Newfoundland Labrador

Mineral Resources Review 2025
CONFERENCE AND EXHIBITION

Prospecting with modern digital tools

GPS, SPREADSHEETS, GOOGLE EARTH, & MORE

NOVEMBER 4,2025

NLPA
STRONGER TOGETHER

Newfoundland & Labrador Branch

NEWFOUNDGOLD

Greetings

Course Demonstrators

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Course content

1. The GPS System and Receivers
2. Coordinate Systems
3. GPX Files
4. Online Coordinate Conversions
5. Station Data & Tables
6. Google Earth & .kml files
7. NL Geoscience Atlas
8. QGIS & Open-Source Mapping Software
9. Avenza Maps on Smart Phones
10. Solocator – GPS Field Camera on Smart Phones

Questions and Group Discussions

This Short Course is meant to be informal. It will cover some of the tools we currently see in mineral exploration that are free to use (Open-Source) and can make exploration data collection easier. Their use is ultimately at your discretion.

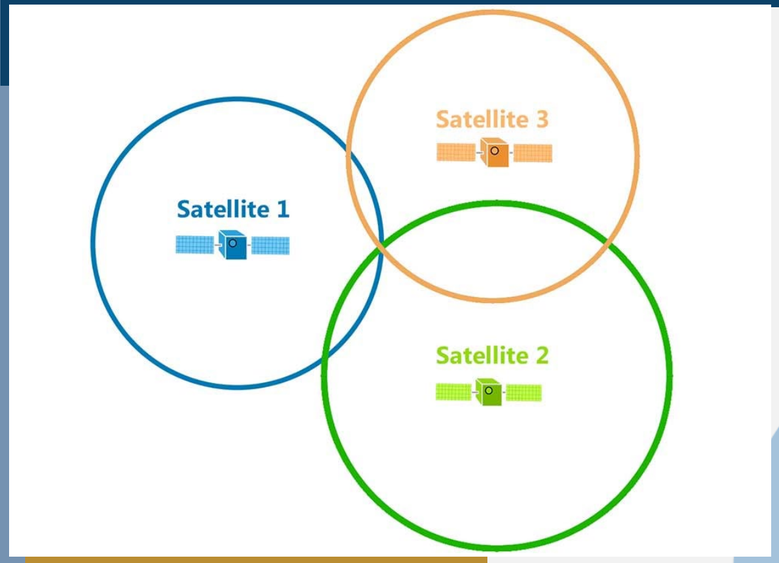
1. The GPS System & Receivers

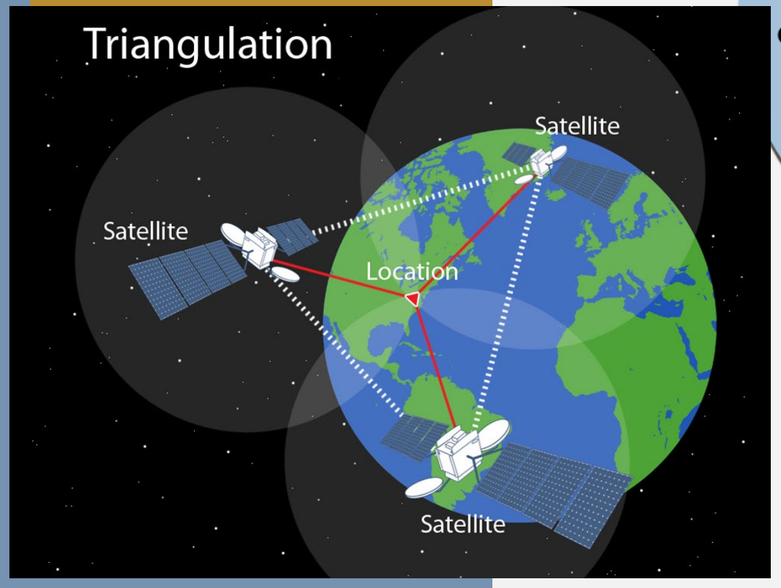
GPS is a satellite-based navigation system that uses a constellation of satellites orbiting Earth to send radio signals to “GPS receivers” on the ground resulting in the triangulation of a position.

The Global Positioning System, "GPS" is often used as a generic term for satellite navigation, but it specifically refers to the **U.S. system.** It is also used in reference to the device. The more correct term, **Global Navigation Satellite Systems (GNSS)** can use other satellite constellations such as; **Europe's Galileo, Russia's GLONASS, China's BeiDou,** and regional systems like **Japan’s QZSS** and **India’s NavIC.** For most of us we will purchase a **Garmin** “**GPS Receiver”** unit with unit names like **eTrex, Rino, Montana, 65, 67, 73, 76** and others. Newer models use multiple satellite constellations, with some offering free satellite imagery, and **inReach** technology, that allows for texting via satellite (a great safety feature).

GPS receivers on smart phones and tablets are useful as well, however less accurate. **Star Link** may replace some current technologies allowing everything on one device like a tablet or smart phone.

1. GNSS Global navigation satellite sy





GPS
- Owned and operated by the United States of America
- First satellite launched in 1978
- Available globally

GLONASS
- Owned and operated by Russia
- First satellite launched in 1982
- Available globally

BeiDou
- Owned and operated by China
- First satellite launched in 2000
- Available globally

Galileo
- Owned and operated by the European Union (E.U.)
- First satellite launched in 2011
- Available globally

QZSS
- Owned and operated by Japan
- First satellite launched in 2010
- Available regionally

IRNSS
- Owned and operated by India
- First satellite launched in 2013
- Available regionally

1. GPS Receivers

A Wide Price Range based on additional Bells and Whistles

Garmin eTrex 22x

$249.99

Garmin eTrex 32x

$379.99

Garmin GPSMAP 65

$469.99

Garmin GPSMAP 86i

$699.95

Garmin Rino 750 (Canadian Version)

$669.99

Garmin GPSMAP 67

$729.99

NEW

Garmin GPSMAP H1i Plus

$1,449.99

Most Company Field Crews will be using Garmin 67, 76 or 86, typically with an inReach add on.

