TECHNICAL NOTES

November 2, 2012

MO-1 Technical Note Number 50

Re: NASIS and GIS - Populating Coordinate Pairs in the NASIS Site Table

Software referred to in technical note:

- Windows 7
- NASIS 6.2
- ArcGIS 10.0
- DNR GPS 6.0
-

This technical note provides detailed guidance in the following:

a. How to correctly populate coordinate pairs and their associated fields in the NASIS Site table.

b. How to use ArcMap to calculate latitude/longitude in decimal degrees, using WGS 84 datum, for a feature class or shapefile.

c. How to use the Import GPS Site Data function in NASIS 6.2, including guidance on how to create .gpx files.

Notes:

- Guidance in this technical note includes detailed step-by-step instructions and numerous screenshots. Discrepancies will occur if using software other than those referred to in this technical note.

- All fields highlighted in green **ARE REQUIRED** to be populated in the NASIS Site table.

Table of Contents

1. Populating Coordinates and Associated Fields in the Site Table 3
Standard Latitude and Longitude in Decimal Degrees 3
a. Std. Latitude/Std. Longitude 3
b. Coordinate Source 4
c. GPS - Positional Error 4
d. GPS - PDOD 4
Latitude and Longitude in Degrees, Minutes, Seconds 5
a. Lat. degrees, lat. minutes, lat. seconds, long. degrees, long. minutes, long. seconds 5
b. Lat. direction, Long. direction 5
c. Datum name 5
Universal Transverse Mercator (UTM) 6
a. UTM Zone 6
b. UTM Easting, UTM Northing 7
2. Calculating Latitude/Longitude in a Shapefile or Feature Class 8
3. How to Use the Import GPS Site Data Tool in NASIS 16
How to Import a GPX File into NASIS 16
How to Create a GPX File in DNR GPS 6.0 19
How to Convert a Point Feature Class or Shapefile to a GPX file 21

1. Populating Coordinates and Associated Fields in the Site Table

NASIS allows coordinate pairs to be entered in the following formats:

- Standard latitude/longitude in decimal degrees
- Latitude/longitude in degrees, minutes, seconds
- UTMs

This section discusses each set of coordinate pairs and their associated fields.

Standard Latitude and Longitude in Decimal Degrees

Site Table Fields Covered in This Section:

a. Std Latitude and Std Longitude
b. Coordinate Source
c. GPS – Positional Error
d. GPS – PDOP

a. Std. Latitude/Std. Longitude

Std Latitude	Std Longitude
44.0242805	-120.4835968
44.0512276	-120.2910919
44.0326157	-120.2385941

- The purpose of these fields is to have a national datum and format standard for all sites entered into NASIS
    - Historically, coordinates were entered into NASIS in variable datums and variable coordinate pair types, which made the display of site locations difficult
    - These new fields provide datum and format consistency, which allows for easy display of site locations in ArcGIS.

- **IMPORTANT: Std Latitude and Std Longitude must be in decimal degrees projected in the WGS84 Datum**
    - **Do not populate these fields with coordinates projected using a datum that is different from WGS84**

- In MO1, Std. Longitude must be negative.

- These fields can be auto-populated from a GPX file or manually populated
    - Auto population will be explained in the last portion of this technical note

b. Coordinate Source

- This field refers only to std. latitude and std. longitude.
- Choose one of the following options:
    - ***Auto-populated from gps***
    - ***Auto-populated from survey grade gps***
        - ***Contact MO-1 staff with questions about what is considered as a survey grade gps.***
    - ***Estimated from other source***
        - Choose when estimating coordinates based on a narrative description or PLSS information.
    - ***Manually entered from gps***
        - Choose when coordinates were collected with a GPS unit but were not auto-populated.
    - ***Manually entered from post-validation***
        - Choose when coordinates were collected with a GPS unit but were not auto-populated and were post-validated before entering.
        - Post-validating implies that the points were reviewed.
    - ***Unknown***
- "Manually entered from gps, auto-populated from gps, or estimated from other source" are most commonly used.

c. GPS - Positional Error

- The potential distance in meters between the GPS coordinate location and the true location of a point observation.
- Acquired from a GPS unit.
- Only refers to the std. latitude and std. longitude fields.

d. GPS - PDOD

- Position dilution of precision.
- Describes the geometric strength of satellites.
- Acquired from a GPS unit.
- Only refers to the std. latitude and std. longitude fields.

Latitude and Longitude in Degrees, Minutes, Seconds

Site Table Fields Covered in This Section:

a. Lat. Degrees, Lat Minutes, Lat Seconds, Long Degrees, Long Minutes, and Long Seconds
b. Lat Direction and Long Direction
c. Datum Name

a. Lat. degrees, lat. minutes, lat. seconds, long. degrees, long. minutes, long. seconds

- Not required.
- These coordinates can be projected in various datums, but NAD 83 or WGS 84 commonly are used.
- Coordinates are entered in degrees, minutes, seconds as opposed to decimal degrees.
- Longitude is always positive when entered in degrees, minutes, seconds.

b. Lat. direction, Long. direction

- Not required.
- Direction must be populated in the lat. direction and long. direction fields.
    - In the United States, longitude is always west and latitude is always north.

c. Datum name

- Not required.
- Only associated field that must be populated when entering latitude in degrees, minutes, seconds.
- This field defines the datum for both UTM and latitude and longitude in degrees, minutes, seconds.

Notes:

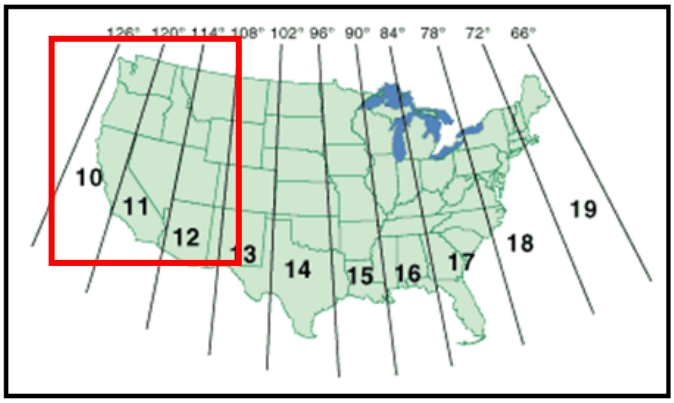
- Coordinate source, GPS - positional error, and GPS - PDOP refer only to the std. latitude and std. longitude fields.
    - These fields do not refer to UTM or latitude/longitude in degrees, minutes, seconds.

