

Land Navigation VIII

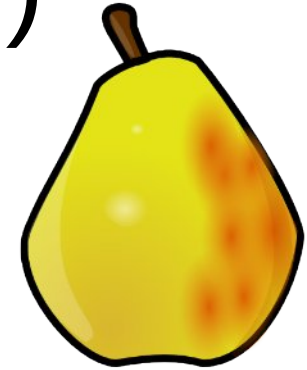
Using GNSS Receivers



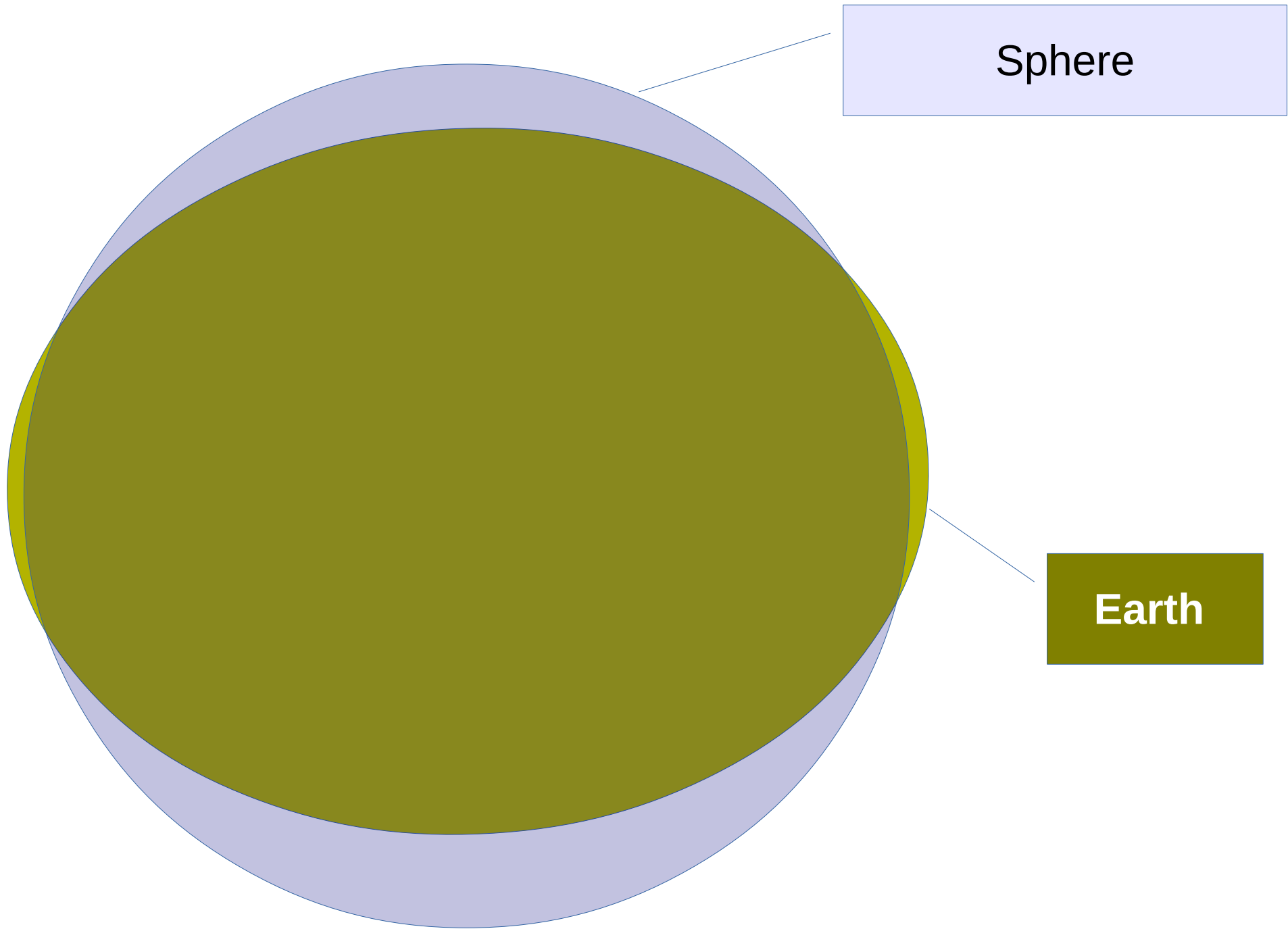
Some Key GNSS receiver Settings

- Position format:
 - Latitude/Longitude
 - Decimal Degrees
 - Degrees, Minutes, Seconds
 - **USNG**, UTM/UPS, MGRS
- Datum: NAD27, NAD83, WGS84, etc.
 - Use **WGS84**
 - Unless using a map with a different datum
- Units (elevation, speed): English, Metric
- Bearings: Magnetic, True
- WAAS (on, off)

Datum (geodetic datum)



- The Earth is not a perfect Sphere
- A geodetic datum is a reference model for the shape of the surface of the Earth
- The same coordinate in two different datums may differ in position by hundreds of meters or even kilometers
- (Distinct from vertical datum for elevation)



Sphere

Earth



The diagram shows a large green circle representing Earth. A thin, light blue arc is drawn across the top of the circle, representing a local datum. A callout box points to this arc with the text 'Local Datum Very Good Fit Here'. Another callout box points to the bottom of the circle with the text 'Local Datum Poor Fit Elsewhere'. A dark green rectangular box labeled 'Earth' is positioned to the right of the circle, with a line pointing to the circle's boundary.

Local Datum
Very Good Fit Here

Earth

Local Datum
Poor Fit Elsewhere



Global Datum
Reasonable Fit
Everywhere

Earth

Universal Transverse Mercator projection, 1927 North American datum
10,000-foot grid based on Alaska coordinate system, zone 5
1000-meter Universal Transverse Mercator grid ticks,
zone 5, shown in blue

NAD27

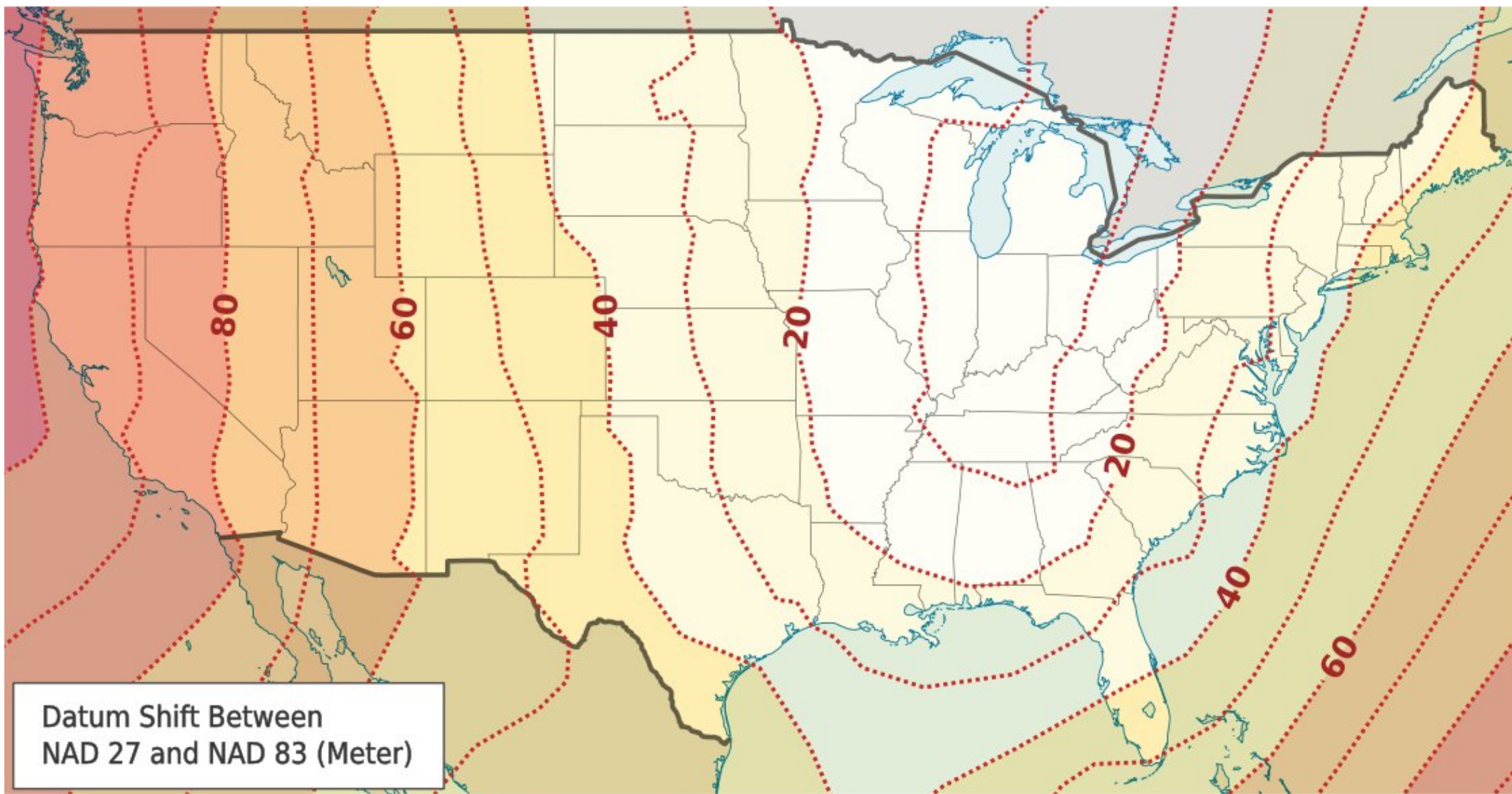
**1000-meter Universal Transverse Mercator grid, zone 18
1927 North American Datum**

**To place on the predicted North American Datum 1983,
move the projection lines 6 meters south and
34 meters west as shown by dashed corner ticks**