1. New GPS receivers

Garmin GPSMAP H1 Premium GPS Handheld

A 3.5-INCH COLOR TOUCHSCREEN AND PHYSICAL BUTTONS. PRELOADED TOPOACTIVE MAPS, HIGH-RESOLUTION SATELLITE IMAGERY AND OPTIONAL OUTDOOR MAPS+ CONTENT. LONG BATTERY LIFE OFFERS UP TO 145 HOURS IN GPS MODE. MULTI-BAND GPS AND MULTI-GNSS SUPPORT HELPS PINPOINT YOUR PRECISE LOCATION. MEETS MIL-STD 810 AND IP67 WATER RATING TO WITHSTAND WATER AND EXTREME TEMPERATURES.

Sensors
GPS: Yes
Galileo: Yes
QZSS: Yes
BeiDou: Yes
IRNSS: Yes
Barometric altimeter: Yes
Compass: Yes (tilt-compensated 3-axis)
High-sensitivity receiver: Yes
GPS compass (while moving): Yes
Multi-band frequency support: Yes

The H1i Plus has inReach added on for exchange of photos, voice messages and text messages.

This unit is over $1,000.00 with older versions available for much less.

But! Do you need all that?

1. GPS receiver limits

Some Pros and Cons to GPS Units

Buy a GPS Unit that fits both your **Budget** and Your **Activity**.
Some GPS Units do not allow for the copying of the **GPX file** onto and off the unit.
Touch Screens can be a nuisance in your vest and require calibration periodically.
Some GPS units have **inReach**, others do not. Do you want/need this safety aspect?
Some Units only have GPS and not the other **constellations**, is accuracy important or is <5m good?
Elevations are always out, unless you use expensive Survey Equipment.
Some GPS Units offer free **satellite imagery** downloads.
Let the GPS unit find satellites and reduce the error, don’t rush them.
Poorer signals in thick trees or against cliffs.

1. GPS receiver sources

Online GPS Resources:

https://www.gpscity.ca/

https://www.gpscentral.ca/

https://www.garmin.com/en-CA/

https://www.gps.gov/systems/gnss/

Any Questions about GPS Units?

2. Coordinate systems

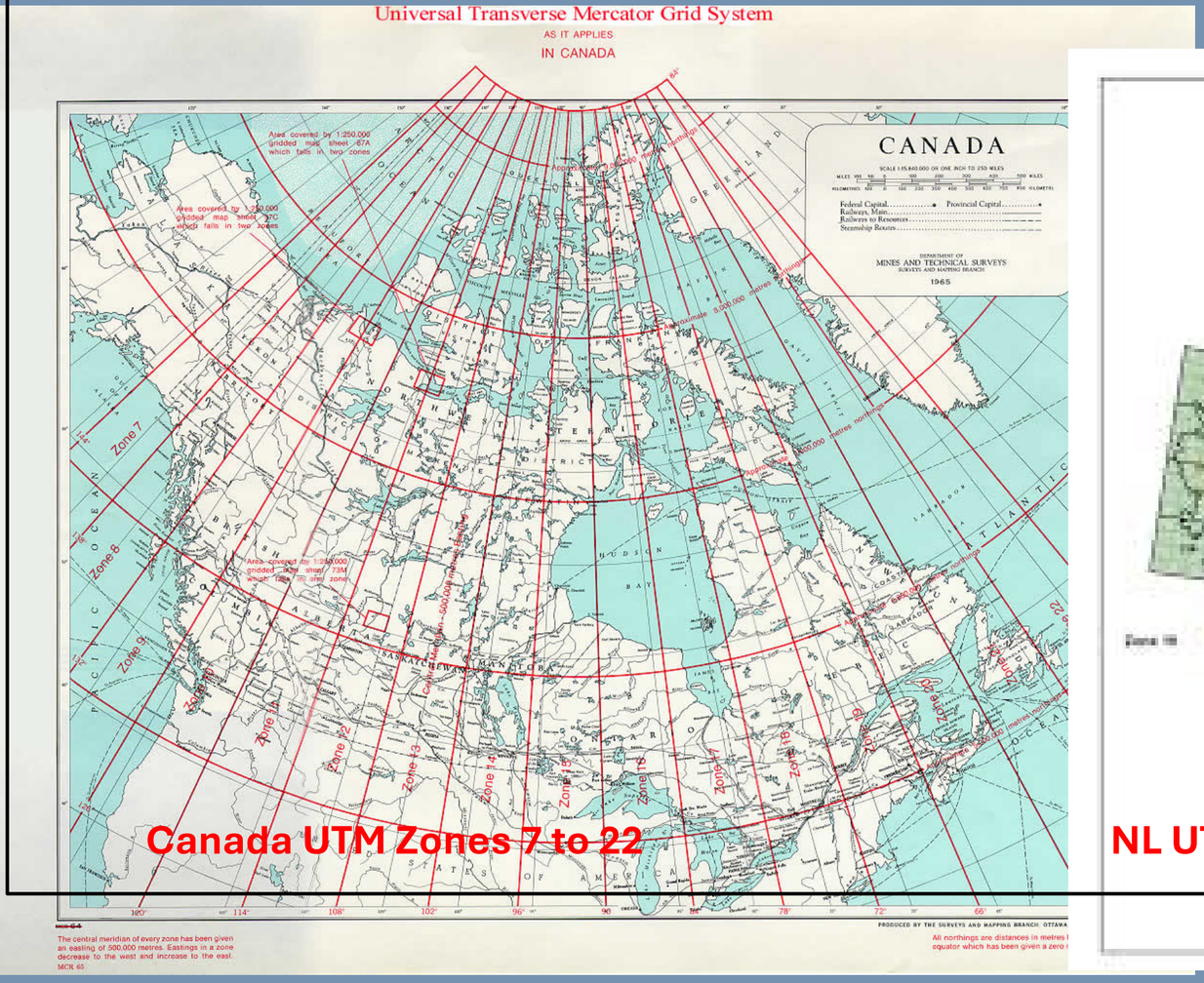
Coordinate Systems used in NL and on most GPS Units

Universal Transverse Mercator (UTM) a grid-based system that divides the Earth's surface into 60 zones, each 6 degrees wide, and projects them onto a flat plane. A ***Projected Coordinate System***. **North American Datums (NAD83 & NAD27)** are standard geodetic reference system for the United States, Canada, Mexico, and Central America established in 1927 and 1983. Most users now use NAD83 with the Mineral Claims system still using NAD27. There is a conversion between both, and they are not the same spatially.