Universal Transverse Mercator (UTM)

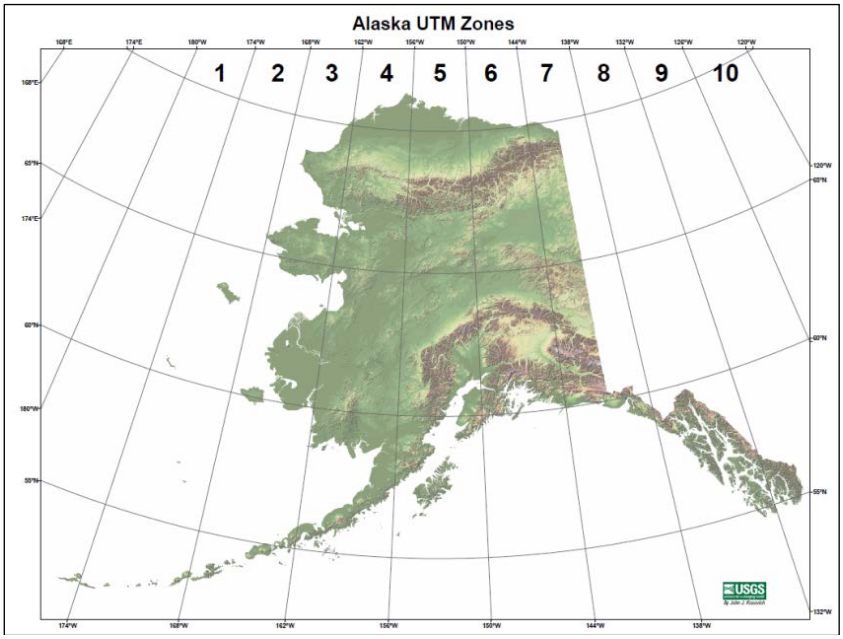
Site Table Fields Covered in This Section:
a. UTM Zone
b. UTM Northing and UTM Easting

a. UTM Zone

- Not required, **but if entering UTMs, must populate the UTM Zone field.**
  - Oregon, Washington, and Idaho are in UTM Zones 10-12.



  - Alaska is in UTM Zones 1-9.



b. UTM Easting, UTM Northing

- Population of these fields is not required.
- These coordinates can be projected in various datums, but NAD 83 or WGS 84 commonly are used.
- UTM coordinates are entered in meters.

Notes:

- Only one datum name field is in NASIS. It defines the datum for both UTMs and latitude and longitude in degrees, minutes, seconds.
- Coordinate source, GPS - positional error, and GPS - PDOP refer only to the std. latitude and std. longitude fields. These fields do not refer to UTM or latitude/longitude in degrees, minutes, seconds.

2. Calculating Latitude/Longitude in a Shapefile or Feature Class

The step-by-step instructions in this section show how to use the Calculate Geometry Tool in ArcMap to calculate latitude and longitude in decimal degrees, WGS 84 for a point feature class or point shapefile that is using the NAD83 datum. This tool will calculate the coordinates for every record (point) in the point shapefile or feature class.

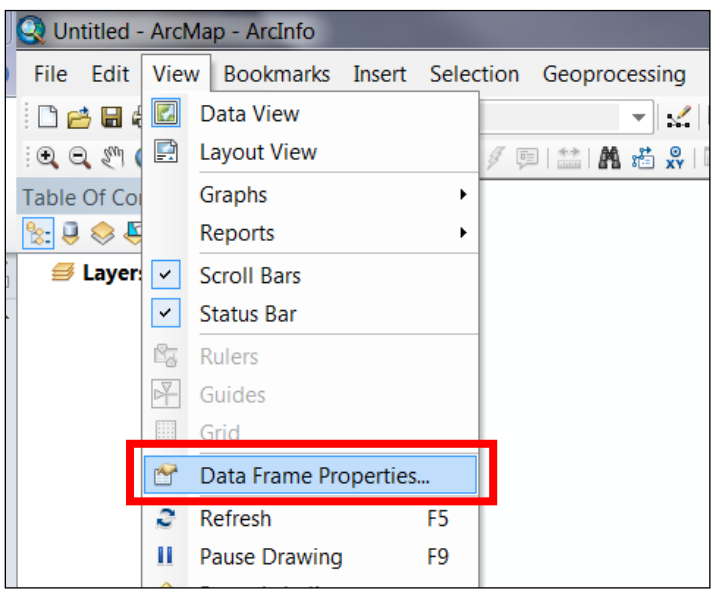
The workflow overview is:

- Start with an empty ArcMap project
- Set the data frame coordinates to WGS 84
- Add your point layer
- Add new fields to the point layer
- Calculate geometry on new fields

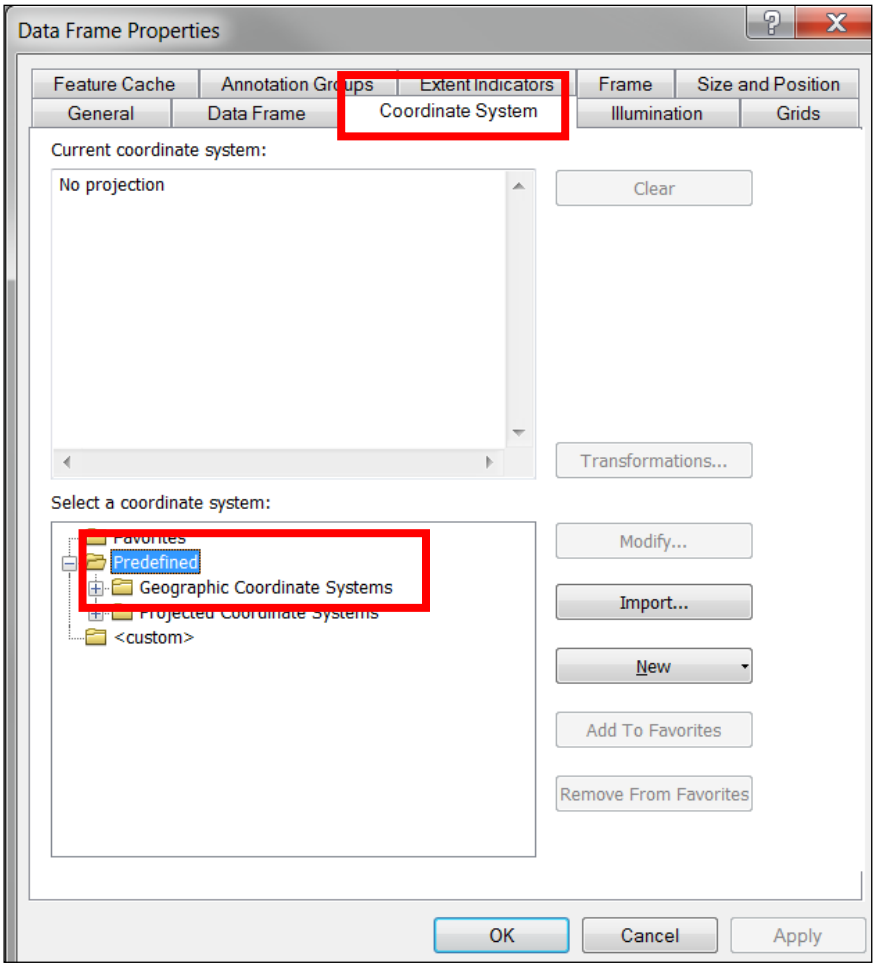
Below are the step-by-step instructions. The instructions are the same for shapefiles and feature classes.