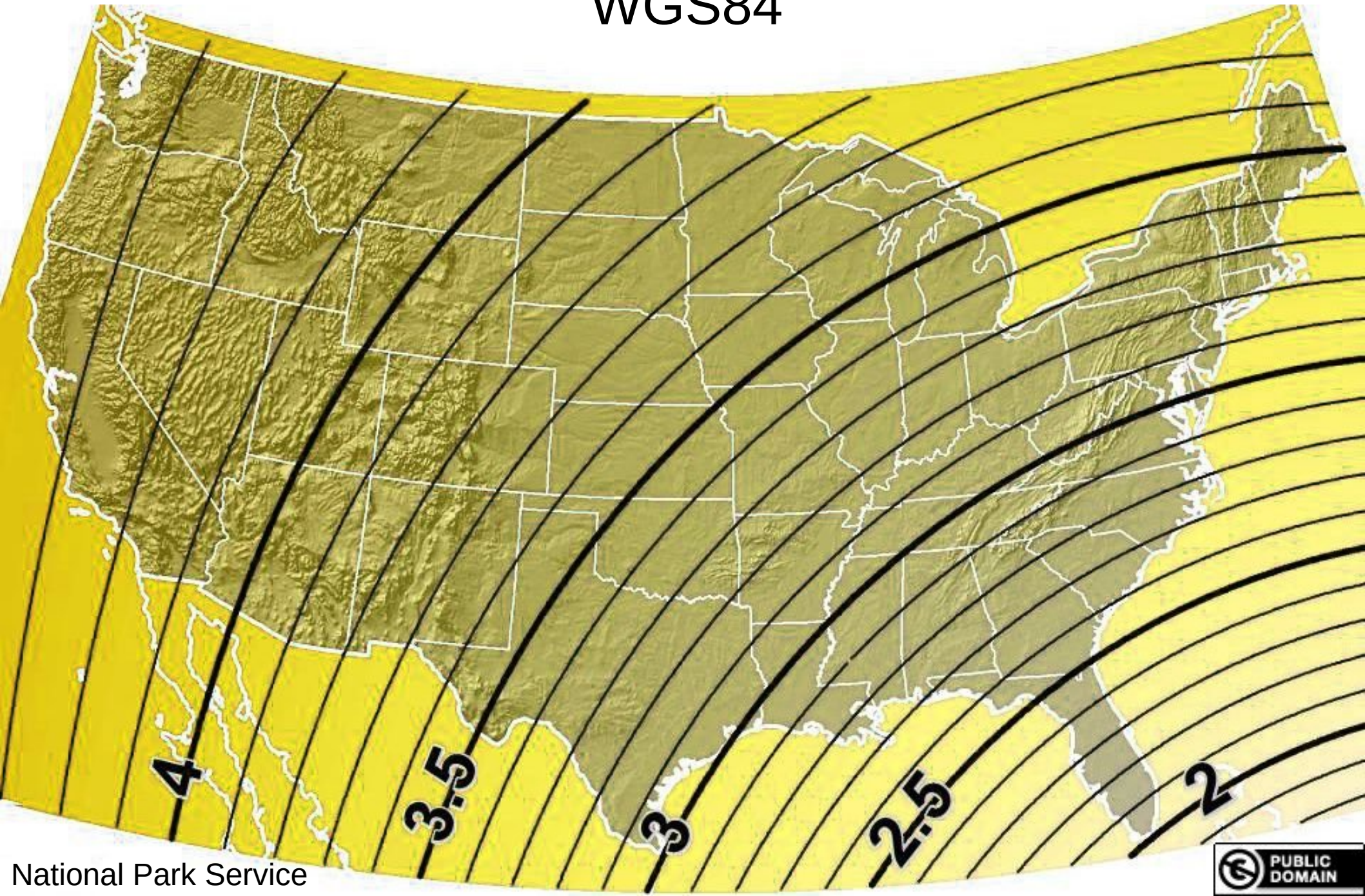


NAD27 with offset for
NAD83
(dashed corner ticks)

Horizontal difference in meters between NAD27 and NAD83



Horizontal difference in feet between NAD83 and WGS84



Produced by the United States Geological Survey

in c Athol, MA 1:24,000
Put

Con 1927 North American Datum
Mas

Cor To place on the predicted North American Datum 1983,
take move the projection lines 5 meters south and
Sup 39 meters west as shown by the dashed corner ticks
date

Projection and 1000-meter grid, zone 18

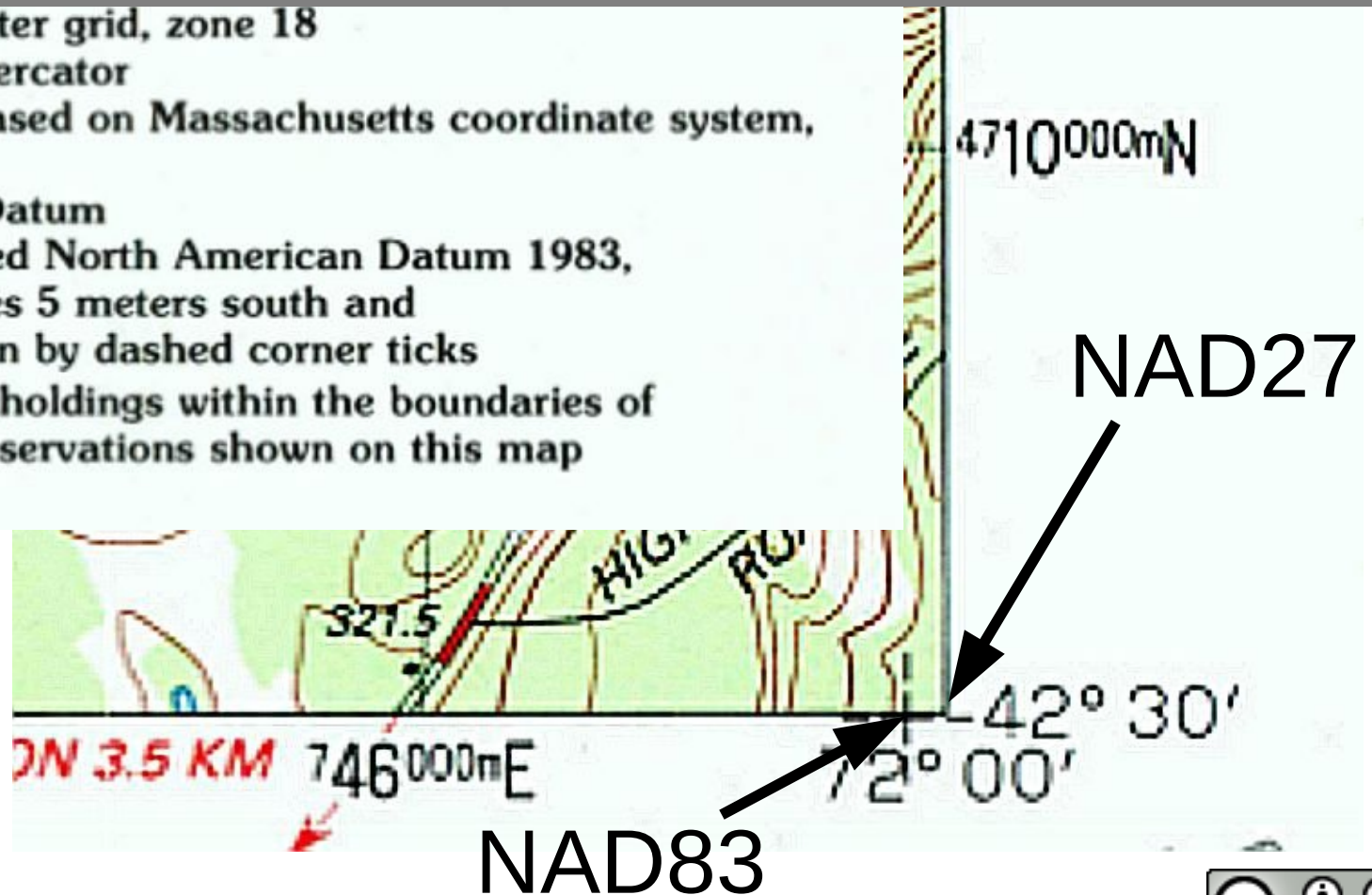
Universal Transverse Mercator

10,000-foot grid ticks based on Massachusetts coordinate system,
mainland zone

1927 North American Datum

To place on the predicted North American Datum 1983,
move the projection lines 5 meters south and
39 meters west as shown by dashed corner ticks

There may be private inholdings within the boundaries of
the National or State reservations shown on this map

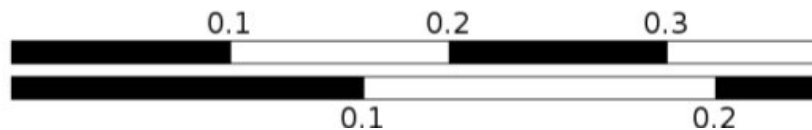


Grids on scanned paper maps as layers in print on demand maps

100m USNG grid, with WGS84 datum
Added to Print on Demand map.



CampActon1/2Mile
WGS84
USNG Zone 19TCH



1 km UTM grid, with
NAD27 datum
Printed on paper map
scanned and
added as layer to
Print on Demand
map.

Vertical Datum

CONTOUR INTERVAL 5 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

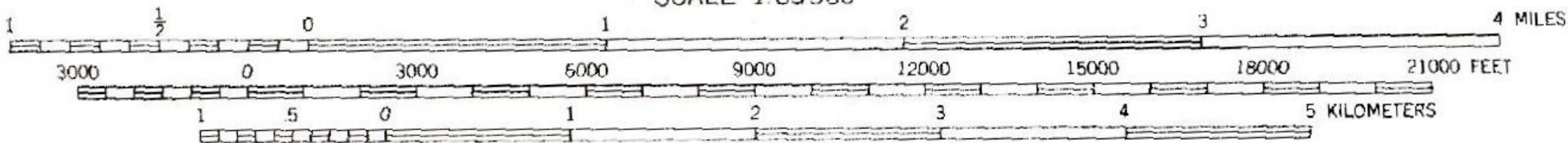
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER

THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE

SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER

THE MEAN RANGE OF TIDE IS APPROXIMATELY 1 FOOT IN INLAND WATERS
AND 4 FEET ALONG THE OCEAN

SCALE 1:63360



CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL

DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER

SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER

THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 8 FEET



Main Menu->Settings->Units

Position Format

UTM UPS

hddd.dddd°

hddd°mm.mmm'

hddd°mm'ss.s"