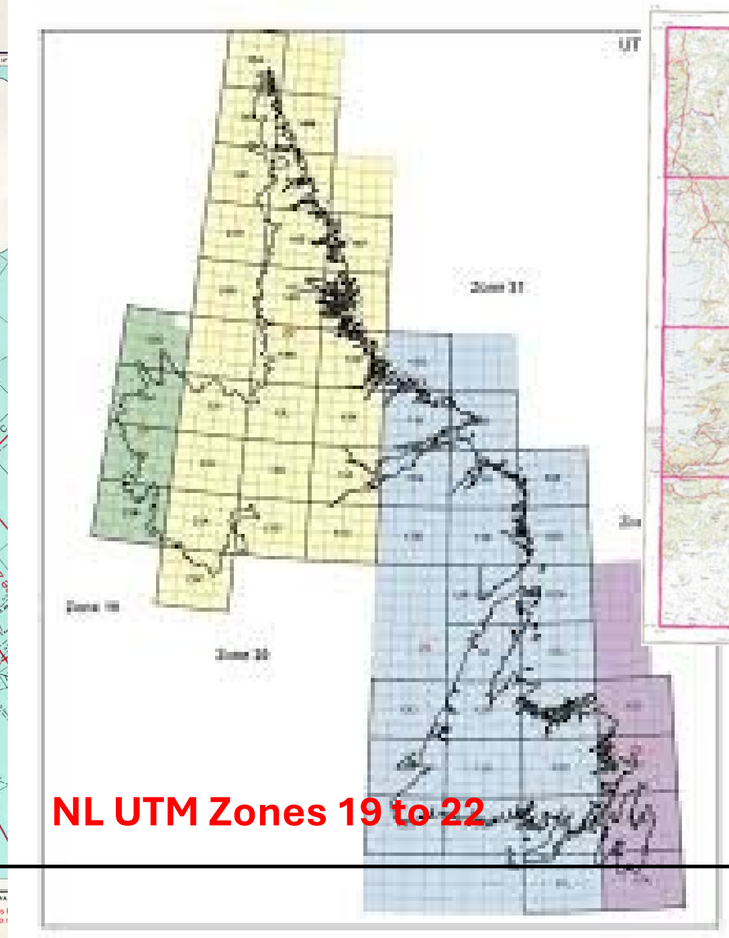
Geographic Coordinate System (GCS) is a ***spherical or geodetic coordinate system*** for measuring and communicating positions directly on Earth as latitude and longitude. **Latitude** is a measure north or south of the Equator in **Degrees, Minutes and Seconds or decimal degrees**, whereas **Longitude** is a measure of East-West from the Prime meridian at Greenwich. Most GPS units use this by default with **WGS84** as the geodetic system.

2. Canada UTM Zones and NTS Maps

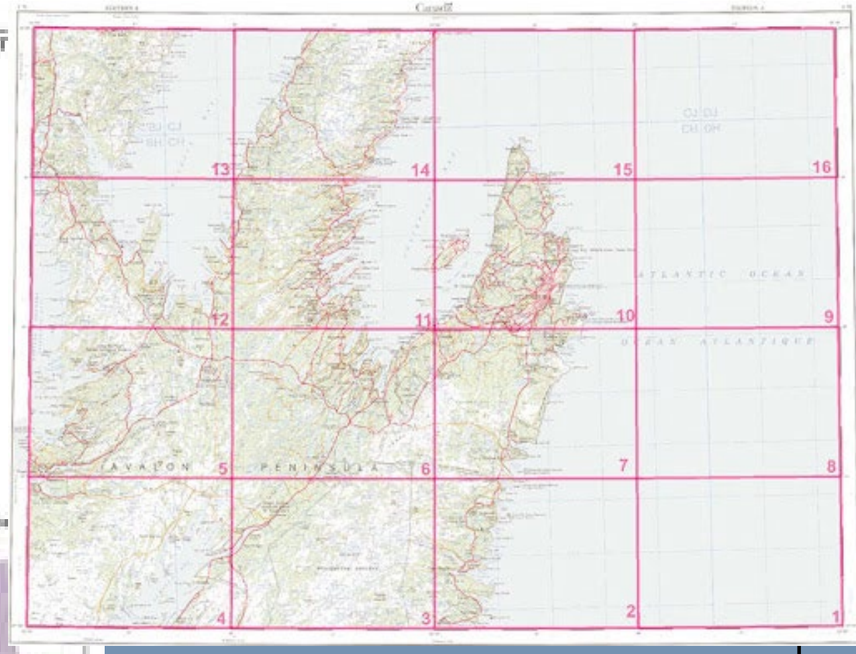
UTM Maps of Canada & Newfoundland and Labrador