1. Open a blank .mxd in ArcMap.

2. Click View > Data Frame Properties.



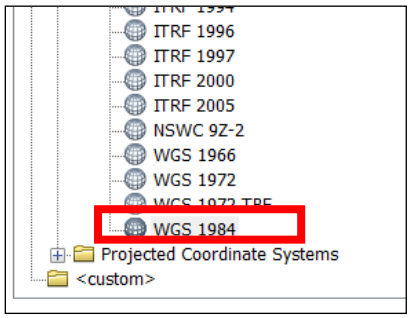
3. Click the Coordinate System tab and in the "Select a coordinate system:" section, click the Predefined folder.



4. Click the Geographic Coordinate Systems folder to expand.

5. Click the World folder to expand.

6. Select WGS 1984.

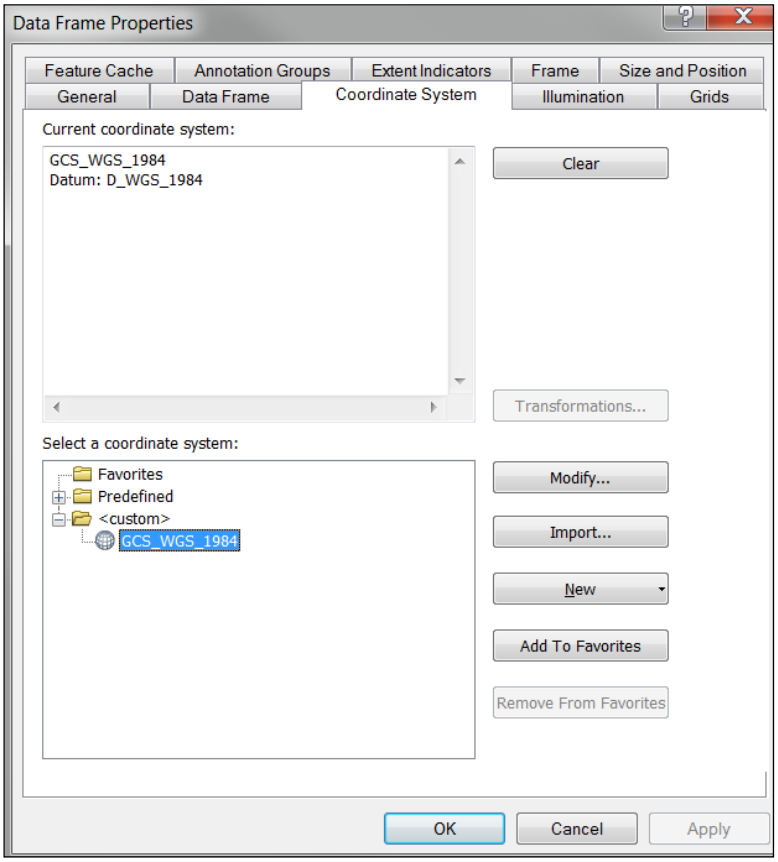


7. Click OK.

The coordinate source for the data frame is now set to Geographic Coordinate System, WGS 1984.

WGS 1984 is synonymous with WGS 84.

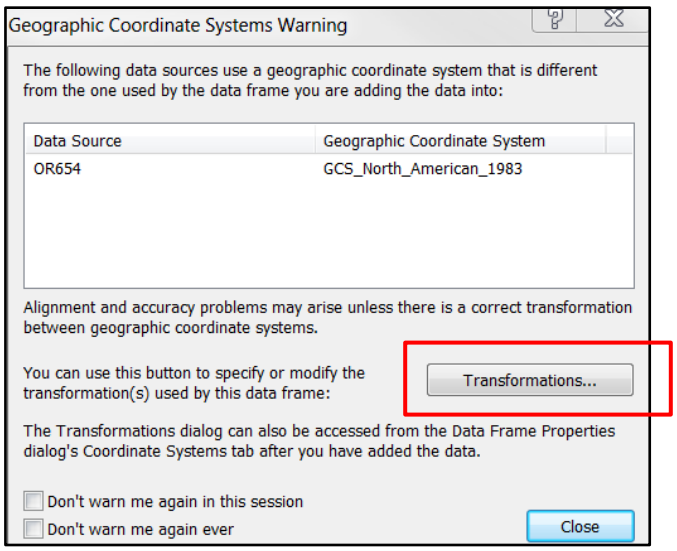
Confirm the coordinate source of the data frame by repeating steps 2 and 3. The image below will appear onscreen.



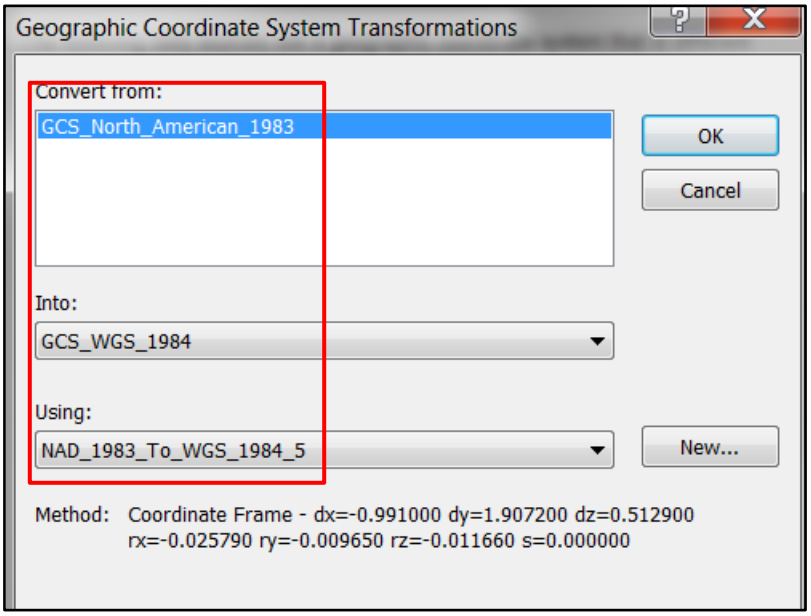
8. Click Add Data and load your point feature class or shapefile.

This process assumes you are going to load a shapefile or feature class that is <u>using the NAD83 datum</u>. This means that ArcMap needs to know what transformation to use in order to convert NAD83 into WGS84. There reason there are different transformation is because different parts of the globe each have their own transformation. When converting NAD83 to WGS84, North America always uses the "NAD_1983_To_WGS_1984_5" transformation.