Austrian Grid

British Grid

Dutch Grid

EOV Hungarian Grid

Finnish Grid

Temperature

Fahrenheit

Pressure

Millibars

Position Format

UTM UPS

Map Datum

WGS 84

NAD27 Central

NAD27 CONUS

NAD27 Cuba

NAD27 Grnland

NAD27 Mexico

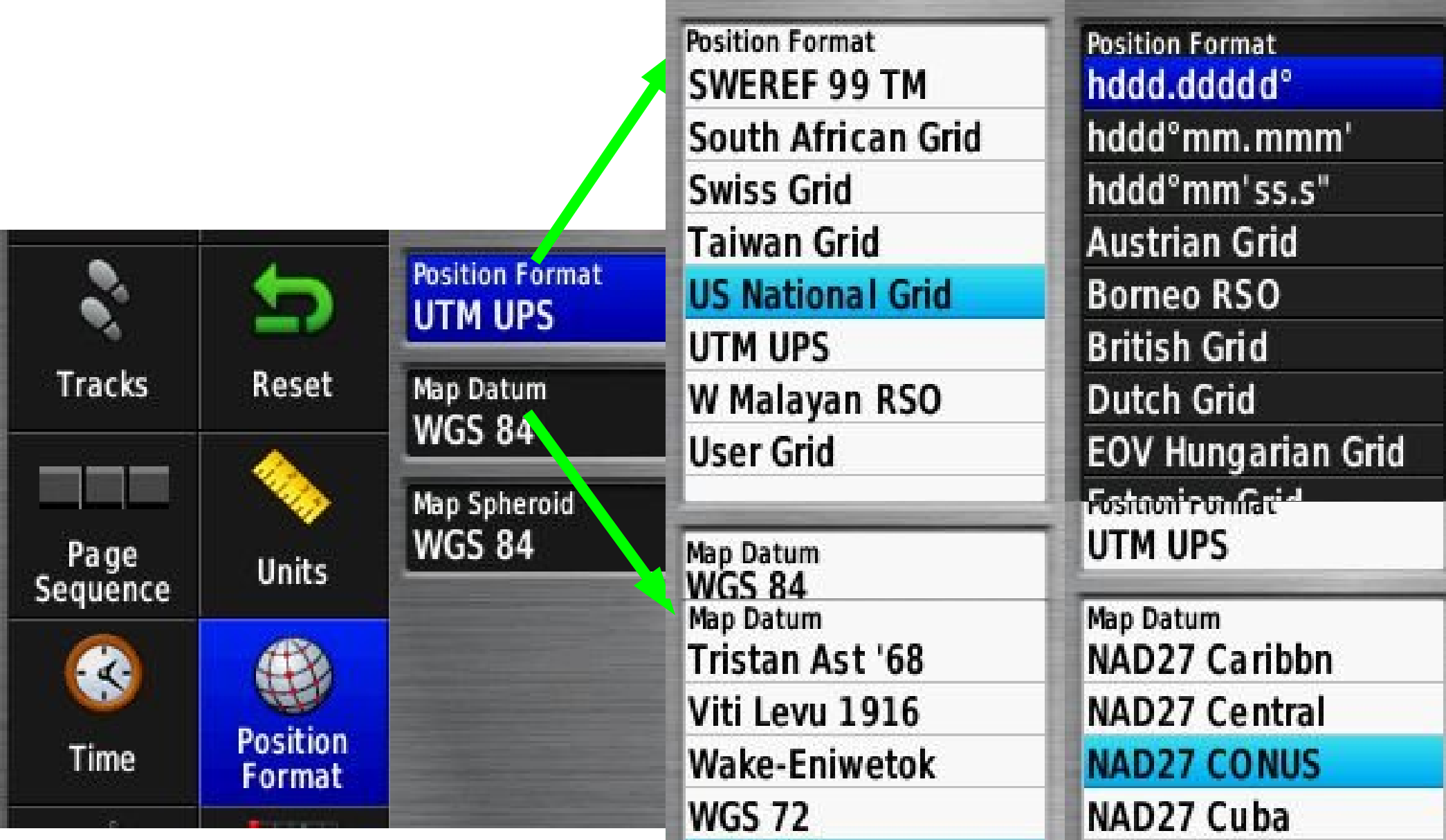
NAD27 San Sal

NAD83

Naparima BWI

Pressure

Millibars



Main Menu->Settings->Position Format

With your GNSS Receiver, Set:

- Position readout to Latitude/Longitude
- Latitude/Longitude Format to Decimal Degrees
- Datum to NAD27
- Units to Feet/Yards/Miles
 - Write down your location

Now change to:

- Position readout to USNG
- Datum to WGS84
- Units to Metric
 - Write down your location

Plot location on a map

- What coordinate system and datum is used by the map?
 - Does it have a UTM grid?
- Change the GPS coordinate system and datum to match the map.
 - View the coordinates (current, in a waypoint)
 - Plot the coordinates on the map.

Converting with a GNSS



Startup: Practice Good Habits

- Before you start:
 - Check/Change your batteries.
 - Check Datum, Coordinate System, distance units
- When you get out at the drop off point
 - Make sure your GPS has an accurate position.
 - Mark a waypoint with your GPS.
 - Save and clear the current track (dog's too).
 - Make sure that your GPS is recording the track.
 - Calibrate the compass.
- When you start your assignment
 - Mark a waypoint
- When you complete your assignment
 - Save the track for the assignment with clear name.

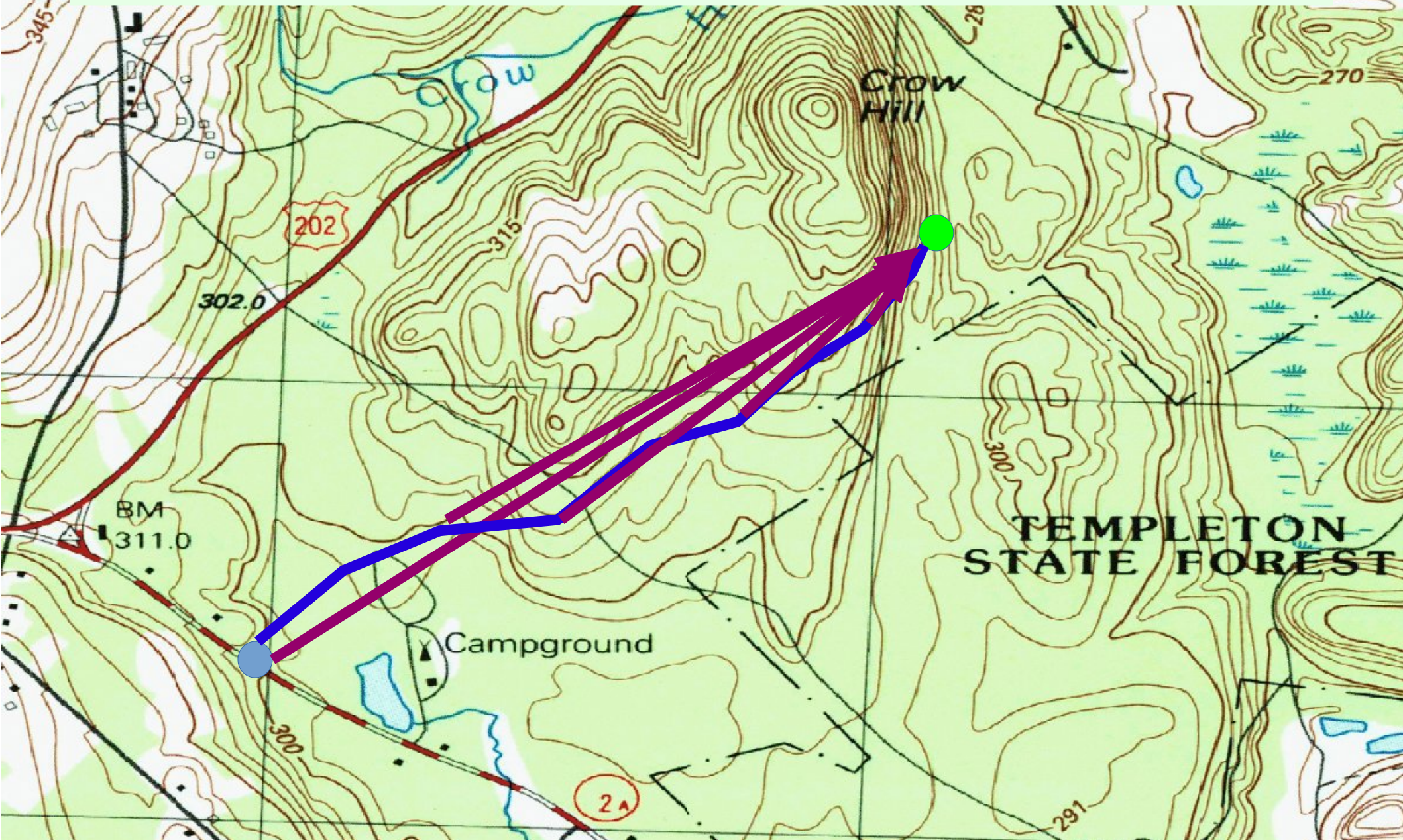
Create Waypoints By:

- Mark Current Position
- Create a waypoint and enter the coordinates.
- Select a position on the map.
- Project a waypoint.