Canada UTM Zones 7 to 22

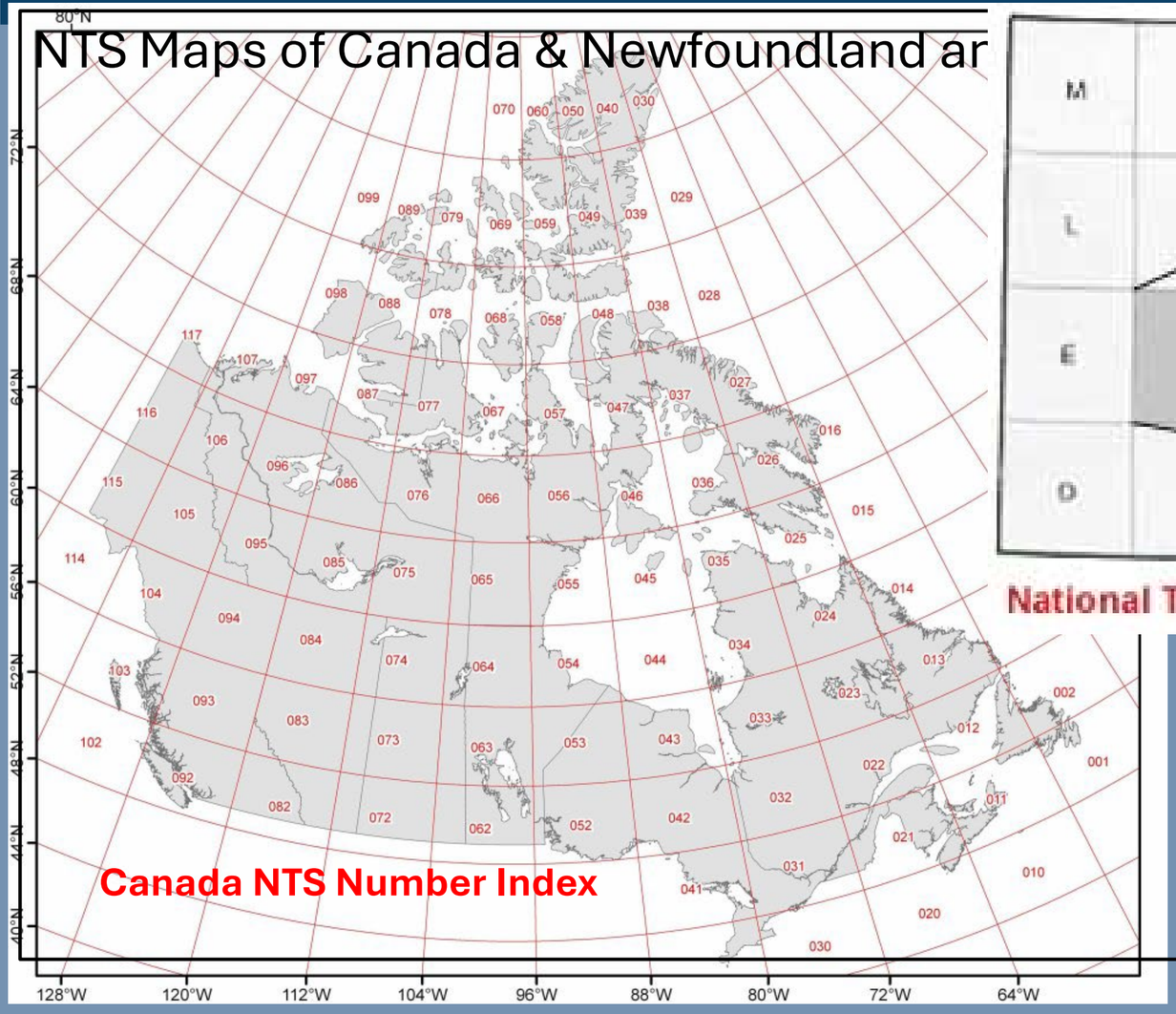


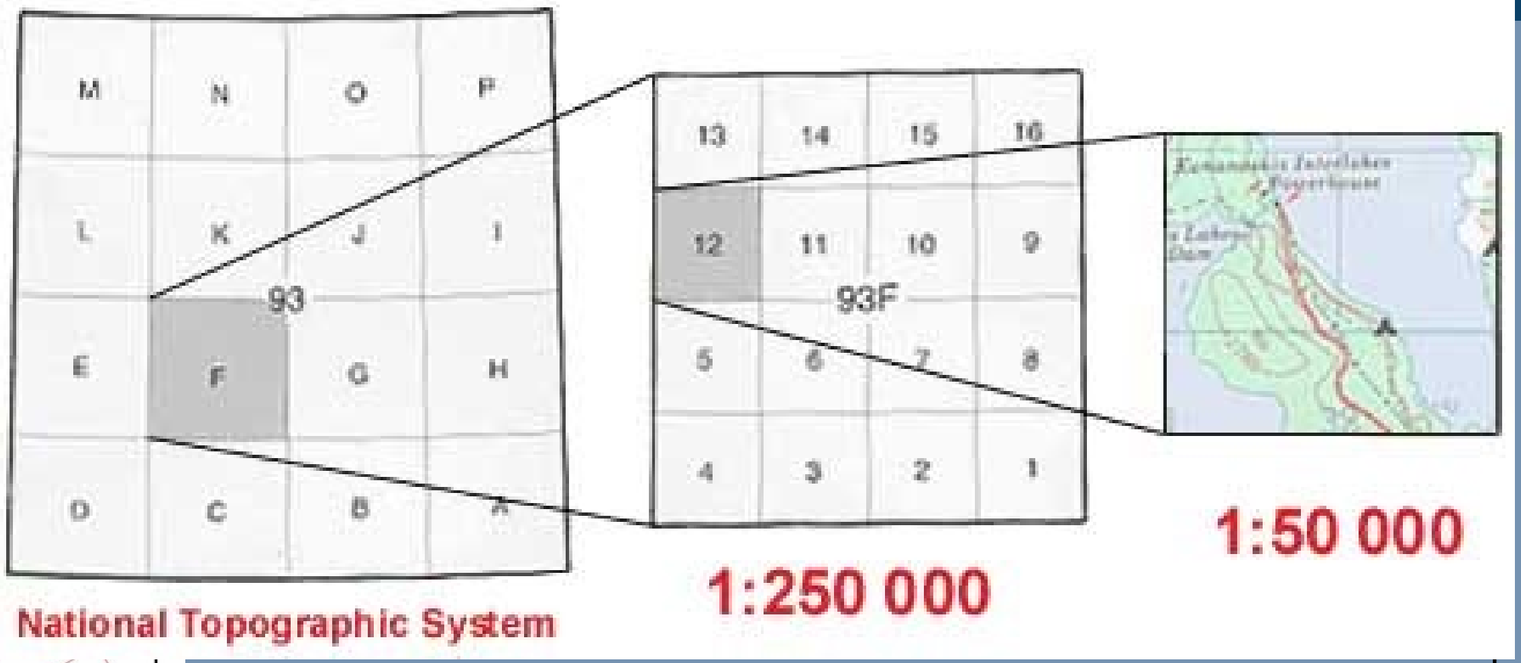
NL UTM Zones 19 to 22



NTS Map Sheet 001N in zone 22N

2. national topographic system NTS Maps





Each Index Number has 16 lettered 1:250,000 Maps
Each 1:250,000 NTS Map has 16 numbered 1:50,000 Maps

St. John's is on NTS Map 001N10 (St. John's)

2. Geographic Coordinate Systems – UTM & GCS

Limitations of the Different Coordinate Systems

Universal Transverse Mercator (UTM) coordinates are measured in metres with a UTM grid of square kilometres. Distances can be quickly calculated to an amount east or north.
North American Datums (NAD83 & NAD27) requires a conversion and must use **NTv2** in GIS for best results. Some offsets can be over 60m in the easting and over 200m in the northing.
The province has **4 UTM zones**, Zone 19 in West Labrador to Zone 22 on the Avalon, these are usually assigned by your GPS but be careful near the boundaries of each.

