File" menu option, which will display the "Select a Different Directory Path" dialog.



The default directory is your Home Directory. The user can search their PC for the desired directory path by selecting the "Search" button. This will display the "Select" dialog.

Once you have found the directory click on the “Select” button to select the Directory Path, which will insert the path into the “Save Files To” text field in the “Select a Different Directory Path” dialog.

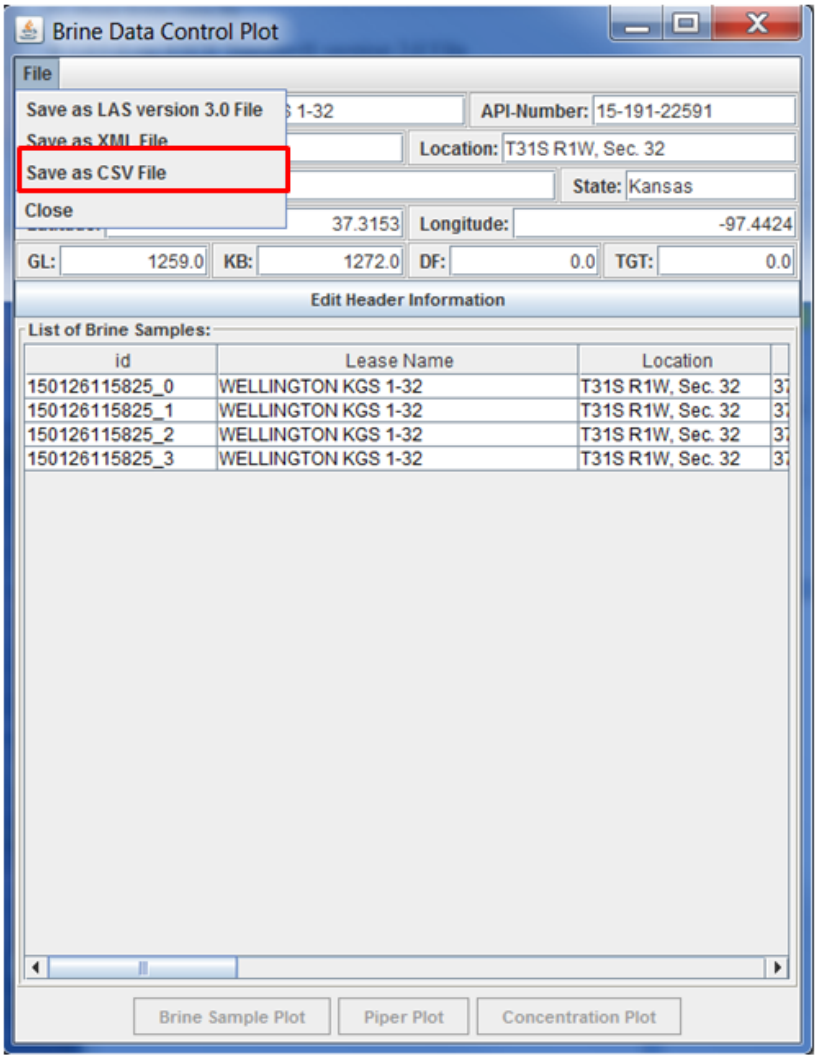




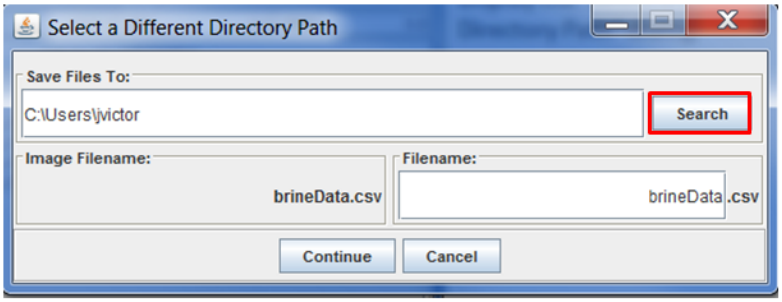
In the “Filename” text field enter the filename you wish to save the XML file to, i.e. Wellington_KGS_1-32 leave off the .xml since the program will automatically append the “.xml” to the filename. Click on the “Continue” button to save the brine data to the XML file.

Save Brine Data as Comma Separated Values (CSV) ASCII File

The Save as CSV File process automatically writes the brine data into a Comma Separated Values (CSV) file. The user does not have to anything more than to define the Directory Path and Filename of the CSV File. NOTE: the brine data will be saved in units of (mg/l).

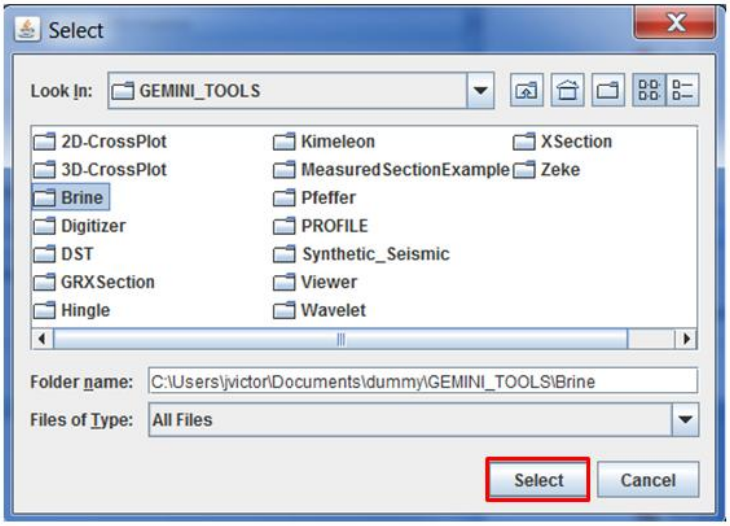


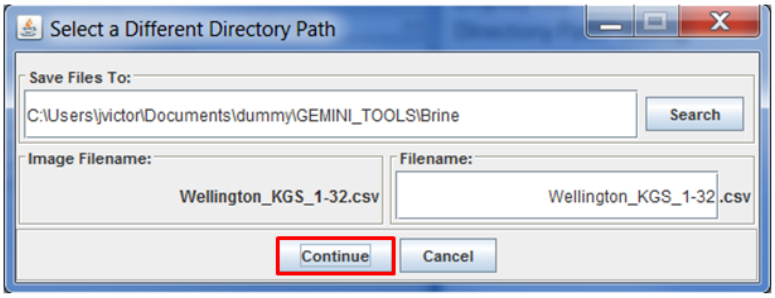
Select the "File" Menu, Click on the "Save as CSV File" menu option, which will display the "Select a Different Directory Path" dialog.



The default directory is your Home Directory. The user can search their PC for the desired directory path by selecting the "Search" button. This will display the "Select" dialog.

Once you have found the directory click on the “Select” button to select the Directory Path, which will insert the path into the “Save Files To” text field in the “Select a Different Directory Path” dialog.





In the “Filename” text field enter the filename you wish to save the CSV file to, i.e. Wellington_KGS_1-32 leave off the .csv since the program will automatically append the “.csv” to the filename. Click on the “Continue” button to save the brine data to the CSV file.