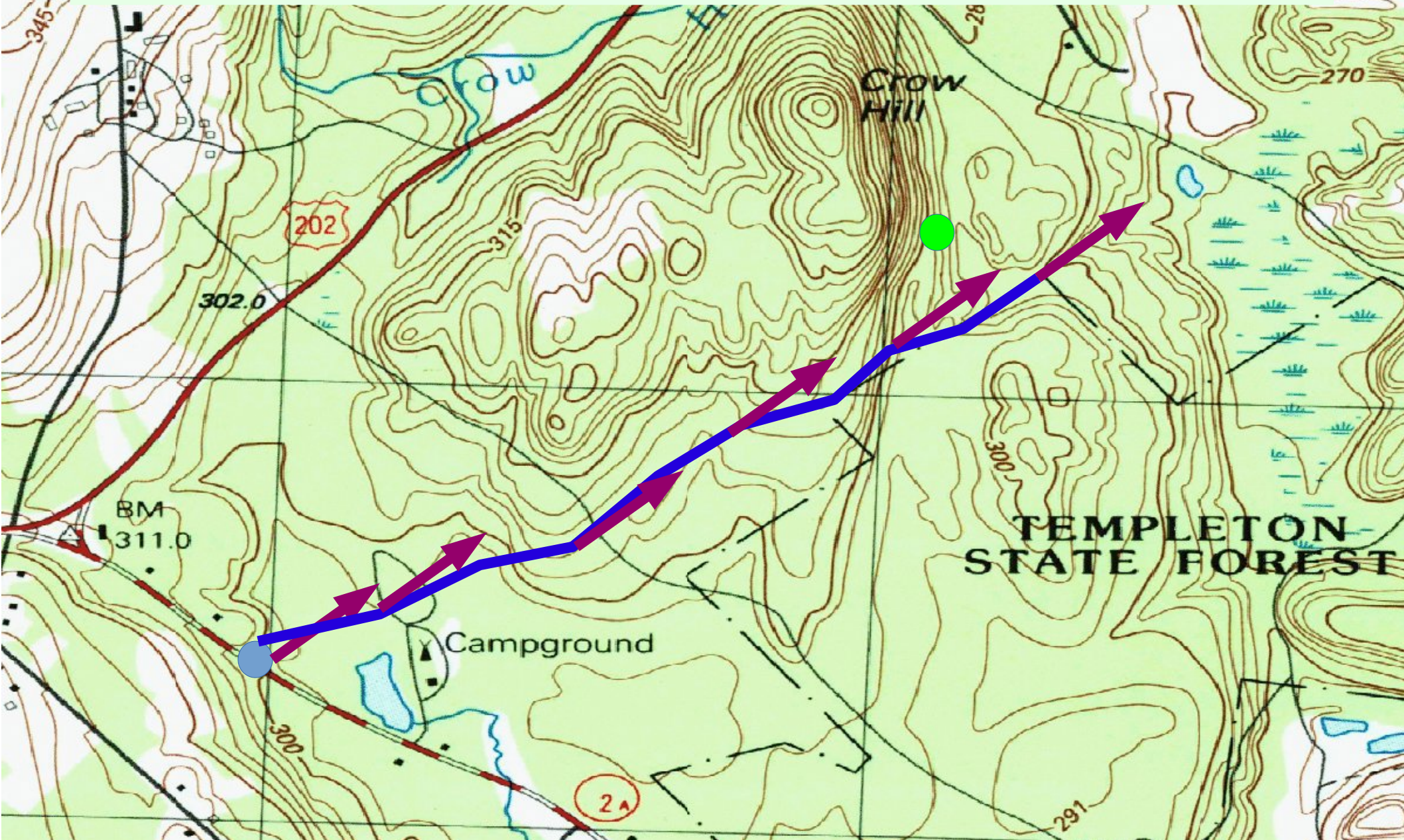
Navigating with GPS

- Enter a waypoint, go to waypoint.
 - Self correcting navigation.
 - (Enter a route, follow route).
- Project a waypoint a distance on a bearing.
 - Self correcting navigation
- Backtrack
- Navigate with the GNSS compass on a bearing
 - Errors accumulate.

To Waypoint: Self Correcting

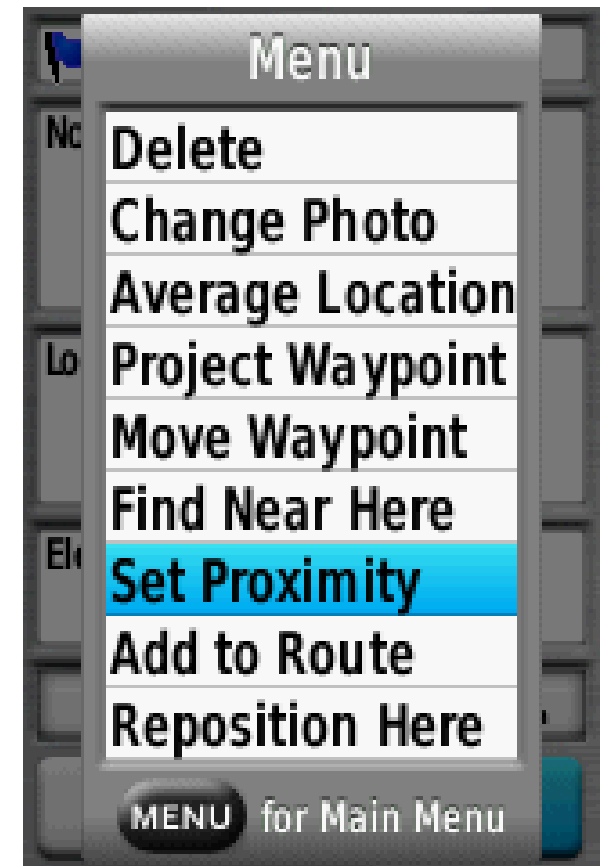
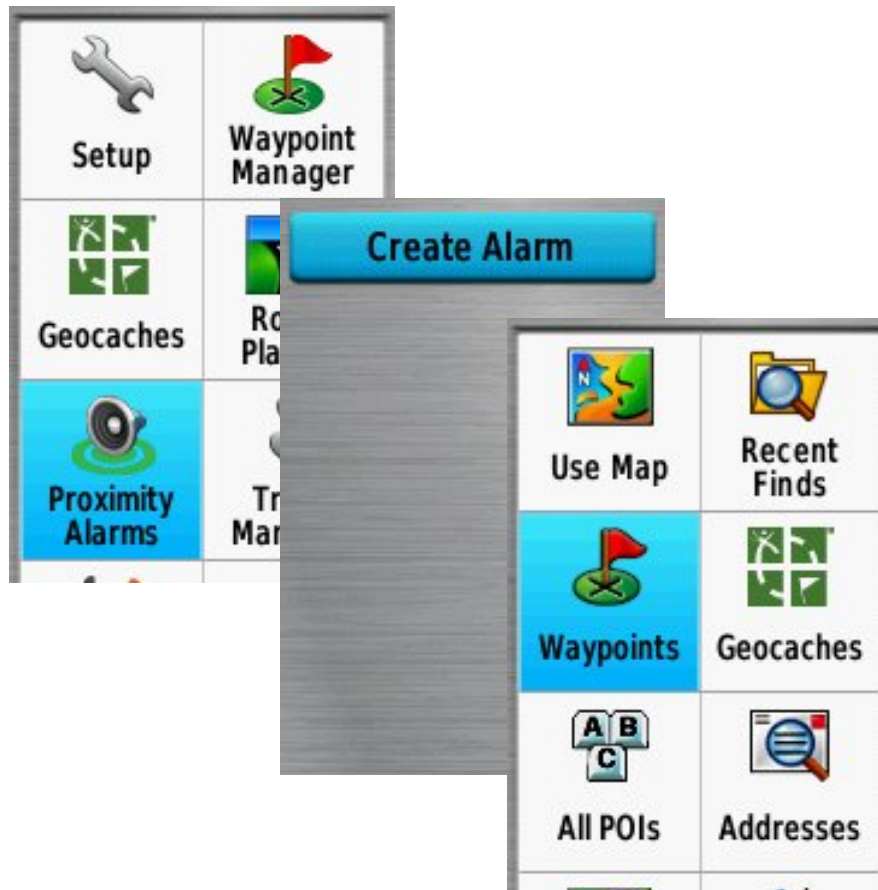


On Bearing: Errors Accumulate



Are we there yet?

- Proximity alerts.



Assemble Waypoints Into A Route

Pr Hill Y-B
Pr Hill Y-SN
Pr Hill Y-B 1
Pr Hill Y-B a
Pr Hill Y-B 1a

<Select Next Point>

Leg Dist
Leg Time

Stop Map

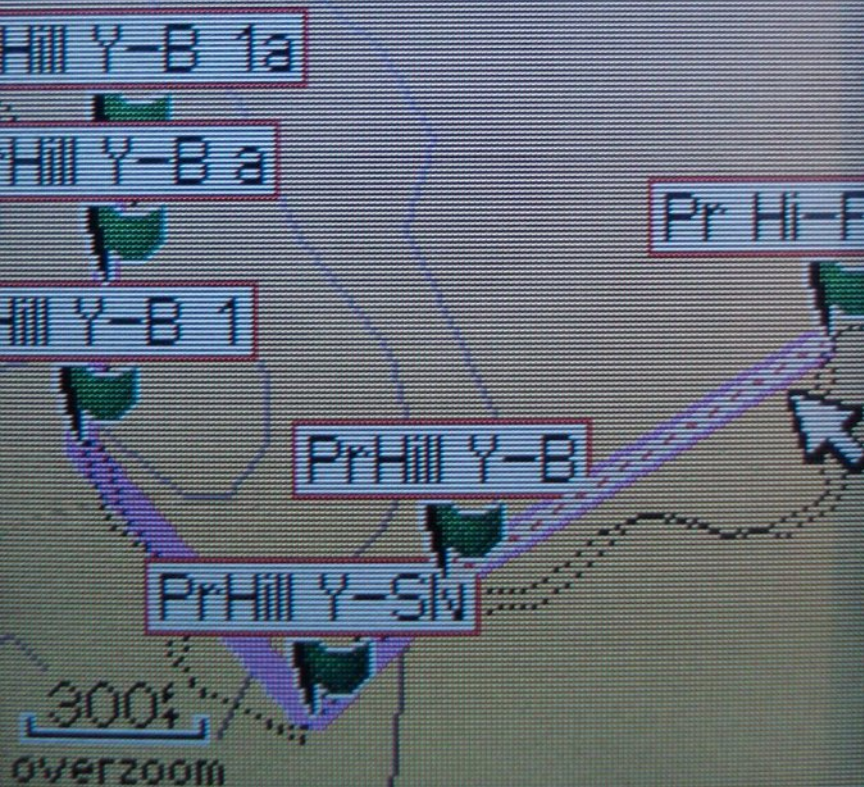
 Setup	 Waypoint Manager
 Geocaches	 Route Planner
 Proximity Alarms	 Track Manager

Hill Y-B 1a
Hill Y-B a
Hill Y-B 1
Pr Hill Y-B
Pr Hill Y-SN
Pr Hill Y-B

300+
overzoom



PrHill Y-B
19 T 0286690
UTM 4709478
237°
256.2%



Route 001
Distance: 108 m

30m
Go

Route



Copy to clipboard
Start capture

Coordinate: -71.597074, 42.515310 Scale 1:2

CC BY SA

Determine Distance and Bearing between two waypoints

The image shows a mobile application interface for managing waypoints. The main screen is titled "Waypoint Manager" and displays a list of waypoints. A callout box points to a specific waypoint (E) with the text "Distance and Bearing from selected Waypoint (E)". Another callout box points to the current location with the text "Distance and Bearing from Current Location". A "Menu" is open, showing options like "Delete", "Change Photo", "Average Location", "Project Waypoint", "Move Waypoint", "Find Near Here", "Set Proximity", "Add to Route", and "Reposition Here". The "Find Near Here" option is highlighted. A separate screen titled "Find Near Here" shows a list of nearby waypoints with their distances and bearings.