Geographic Coordinate System (GCS) uses **Degrees, Minutes and Seconds (DMS)** or **Decimal Degrees (DD)** which is fine for long distances and on the ocean but does not allow for easy distance calculations. The length of one degree on Earth's surface varies depending on whether it's a degree of latitude or longitude, and its location. One degree of latitude is consistently about 111 kilometers, but the distance for a degree of longitude varies from roughly 111 km at the equator to zero at the poles, because the lines of longitude converge at the Earth's poles.

3.gpxfiles

Most GPS Units store their **Tracks** and **Waypoints** into a **GPX file (.gpx)**, and most GPS Units once plugged into a computer will have these files available to the user and other software packages.

These files can be saved to your computer, shared to team members, sent to managers and as part of an assessment, and converted into other file types as an export in BaseCamp or using other software.

Exports as KML file (.kml) can be opened in Google Earth or used in a GIS software.

BaseCamp allows for the GPX file to be modified into daily tracks, soils vs grabs, separated by license, and a host of other variations.

3.gpxfiles & Garmin Basecamp

Software Demonstration

GPX Files on the GPS from File Explorer

Open in Basecamp and convert to kmz/kml

Open kmz/kml in Google Earth

Demo change of coordinate in Google Earth in a few minutes

4. online Coordinate conversions

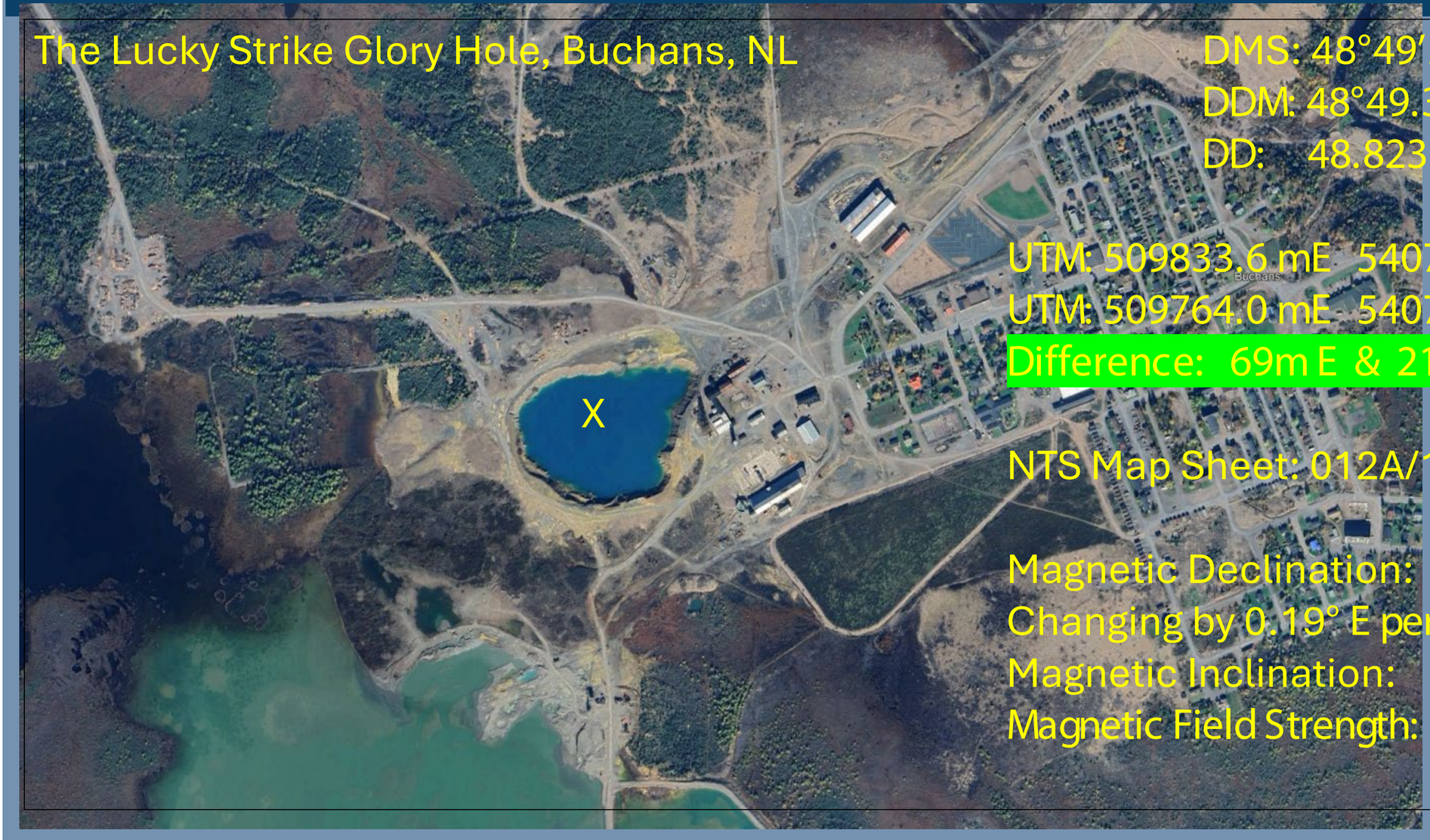
Coordinate Conversions Online

https://webapp.csrs-scrs.nrcan-rncan.gc.ca/geod/tools-outils/ntv2.php
https://webapp.csrs-scrs.nrcan-rncan.gc.ca/geod/tools-outils/trx.php