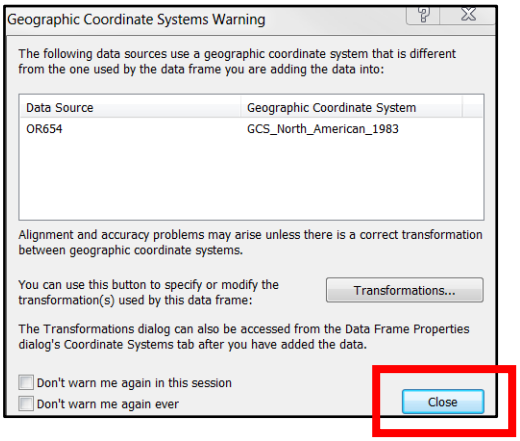
9. Click Transformations



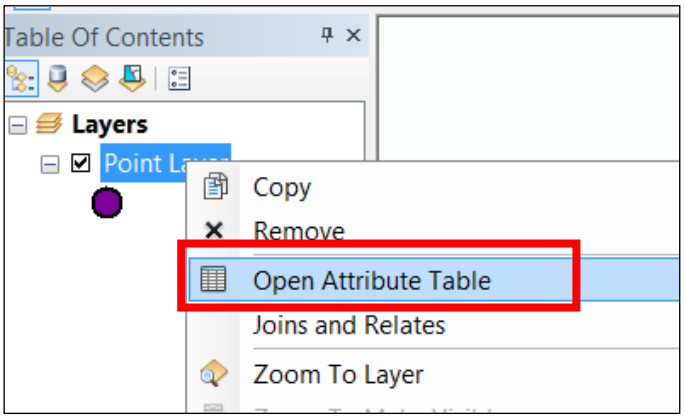
10. Enter the same parameters as in the screen shot below > Click Ok



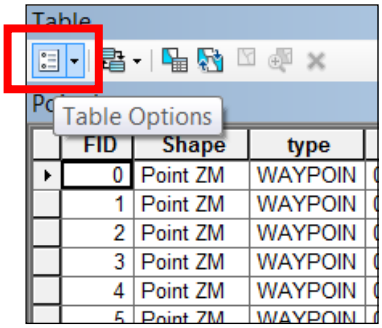
11. Click close on the next screen

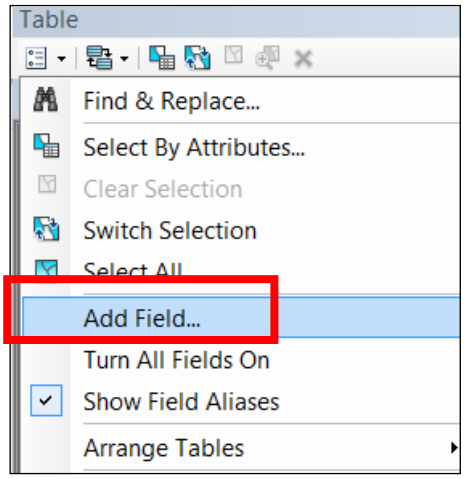


12. Right click your point feature class or shapefile and choose Open Attribute Table.

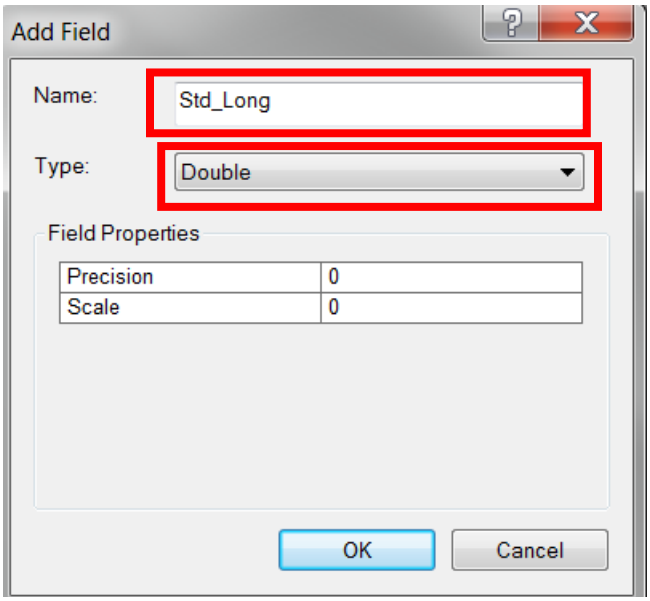


13. Click Table Options > Add Field.



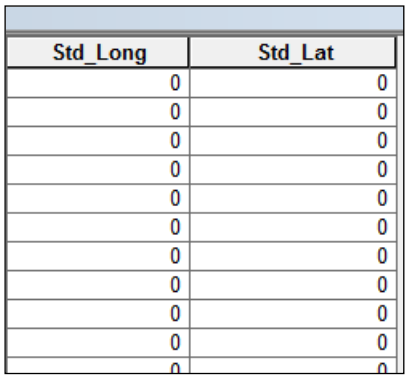


14. Enter Std_Long as the name and select Double as the type.



15. Click OK.
16. Repeat steps 11-12, but enter Std_Lat as the name.

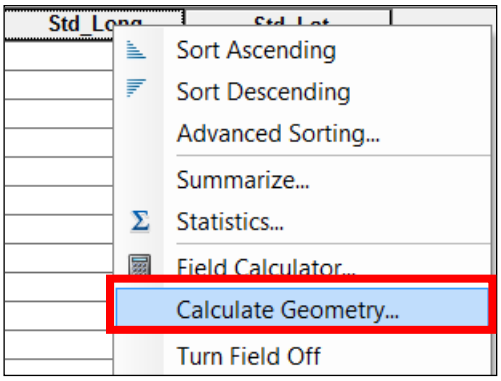
These two fields should be in the attribute table:



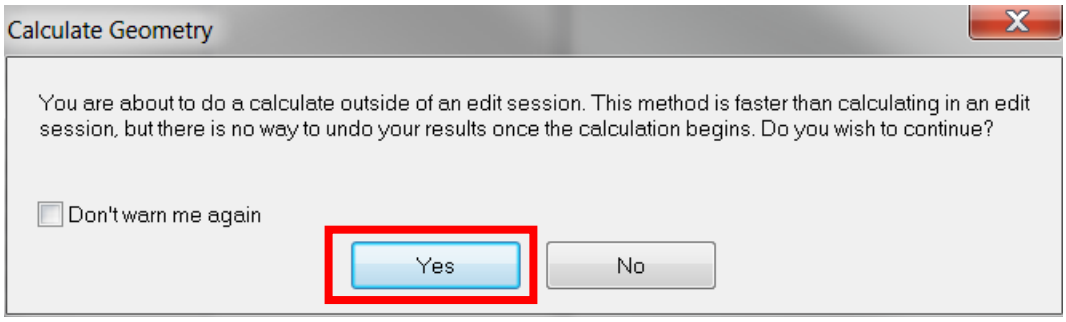
Std_Long	Std_Lat
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