Distance and Bearing from selected Waypoint (E)

Distance and Bearing from Current Location

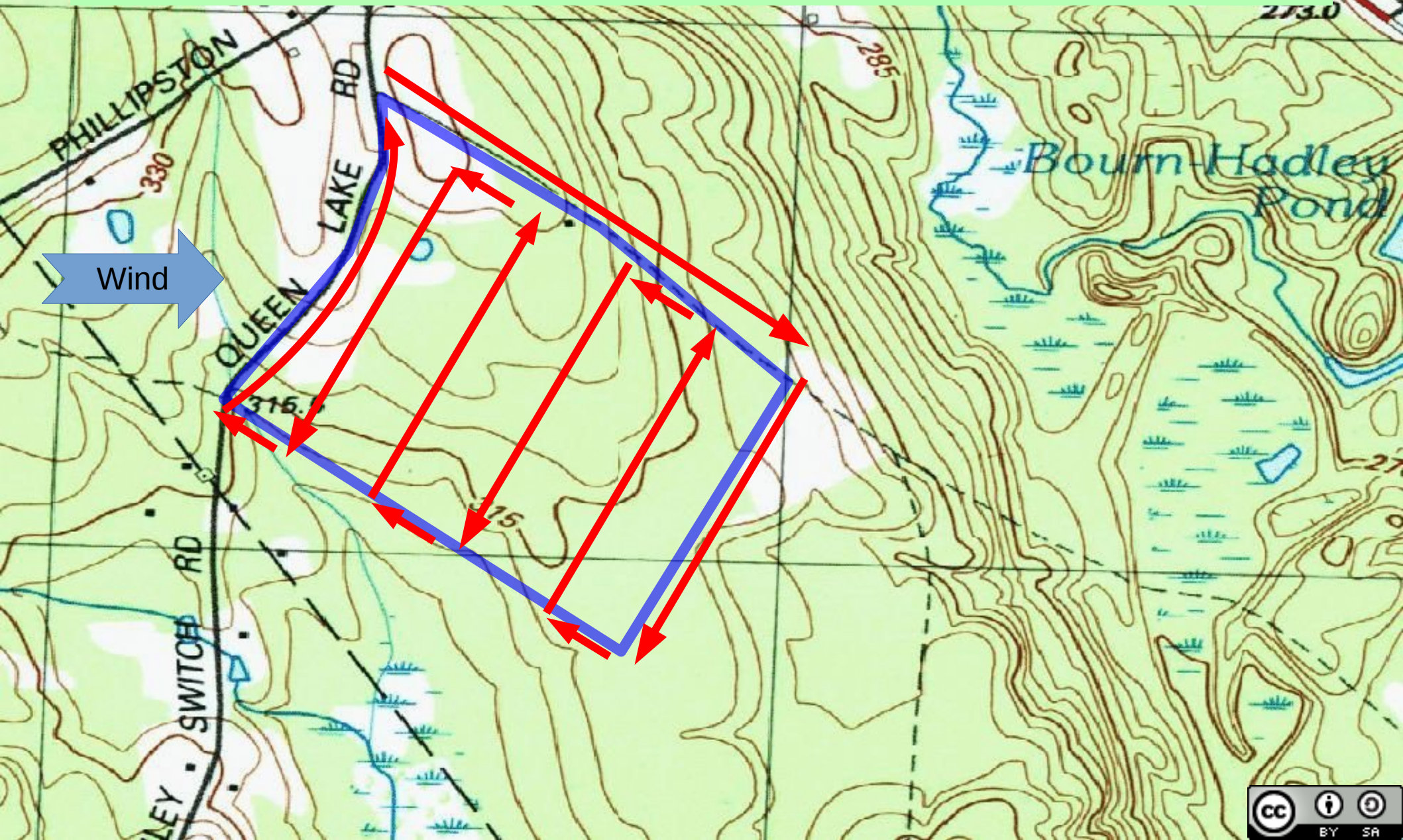
Waypoint Manager

Find Near Here

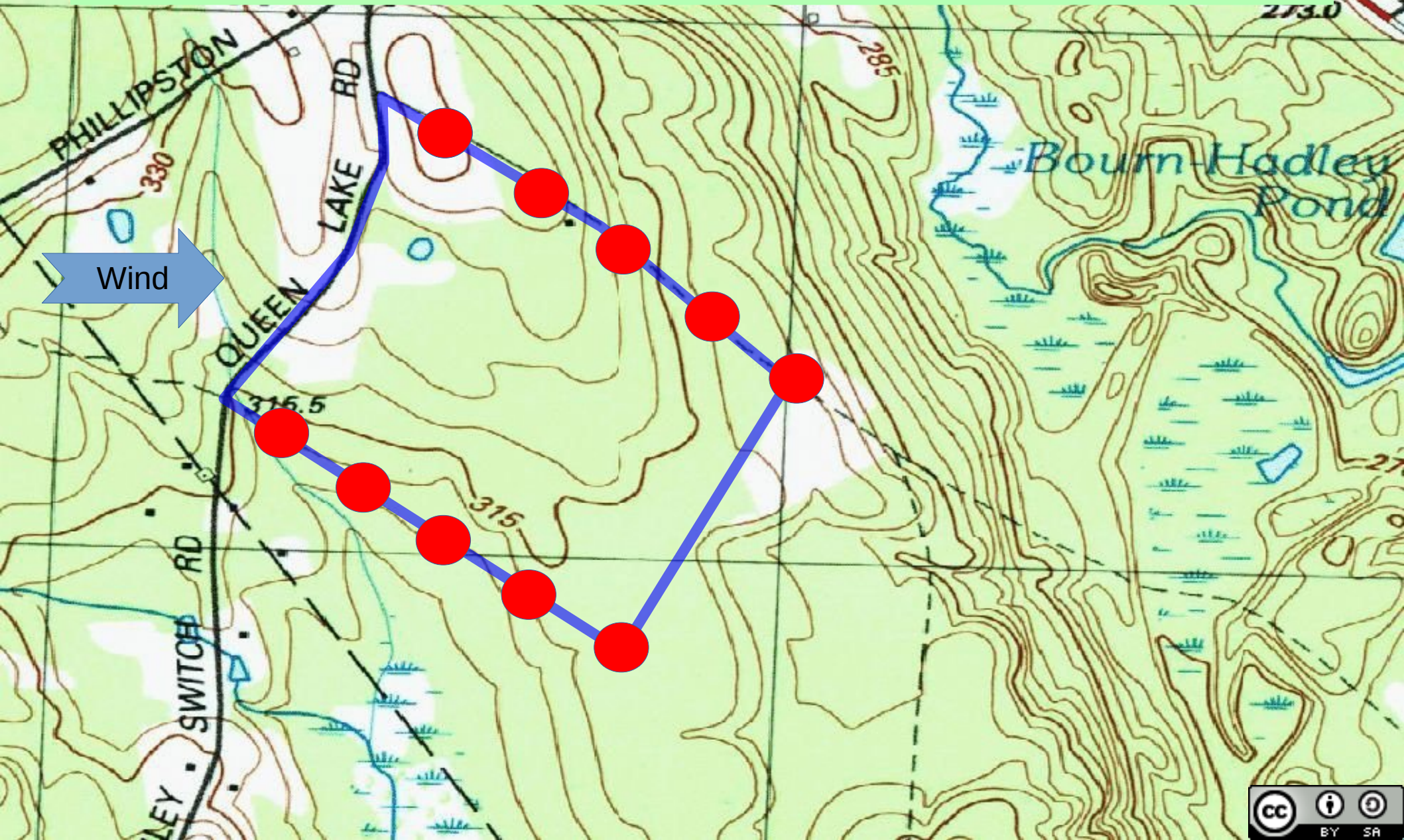
Waypoint	Distance	Bearing
003 (8:04 AM)	0m	180°
370 Ft	1.74km	326°
E	1.80km	329°
55 Prospect Hill	1.95km	322°

Waypoint	Distance	Bearing
E	0m	0°
B	49m	28°
370 Ft	100m	197°
A	123m	26°
C	238m	308°
43 Prospect Hill	246m	295°
21 Prospect Hill		