Magnetic Declination Calculations (The Magnetic Poles are Moving)
Use this tool to adjust a compass to True North each season.

https://www.magnetic-declination.com/
https://geomag.nrcan.gc.ca/mag_fld/magdec-en.php
https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml?useFullSite=true
https://www.magnetic-declination.com/locations.php?cc=CA

4. Conversion Example



DMS: 48°49′24.06″N 56°51′57.91″W
DDM: 48°49.398′N 56°51.962′W
DD: 48.823233°N 56.866029°W

UTM: 509833.6 mE 5407814.4 mN NAD83 z21N
UTM: 509764.0 mE 5407596.0 mN NAD27 z21N
Difference: 69m E & 218 mN

NTS Map Sheet: 012A/15 (Buchans)

Magnetic Declination: -17.40° (Negative = West)
Changing by 0.19° E per year.
Magnetic Inclination: 68° 11′
Magnetic Field Strength: 51772.3 nT

5. Station data & tables

All GIS and related mapping software packages require that sample data and/or track data be stored in a spreadsheet or table. Software such as **MS Excel** or **LibreOffice Calc** or **Apache OpenOffice Calc** allow for sample data to be stored in an organized means.

Sample or Station **Records** are shown as ***horizontal rows*** which contain the sample **Attributes** in columns or ***vertical rows***. Sample records will contain the minimum of the **Sample ID**, the **Easting** and the **Northing** in whatever coordinate system the prospector has chosen. This table is used to plot these points in a GIS package. Recommended additional data might include elevation, sample type, rock/soil description, date, sampler, strike/dip, and the assay results among other items.

5. Station data & tables

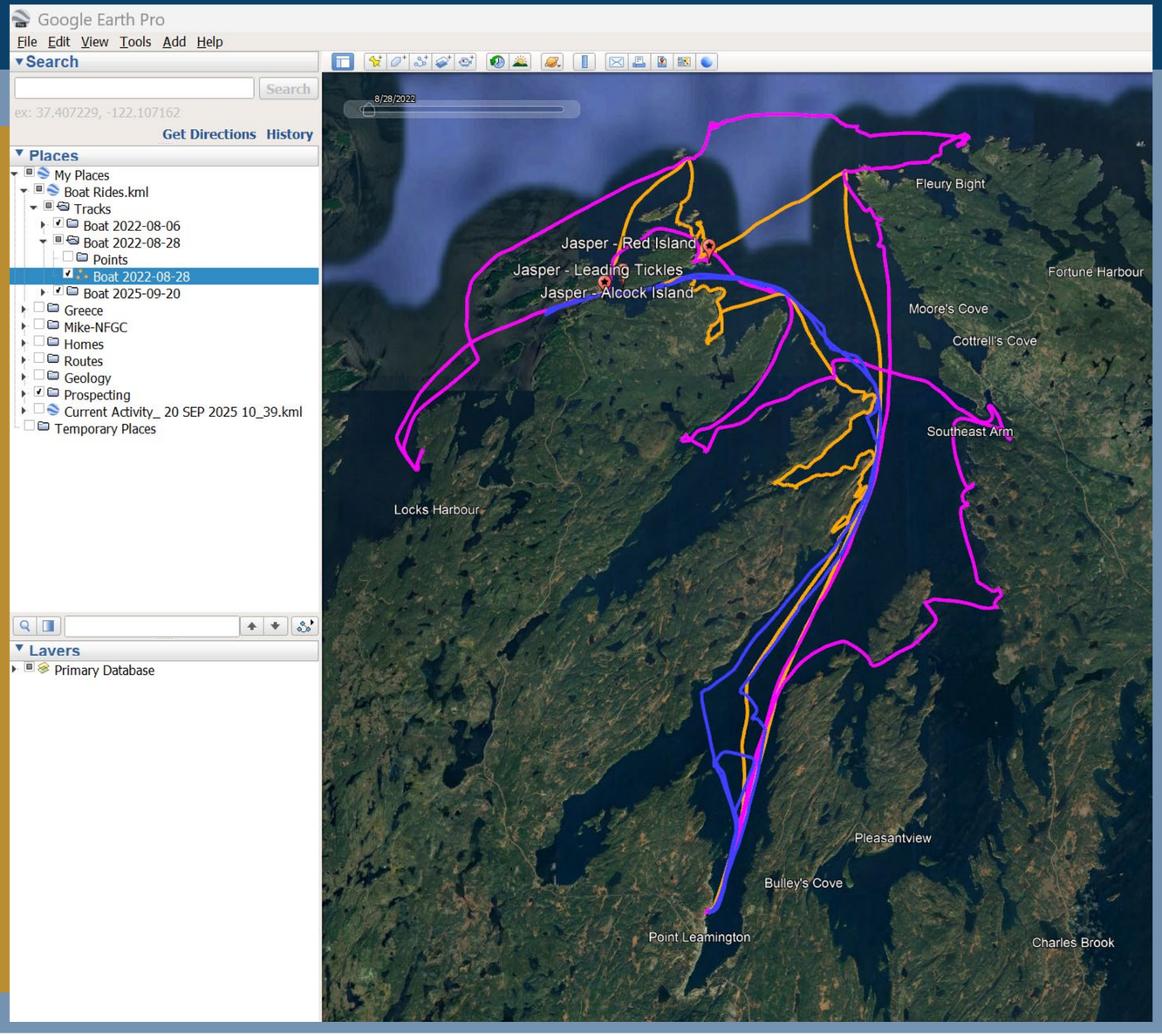
SiteID	UTM_E	UTM_N	SampleID	SamType	Project	Date	Descrptn
IK18-001	617733	5438624	BG001	Reference	Inger Knoll	May 19, 2018	3m x 10m Outcrop: Thick bedded red-orange sandstone.
IK18-001	617734	5438625	BG002	Reference	Inger Knoll	May 19, 2018	3m x 10m Outcrop: Thin bedded red-orange mudstone at top of bed.
IK18-002	617828	5438286	BG003	Reference	Inger Knoll	May 19, 2018	2m x 3m Outcrop: Thin bedded interbedded green-grey and red-orange sandstone.
IK18-002	617828	5438286	BG004	Reference	Inger Knoll	May 19, 2018	2m x 3m Outcrop: Thin basal bed of pebble or pale orange flake conglomerate.
IK18-003	616890	5438932	BG005	Reference	Inger Knoll	May 21, 2018	10m x 15m stripped roadside OC: Pale orange Fe-Carbonatized fissile silty sandstone (BG Blank Site)
IK18-004	616524	5438878	BG006	Reference	Inger Knoll	May 21, 2018	3m x 10m stripped roadside OC:Thick bedded red-orange sandstone.
IK18-005	615654	5438353	BG007	Reference	Inger Knoll	May 21, 2018	Old Rock Quarry: Thick bedded red-orange sandstone.
IK18-005	615660	5438357	BG008	Reference	Inger Knoll	May 21, 2018	Old Rock Quarry: Thin bedded ripple marked mudstone at bed top.
IK18-006	613370	5536117	BG009	Reference	Inger Knoll	May 21, 2018	Active Rock Quarry: Thick bedded red-orange sandstone.
IK18-006	613375	5536125	BG010	Reference	Inger Knoll	May 21, 2018	Active Rock Quarry: Thin bedded ripple marked mudstone at bed top.
IK18-007	618836	5448434	BG011	Reference	Inger Knoll	June 9, 2018	2m x 15m Roadside Rockcut: Thick bedded red-orange sandstone.
IK18-008	620679	5444744	BG012	Reference	Inger Knoll	June 9, 2018	Cannings Hill: Deformed-folded thick bedded red-orange sandstone.
IK18-009	619233	5444448	BG013	Reference	Inger Knoll	June 9, 2018	Tower Ridge: Deformed-folded thick bedded red-orange sandstone.
IK18-010	612971	5431361	BG014	Reference	Inger Knoll	June 9, 2018	TCH Rockcut: deformed green-grey siltstone-mudstone
IK18-010	612975	5431370	BG015	Reference	Inger Knoll	June 9, 2018	TCH Rockcut: deformed green-grey siltstone-mudstone
IK18-011	625045	5434746	BG016	Reference	Inger Knoll	June 9, 2018	TCH Rockcut: Gabbro
IK18-012	615054	5436854	BG017	Reference	Inger Knoll	May 15, 2019	1m x 1m Outcrop: Medium bedded red-orange sandstone.
IK18-013	615217	5436869	BG018	Reference	Inger Knoll	May 15, 2019	2m x 2m Outcrop: Medium to thick bedded red-orange sandstone.
IK18-014	615280	5436871	BG019	Reference	Inger Knoll	May 15, 2019	1m x 2m Outcrop: Medium to thick bedded red-orange sandstone.
IK18-015	615953	5437078	BG020	Reference	Inger Knoll	May 15, 2019	2m x 10m Roadcut: Medium to thin bedded locally grey silty sandstones.
IK18-016	615971	5437127	BG021	Reference	Inger Knoll	May 15, 2019	2m x 5m Roadcut: Deformed-Slickensided, bleached, Fe-Carbonatized thin bedded sandstones.