17. Right click on the Std_Long field (right click on the Std_Long header).

18. Choose Calculate Geometry.



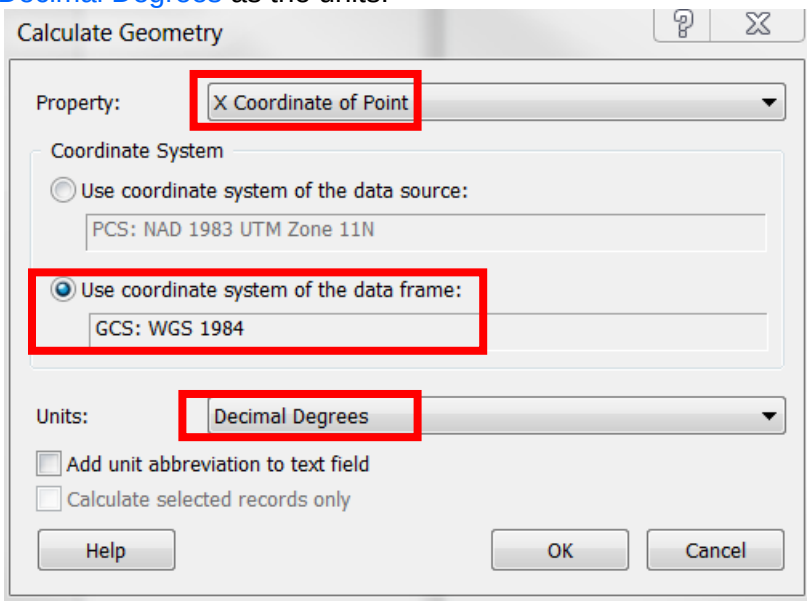
19. Click Yes if the following message appears.



20. Choose X Coordinate of Point as the property.

    a. Click Use coordinate system of the data frame (should show GCS: WGS 1984).

21. Choose Decimal Degrees as the units.



Longitude coordinates are on the X axis.

Latitude coordinates are on the Y axis.

22. Repeat steps 15-19 for Std_Lat, but select Y Coordinate of Point as the property for this field.

Something similar to the screenshot below should appear.

These coordinates are all in the WGS 84 Geographic Coordinate Source.

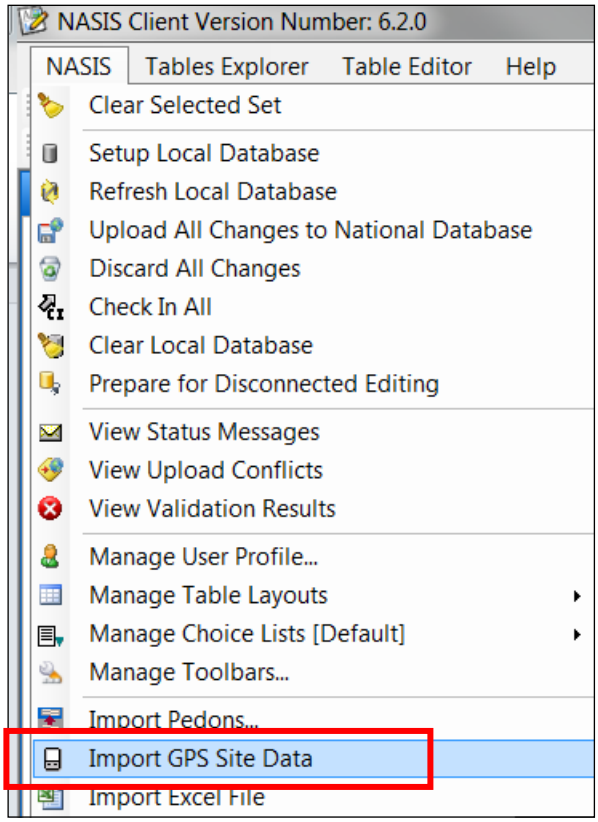
They are in the correct format for entry into the std. longitude and std. latitude fields in the NASIS Site table.

Notice how the Std_Long values are all negative. Longitude coordinates in decimal degrees are displayed this way in the United States.

Std_Long	Std_Lat
-122.654766	45.530032
-122.654766	45.530032
-122.654766	45.530032
-122.654766	45.530032
-121.386855	44.964839
-121.38682	44.964774
-121.385148	44.965358
-121.385051	44.965149
-121.384796	44.965622
-121.384794	44.965533
-121.37913	44.966505
-121.37836	44.966356
-121.37821	44.966209
-121.378289	44.966062

3. How to Use the Import GPS Site Data Tool in NASIS

NASIS 6.2 includes a function called Import GPS Site Data. It is located in the NASIS drop-down menu.



This function auto populates the std. longitude, std. latitude, and user site ID fields from a .gpx file.

A .gpx file can be created in DNR GPS 6.0, or it can be created by converting a feature class or shapefile into the GPX format. GPX stands for "GPS Exchange Format". It is a universal data format for exchanging GPS data between programs. Coordinates in the .gpx file always include decimal degrees in WGS 84.

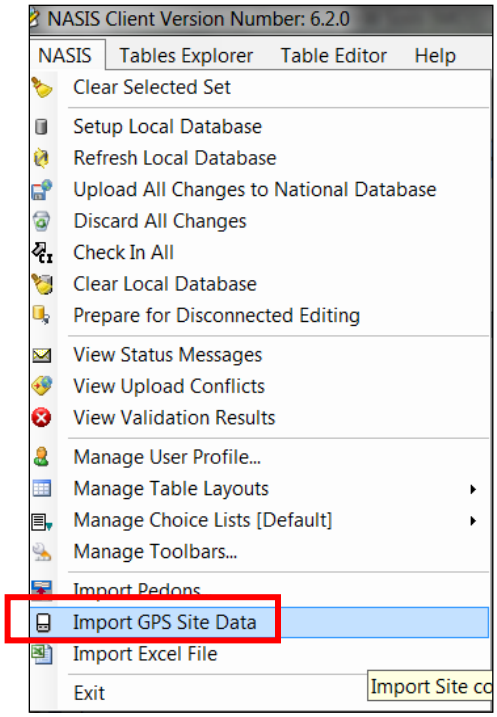
Guidance in this section will cover

- How to import a GPX file into NASIS
- How to create GPX files in DNR GPS 6.0
- How to convert a feature class or shapefile to GPX