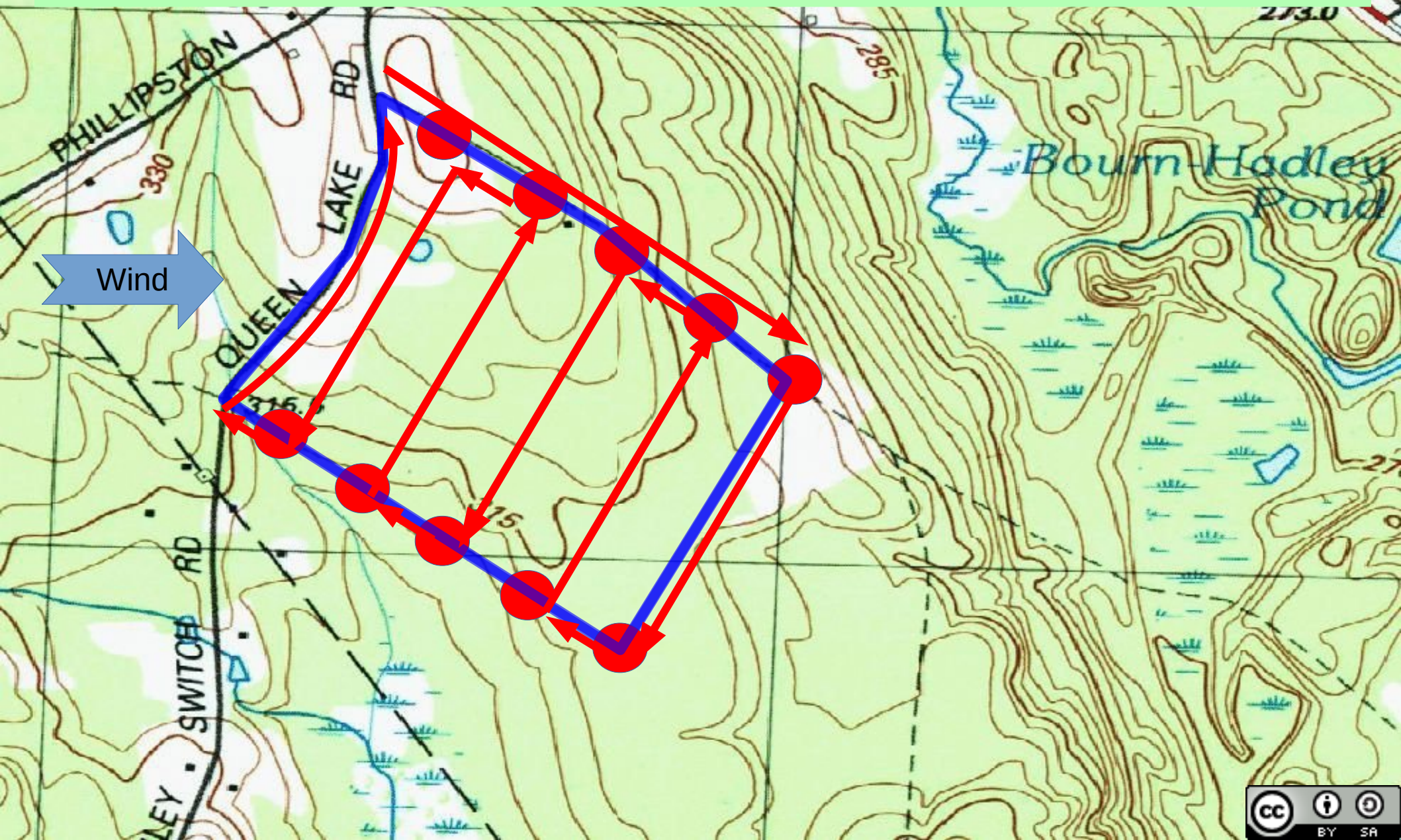
Navigate a Grid with a Route



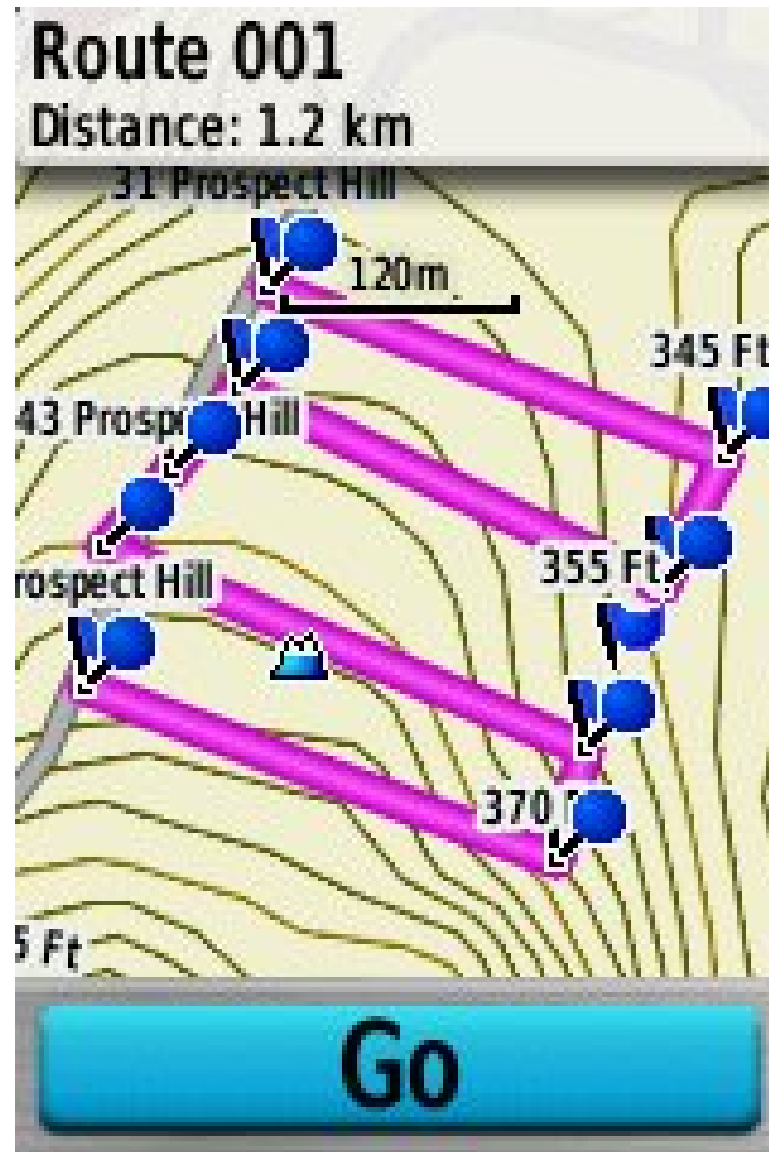
(1) Create a set of waypoints



(2) Connect them in order as a Route



Select the route and navigate it

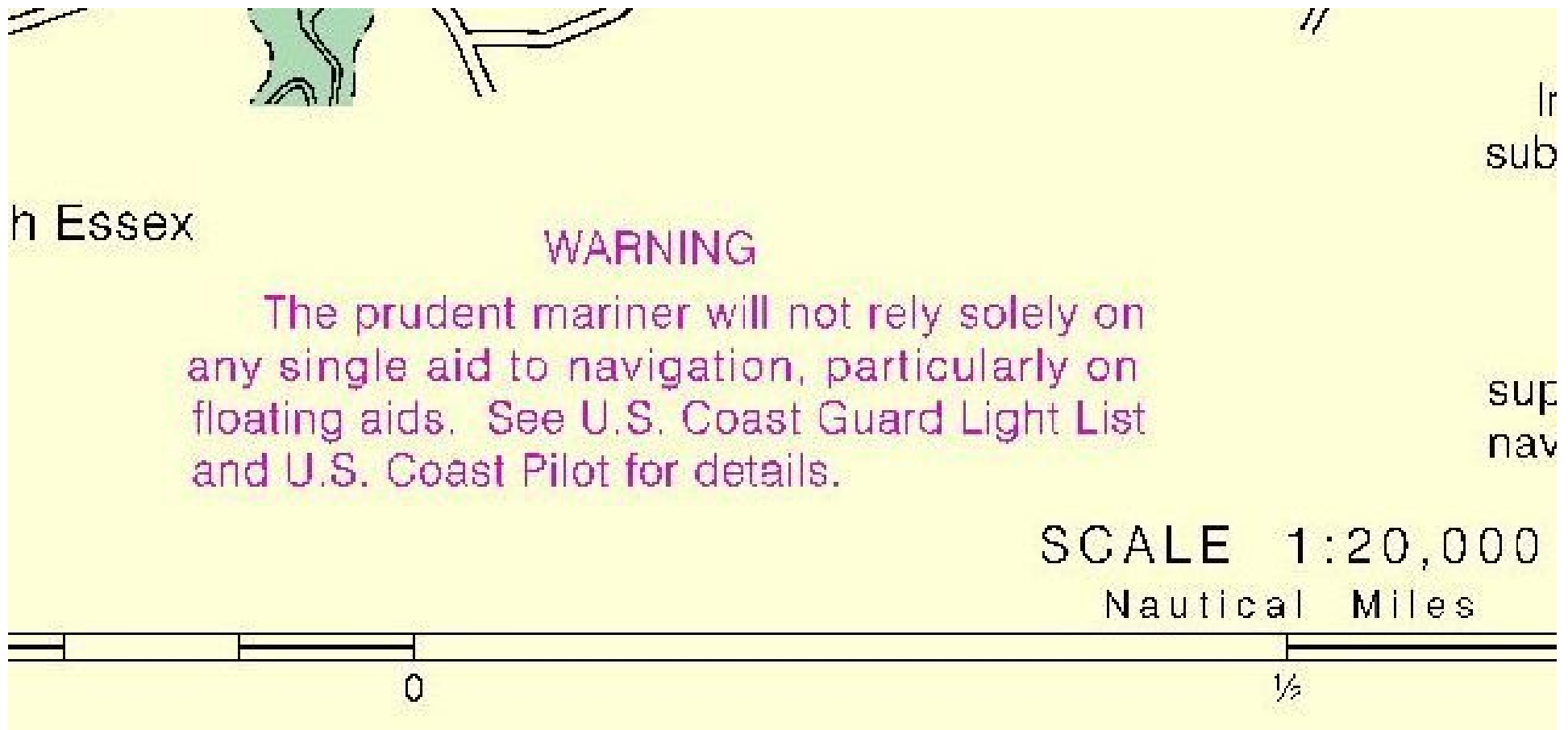


Backtrack

- Manually
 - Use GPS map and pointer to work out bearings to points along track.
- Automatically (some GPS units)
- You need to be recording the track....