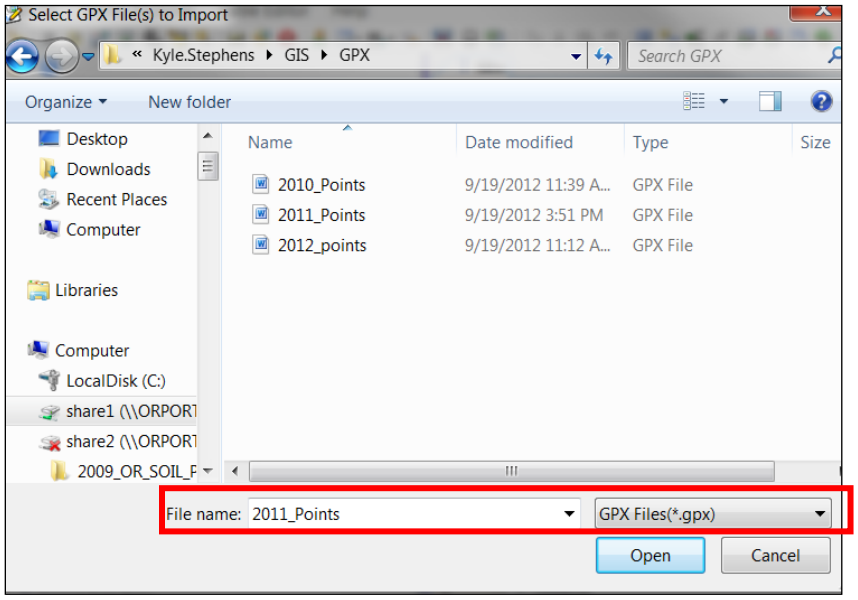
How to Import a GPX File into NASIS

1. Open NASIS 6.2.

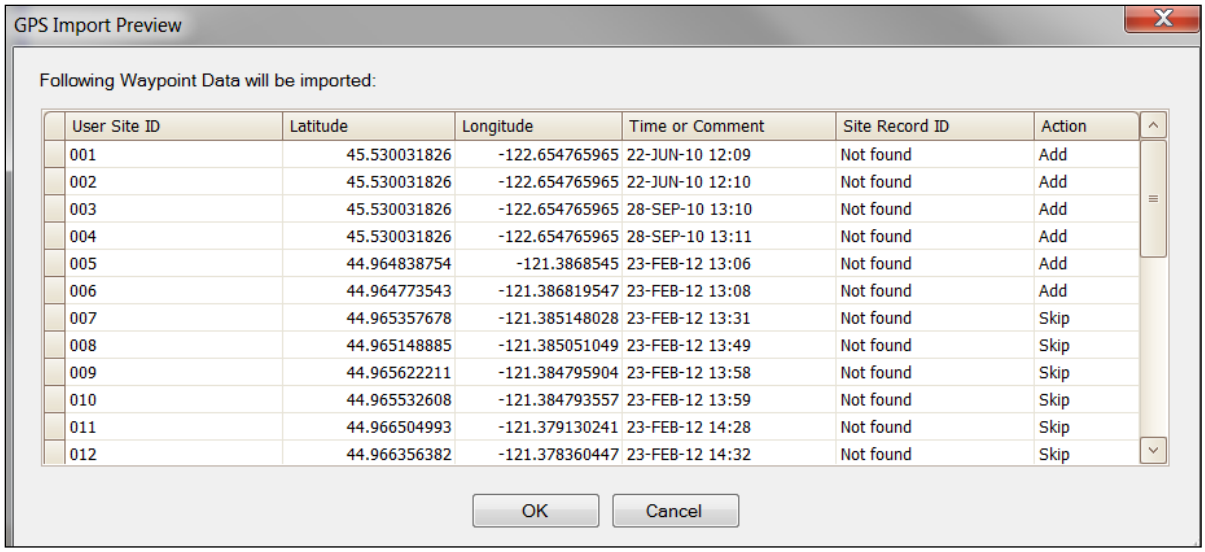
2. Click NASIS > Import GPS Site Data.



3. Browse to .gpx file and click Open.

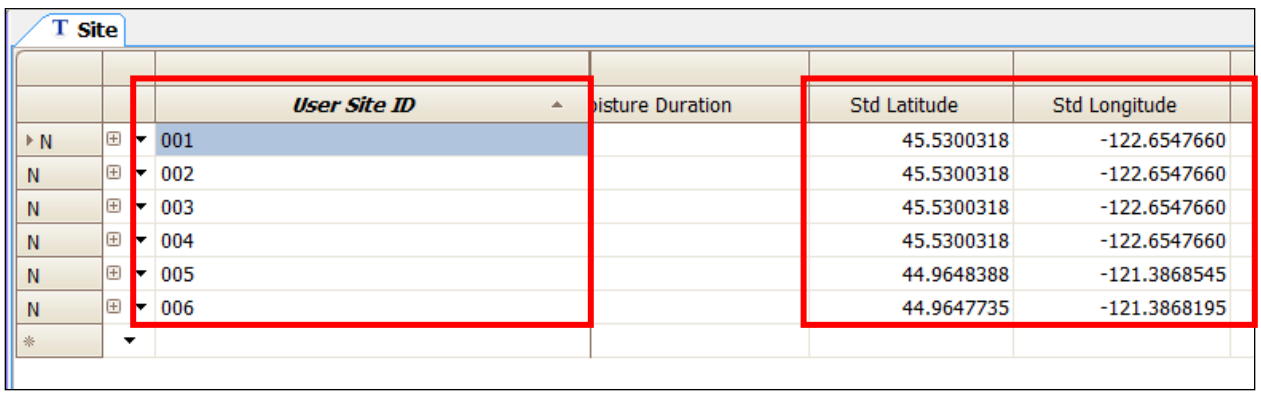


4. After the dialog box shown below opens, click OK to import data from all points.



User Site ID	Latitude	Longitude	Time or Comment	Site Record ID	Action
001	45.530031826	-122.654765965	22-JUN-10 12:09	Not found	Add
002	45.530031826	-122.654765965	22-JUN-10 12:10	Not found	Add
003	45.530031826	-122.654765965	28-SEP-10 13:10	Not found	Add
004	45.530031826	-122.654765965	28-SEP-10 13:11	Not found	Add
005	44.964838754	-121.3868545	23-FEB-12 13:06	Not found	Add
006	44.964773543	-121.386819547	23-FEB-12 13:08	Not found	Add
007	44.965357678	-121.385148028	23-FEB-12 13:31	Not found	Skip
008	44.965148885	-121.385051049	23-FEB-12 13:49	Not found	Skip
009	44.965622211	-121.384795904	23-FEB-12 13:58	Not found	Skip
010	44.965532608	-121.384793557	23-FEB-12 13:59	Not found	Skip
011	44.966504993	-121.379130241	23-FEB-12 14:28	Not found	Skip
012	44.966356382	-121.378360447	23-FEB-12 14:32	Not found	Skip

After clicking OK, the sites should be imported. The user site ID, std. latitude, and std. longitude fields should all be populated. See screenshot below for an example.