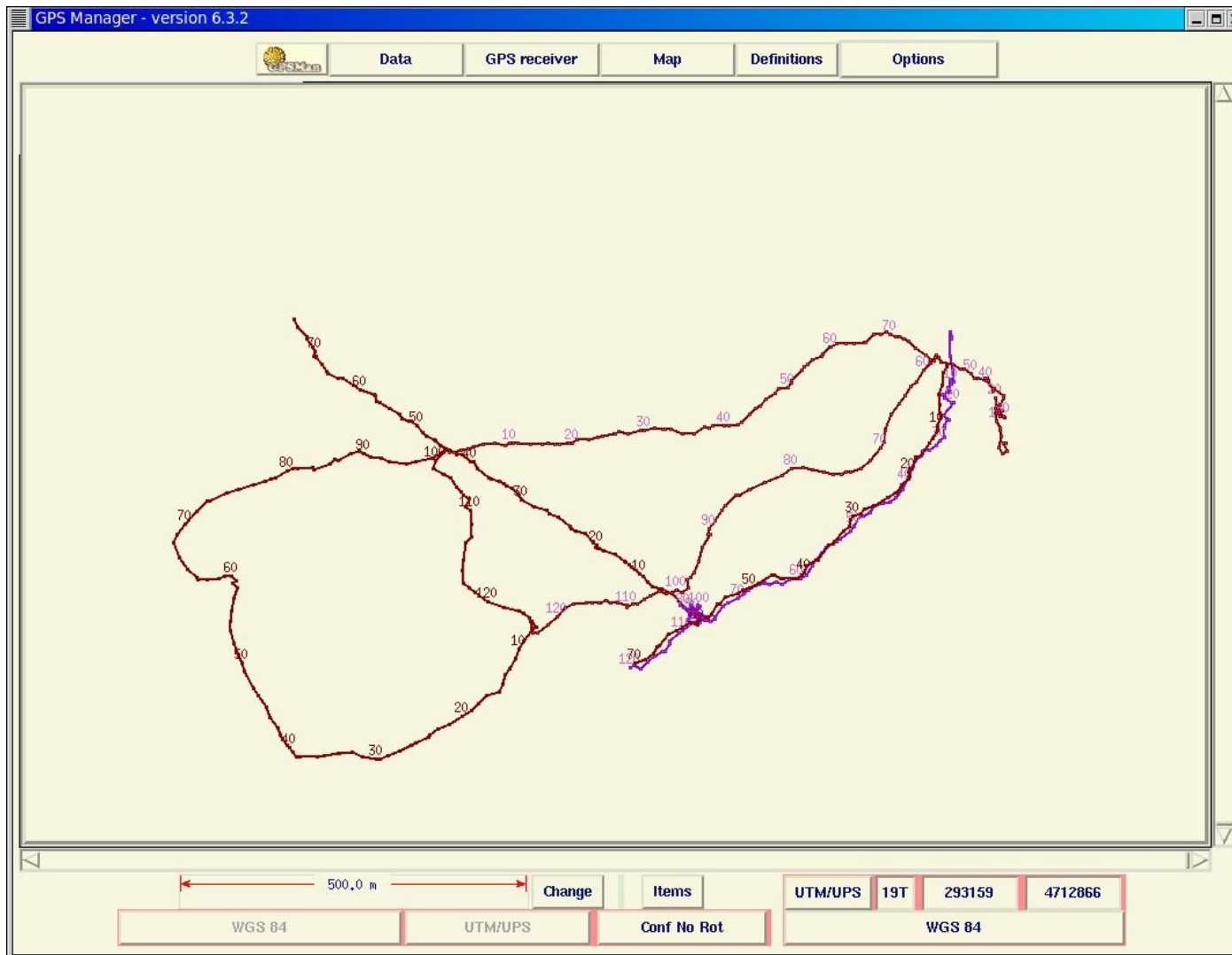


Navigation Errors....

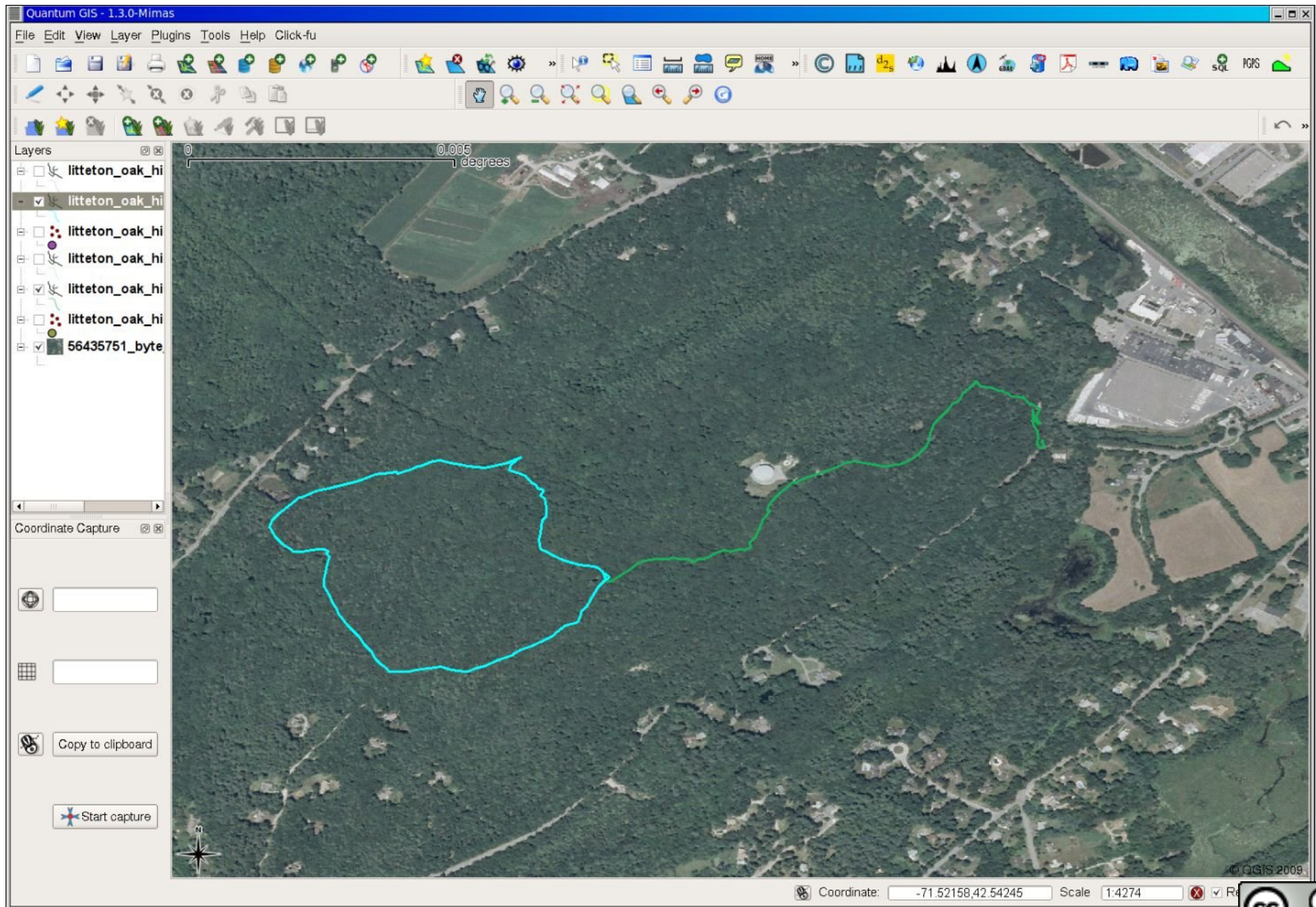


“The prudent mariner will not rely solely on any single aid to navigation”