	User Site ID	isture Duration	Std Latitude	Std Longitude
N	001		45.5300318	-122.6547660
N	002		45.5300318	-122.6547660
N	003		45.5300318	-122.6547660
N	004		45.5300318	-122.6547660
N	005		44.9648388	-121.3868545
N	006		44.9647735	-121.3868195

Several options are in the Action column:

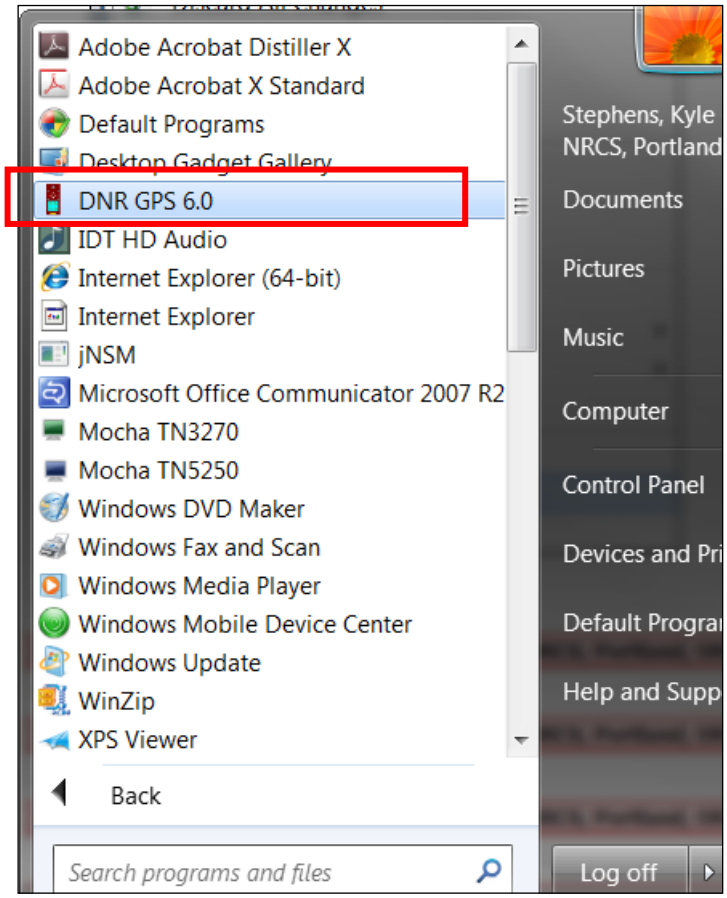
- *Add*
  - *Choose this to add new sites.*
- *Skip*
  - *Choose this if a particular site should not be added.*
  - *In the example above, 007-012 was not imported into NASIS.*
- *Update*
  - *Choose this to update information for sites that are already in NASIS.*
  - *<u>The user site ID in the .gpx file must match the user site ID in NASIS for this option to work.</u>*

5. Click Upload All Changes to National Database to save your new sites.

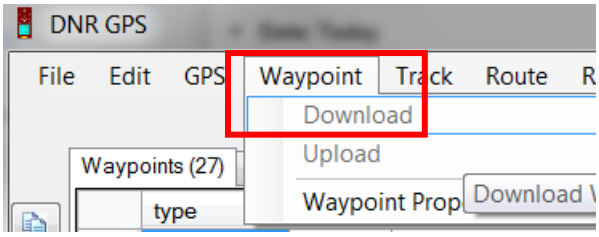
6. Begin populating sites with additional information and link to pedons.

How to Create a GPX File in DNR GPS 6.0

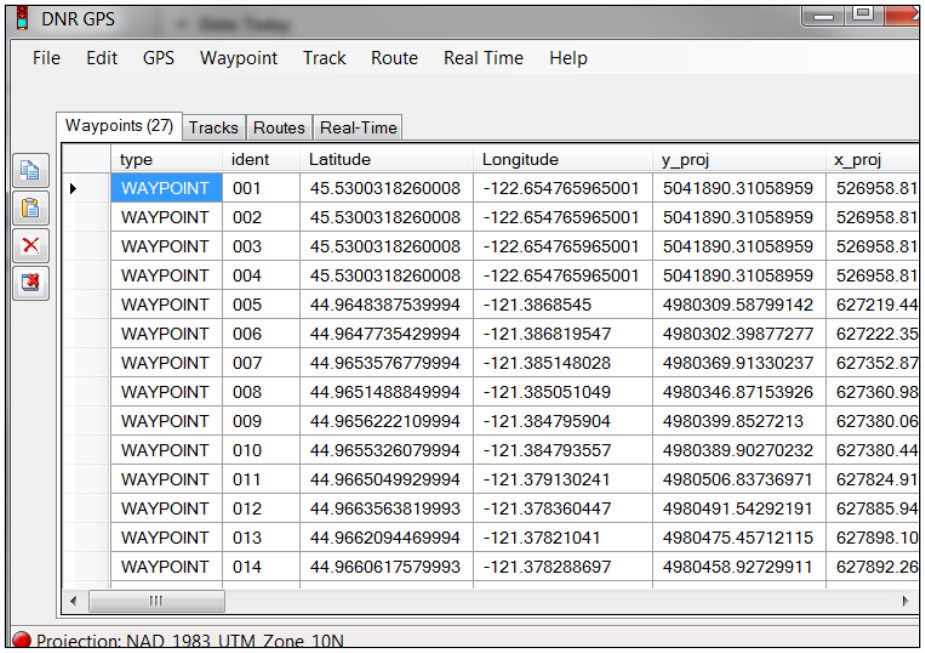
1. Hook up the Garmin GPS unit to the computer and turn it on.
2. Open the DNR GPS 6.0 program.



3. At the top of menu bar, click Waypoint > Download.

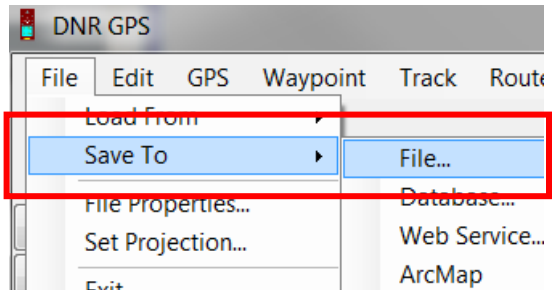


Something similar to the screenshot below should appear:

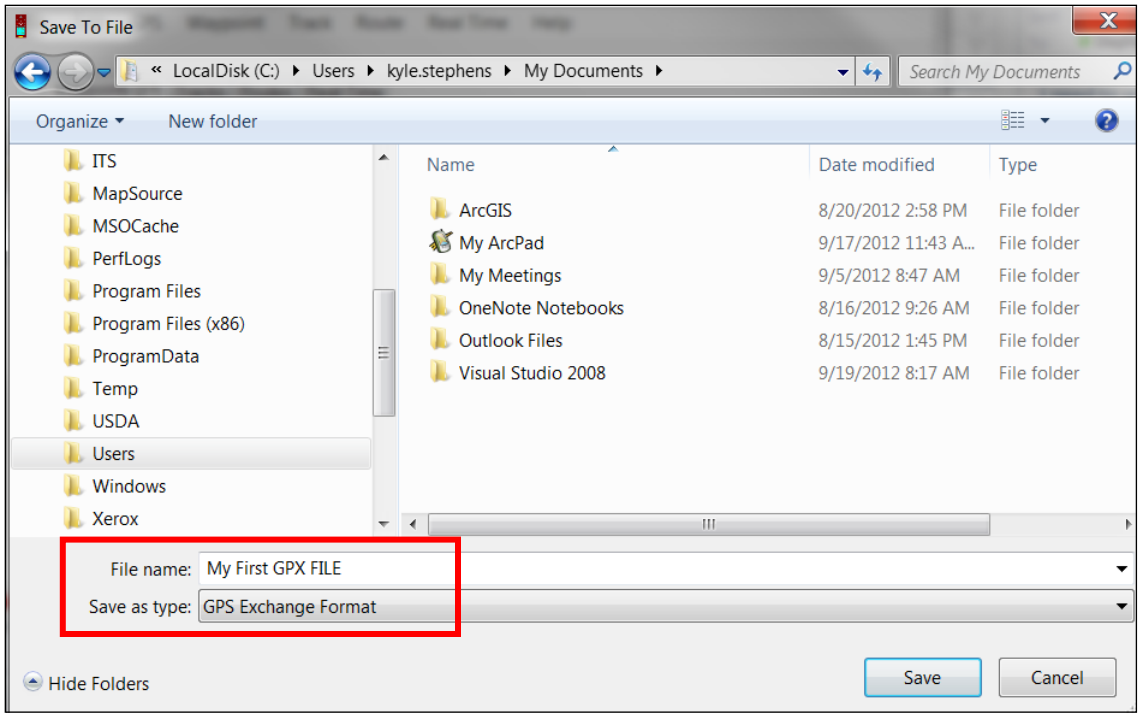


type	ident	Latitude	Longitude	y_proj	x_proj
WAYPOINT	001	45.5300318260008	-122.654765965001	5041890.31058959	526958.81
WAYPOINT	002	45.5300318260008	-122.654765965001	5041890.31058959	526958.81
WAYPOINT	003	45.5300318260008	-122.654765965001	5041890.31058959	526958.81
WAYPOINT	004	45.5300318260008	-122.654765965001	5041890.31058959	526958.81
WAYPOINT	005	44.9648387539994	-121.3868545	4980309.58799142	627219.44
WAYPOINT	006	44.9647735429994	-121.386819547	4980302.39877277	627222.35
WAYPOINT	007	44.9653576779994	-121.385148028	4980369.91330237	627352.87
WAYPOINT	008	44.9651488849994	-121.385051049	4980346.87153926	627360.98
WAYPOINT	009	44.9656222109994	-121.384795904	4980399.8527213	627380.06
WAYPOINT	010	44.9655326079994	-121.384793557	4980389.90270232	627380.44
WAYPOINT	011	44.9665049929994	-121.379130241	4980506.83736971	627824.91
WAYPOINT	012	44.9663563819993	-121.378360447	4980491.54292191	627885.94
WAYPOINT	013	44.9662094469994	-121.37821041	4980475.45712115	627898.10
WAYPOINT	014	44.9660617579993	-121.378288697	4980458.92729911	627892.26

4. At the top left of the menu bar, click File > Save To > File.



5. Browse to the location where the file is to be saved.
   a. Enter a file name.
   b. Select GPS Exchange Format as the “Save as type.”
   c. Click Save.



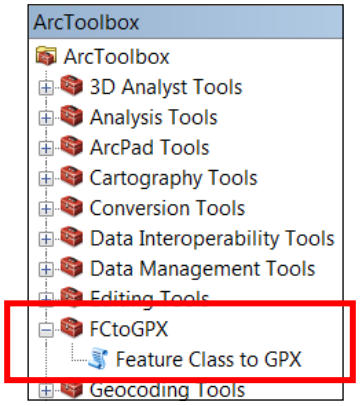
The GPX file is now ready to be imported into NASIS.

How to Convert a Point Feature Class or Shapefile to a GPX file

In order to convert a point feature class or shapefile into a GPX file you will need to install the "Convert Feature Class to GPX toolbox. Contact MO1 staff for assistance locating and installing this tool.

Your point layer must be in WGS 84 before it can be converted to a GPX file. Contact your MO staff if you need assistance with projecting or defining the projection of your shapefile or feature class.

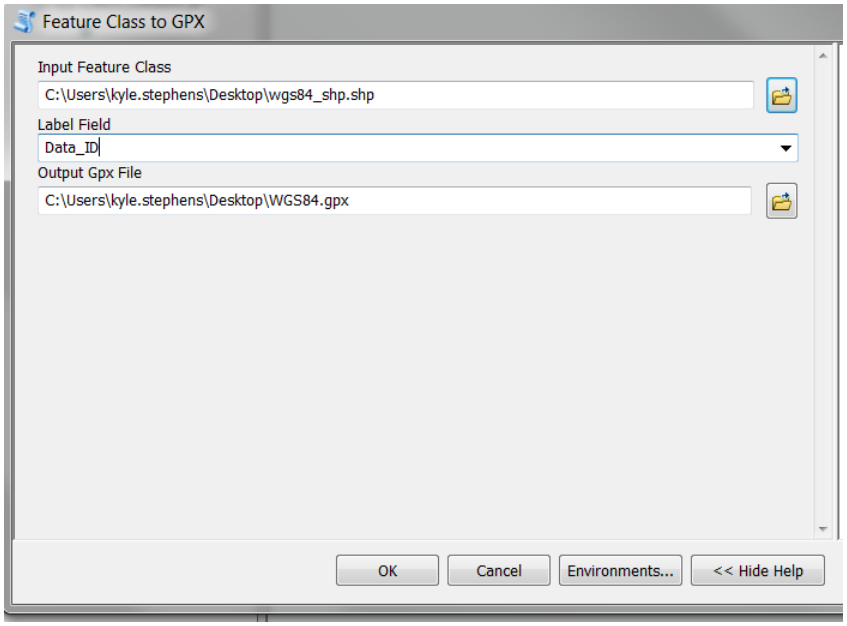
This should appear when after the toolbox has been installed:



1. Right click on Feature Class to GPX to open.
2. Browse to your feature class.
3. Select a Label Field.

Be sure the label field is known before completing this step.

4. Store and label the output .gpx file.
5. Click OK.



The label field what will become the user site ID when the .gpx file is imported into NASIS.