Download Tracks, Waypoints, or Routes from GPS to Computer

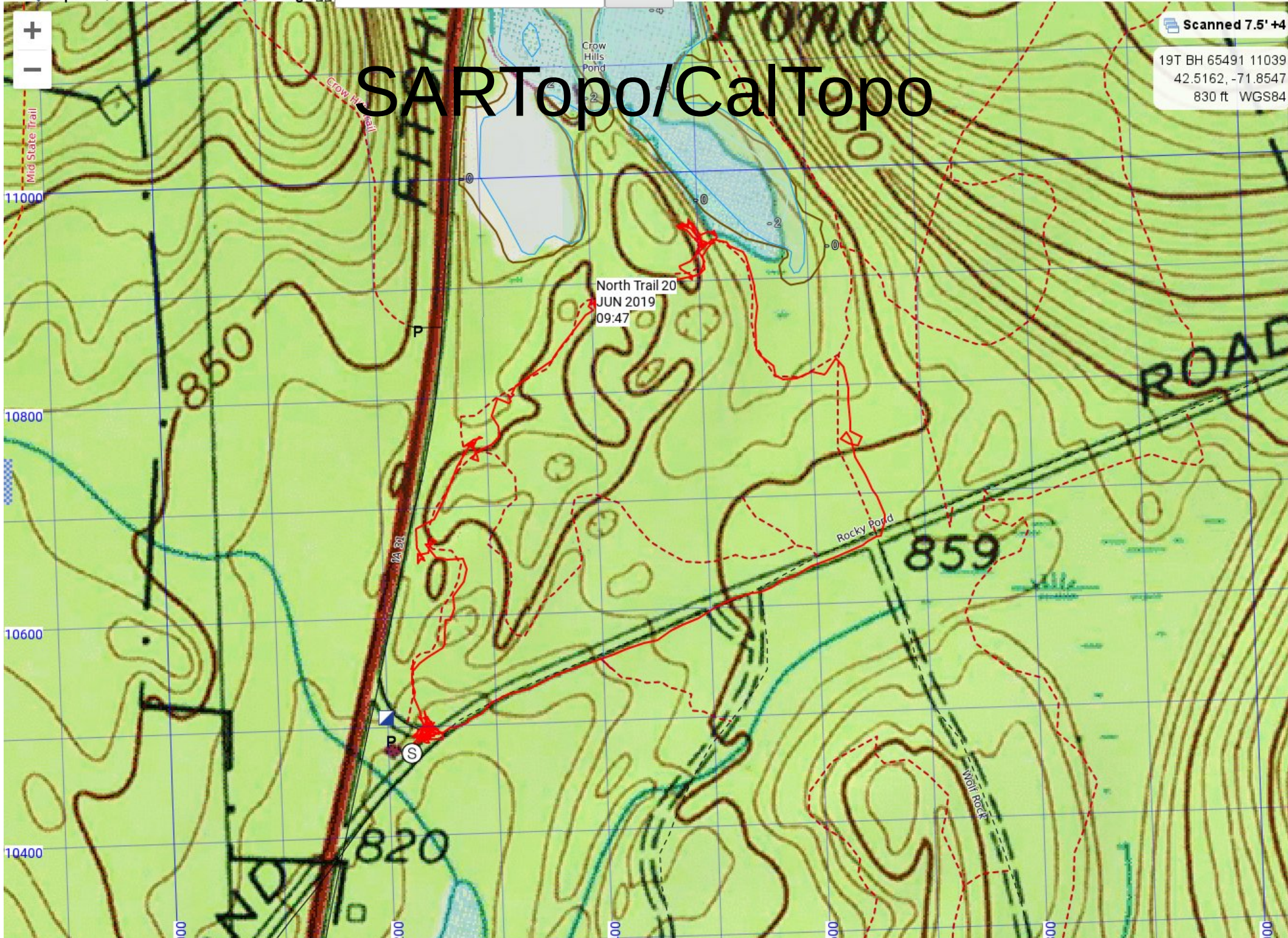


Add as Layers in a GIS Application



Scanned 7.5' +4
19T BH 65491 11039
42.5162, -71.8547
830 ft WGS84

SARTopo/CalTopo



11000

10800

10600

10400

100

100

100

100

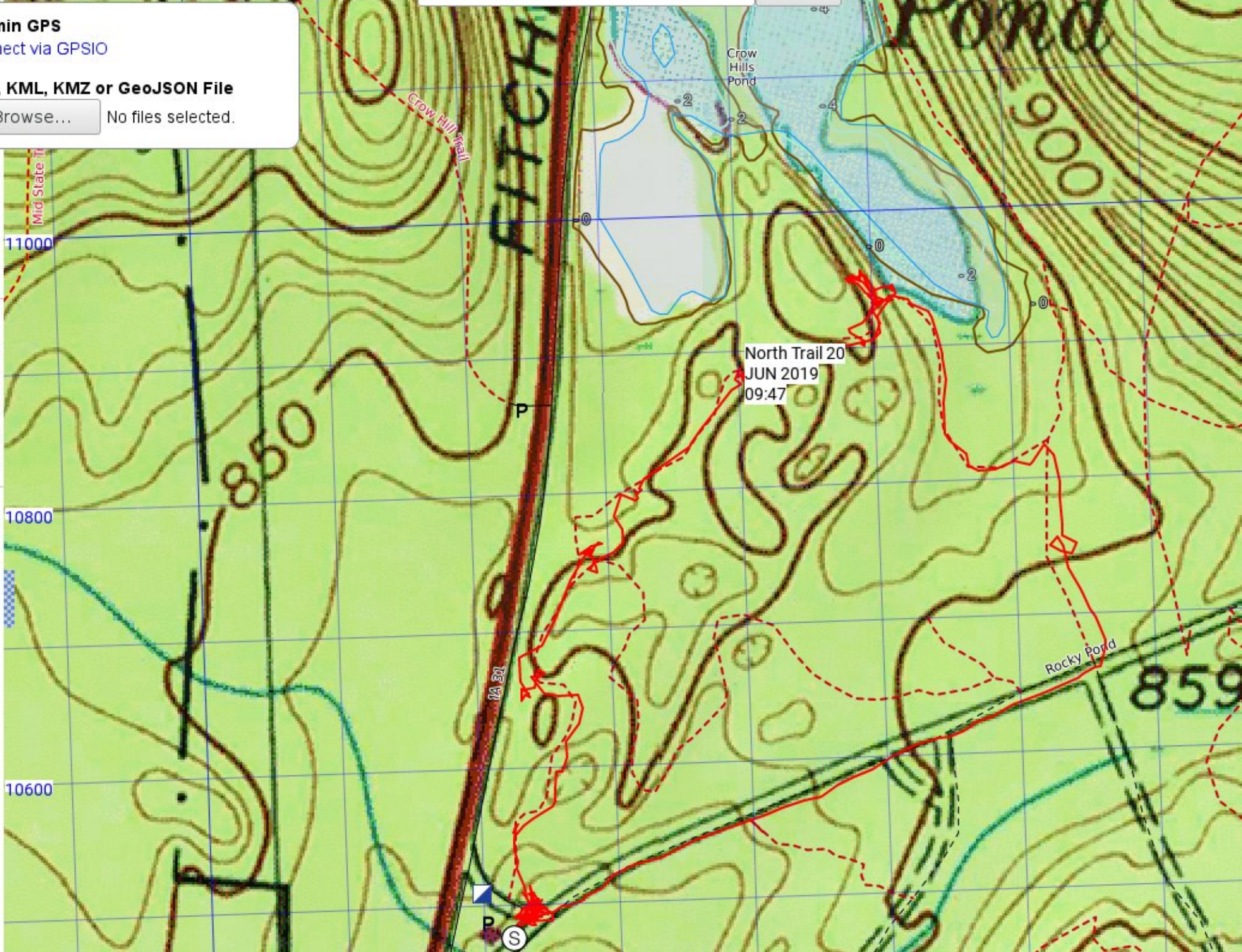
100

100

Garmin GPS
 Connect via GPSIO

GPX, KML, KMZ or GeoJSON File
 Browse... No files selected.

- X
 - X
 - X
 - X
- Bulk Ops
- X
- Bulk Ops





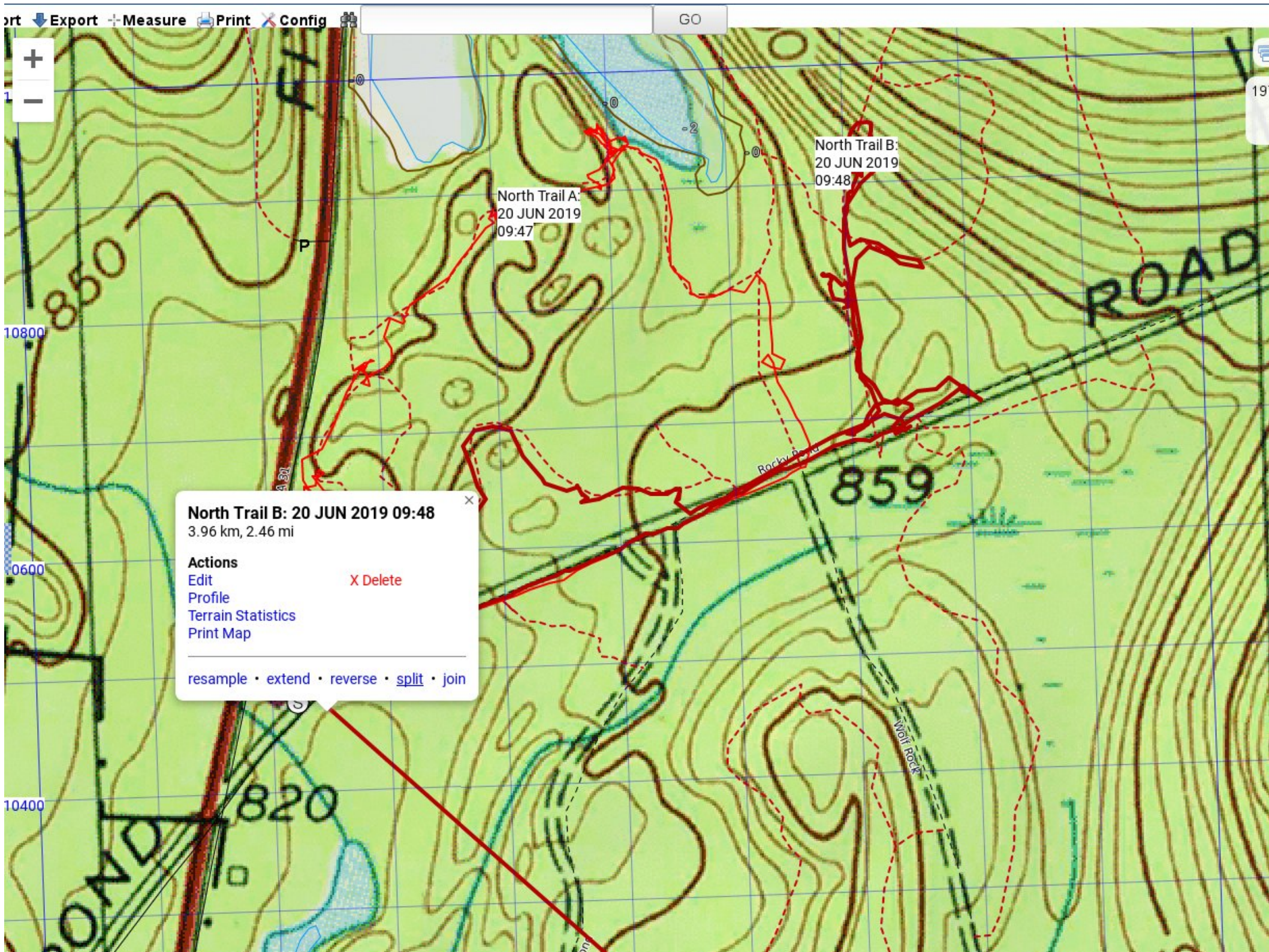
Import Data [X]

Check/Uncheck All Check/Uncheck All

Shape

Current Track: 20 JUN 2019 09:48 on map 3.27 km, 2.03 mi

- X
- X
- X
- X
- ilk Ops
- X
- ilk Ops



North Trail B:
20 JUN 2019
09:48

North Trail A:
20 JUN 2019
09:47

North Trail B: 20 JUN 2019 09:48
 3.96 km, 2.46 mi

Actions

- Edit
- Profile
- Terrain Statistics
- Print Map

[resample](#) · [extend](#) · [reverse](#) · [split](#) · [join](#)

[X Delete](#)

10800

10600

10400

19

Saving Tracks

- Save a separate track for each assignment (documenting your search effort for that assignment).
 - Reduce clutter and work for the Planning Section.
 - Some GNSS Receivers limit the number of points in a track. Saving very large tracks can reduce precision of fit between the track and your route.
- Establish a routine – use on every training.
- Make sure tracking is on, start new/save with each assignment.

Contribute to Open Street Map

The image shows a screenshot of the OpenStreetMap Java Editor interface. The main window displays a map with various trails and buildings. The editor's toolbar is visible on the left, and the right sidebar contains panels for Layers, Properties / Memberships, Selection, Command Stack, and Validation Results. The status bar at the bottom shows coordinates and a message: "Move objects by dragging; Shift to add to selection (Ctrl to toggle); Shift-Ctrl to rotate selected; Alt-Ctrl to scale selected; or change selection".

OpenStreetMap Edit History Export

GPS Traces User Diaries Copyright Help About Log In Sign Up

Search Where am I? Go

Java OpenStreetMap Editor

File Edit View Tools Presets Imagery Windows Audio Help

Layers
Data Layer 1
Downloaded GPX Data

Properties / Memberships
Select objects for which to change properties.

Selection

Command Stack

Validation Results

42.5408782 -71.5359019 (no object)

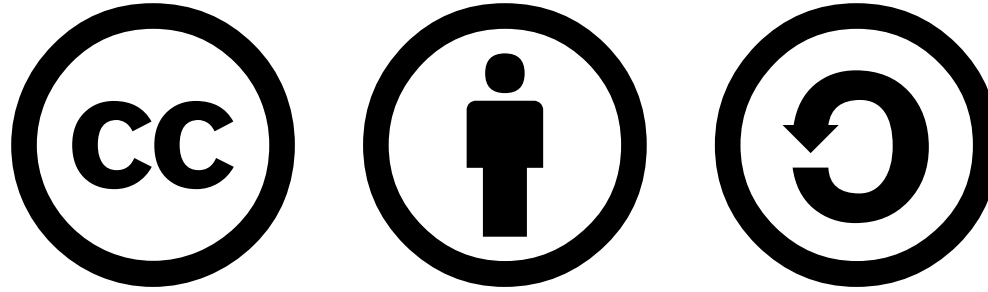
Move objects by dragging; Shift to add to selection (Ctrl to toggle); Shift-Ctrl to rotate selected; Alt-Ctrl to scale selected; or change selection

50 m 200 ft

© OpenStreetMap contributors BY SA

Load Maps into your GNSS receiver

- Options may include (see your user manual)
 - Maps on a micro SD card.
 - Maps uploaded from a computer.
 - Maps loaded over a wireless connection.



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