6. google earth kml/kmz files

Download:
https://www.google.com/intl/en/earth/versions/

Can be used Online
Downloaded as Google Earth Pro
On a Mobile Device

Save your work as .kml/.kmz files
Store in **My Places**

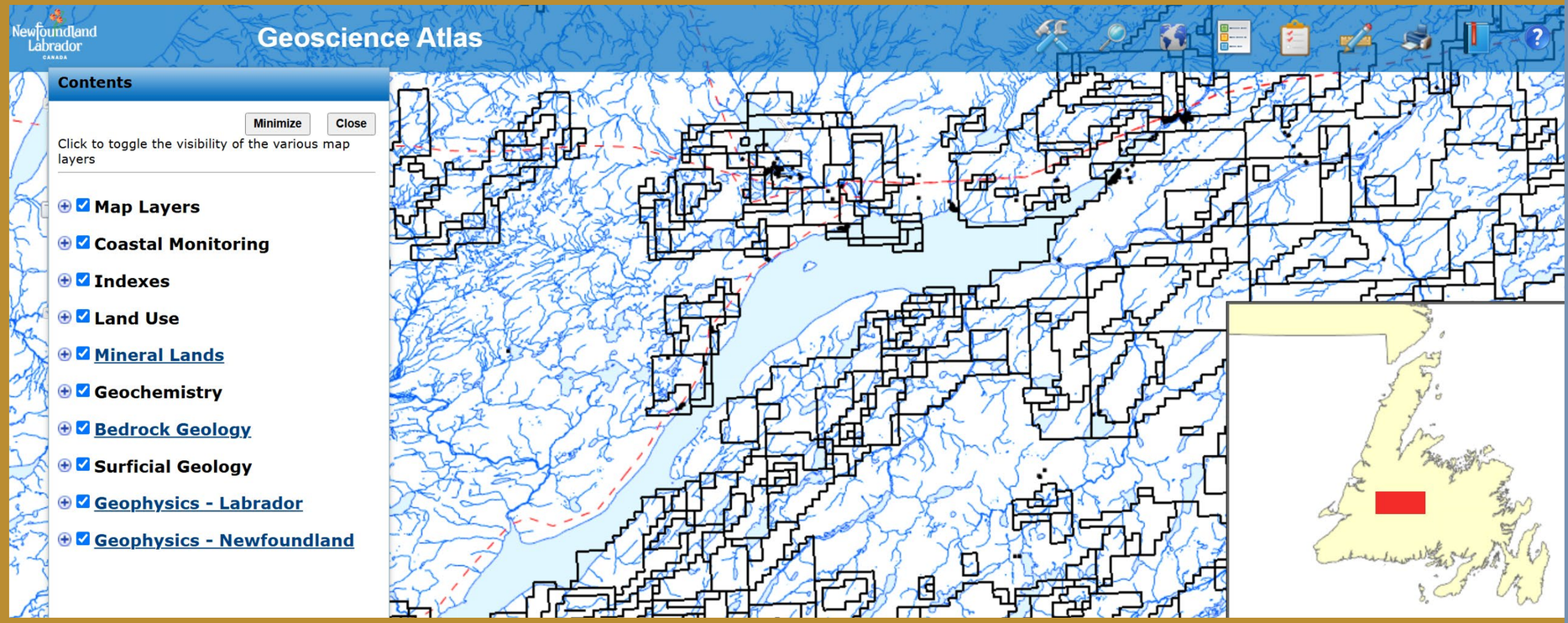


7. The Geoscience Atlas

https://geoatlas.gov.nl.ca/Default.htm

Domo:

Contents
Tools
Search
Base Map
Legend
Contents On/Off
Measure Tool
Print Tool
Bookmark Tool
Help



7. The Geoscience Atlas

Demonstration of using the Geoscience Atlas

8. qgis & open source mapping software

QGIS Software for your computer: https://qgis.org/

QGIS Demonstration

9. avenza maps

https://www.avenza.com/avenza-maps/

Use Avenza Maps® on your mobile devices to locate yourself without the Internet or network connections.
Take Avenza Maps hiking, biking, climbing, camping, out in the field while at work, and anywhere you need a map outdoors.
Use your device's built-in GPS to stay safe, on track, on the trail, and aware of where you are on any map, even in the most remote places.

Avenza Maps uses **GeoPDF** and **GeoTIFF** which are Adobe pdf and tiff images imbedded with geographic information. For importing map features, Avenza Maps also supports **KML/KMZ** and **GPX** formats.

9. avenza maps

Avenza Maps Software

For PC: https://store.avenza.com/

On Mobile: Open Play Store > Search Avenza Maps > Install

9. Georeferencing maps & Georeferencing in QG

First, find a map as a pdf from Geofiles or other sources or look directly for geoPDF or GeoTiff maps already georegistered and save it to your project folder.

Next, in QGIS go to ***Web>Quick Map Services>OSM*** and open a base map.
If the plugin is not active go to **Plugins>Manage** and **Install Plugins** and search for **Quick Map Services.**

To Georeference the map go to **Layer>Georeferencer** then **File>Open Raster** and load the pdf from your folder.
Now we need to generate **Ground Control Points (GCP).**
Click a point on the pdf then click the **From Map Canvas** button, then click the same point on the OSM map, then OK. ***Do this at least 3 times, more is always better.***
Once control points have been collected, we can start Georeferencing by hitting the play button. 
Hit Play Again, close the Raster Window and Save GCPs if prompted.

The map is now saved as a .TIFF and can be quite large.
Click **Project>Import/Export>Export Map to PDF** then select the **Create Geospatial PDF** and hit **Save.**
Save your georegistered map to your folder.

9. Avenza Maps & Georeferencing in QG

To get the map to your phone simply plug in and upload or email it to yourself and download.
Open Avenza Maps and add the map to your list.

Some YouTube Videos to help.

https://www.youtube.com/watch?v=jKLBFddpTGI&t=258s

https://www.youtube.com/watch?v=OYzJPCzNG18

https://www.youtube.com/watch?v=5xorDrMh5mI&t=21s

10 solocator - gps field came

solocator®
Photos with direction

Solocator is an application developed for Android/IOS Phones that captures the **Where, When** and **What** of your pictures. It has a nominal price ($10.00) and is downloaded from Google Play Store.

Where: GPS Coordinates, Bearing, Altitude as a banner atop your picture.
When: Date and Time of your picture
What: Fields for Project Name, Description, Photographer, etc.

https://solocator.com/

The App takes 2 photos at once, stamps one with the selected overlays.
Photo can be saved on the phone, or to Cloud Storage (iCloud, Dropbox, Google Drive, OneDrive).
Photos can be emailed or exported along with maps, photo location data, KML, KMZ and CSV file formats.

10solocator-gpsfield came

solocator®
Photos with direction

Hunting for Red Jasper near Leading Tickles, NL

conclusions

Yes, these digital tools can be intimidating to those who do not use them often.

Ultimately what tools are used depends on the individual, and there is always those in the Industry who will gladly assist.

Start with the basics of your GPS, your computer, and some basic software.

Using GIS software does have a steep learning curve, many, including Geologists, avoid this avenue.

Some will find the Smart Phone or Tablet software an advantage to use over a laptop.

Technology is constantly changing, especially Open-Sourced, use what you are comfortable with.

In the end maybe the GPS, a notebook, and a keen eye is all you need?

questions & group discussions

Open Floor for Questions, Group Discussions, and Shared Assistance

Is there anything you would like to revisit!

thank you & Good luck in the field

Kiley Billard

On Greenwich Meridian St. Lucia

Angela Norman

In the Trenches at the AFZ

Mike Regular

The Pitons,

Imagery Links

Base maps and Imagery:

OpenStreetMap, Google Satellite, or ESRI basemaps via QuickMapServices plugin. Plugins like quick map services and open layers allow users to view imagery straight into QGIS

Personally I like using a method called “XYZ tiles” in your browser:

Browser -> XYZ Tiles -> New Connection -> Give it a name and enter a URL

Google Satellite: http://mt0.google.com/vt/lyrs=s&hl=en&x={x}&y={y}&z={z}

Google Earth Hybrid: http://mt0.google.com/vt/lyrs=y&hl=en&x={x}&y={y}&z={z}

Copernicus Remote Sensing:

https://browser.dataspace.copernicus.eu/?zoom=13&lat=48.92239&lng=-54.5913&themeId=DEFAULT-THEME&visualizationUrl=U2FsdGVkX1%2F%2BVF00dXLQ638eHgGRa%2BrV4kbUNJkpKaBFrEtixrQpuoL2Z81xwdkp%2BL%2Fu0SMvqh4otSrVym3JTfBUqJEFfb%2FZiu281hEsqJkcuGxUUSHYuO5Xot%2FmNuFO&datasetId=S2_L2A_CDAS&demSource3D=%22MAPZEN%22&cloudCoverage=30&dateMode=SINGLE

Topography Links

Topography: includes information about the Earth's physical and cultural features, such as elevation, terrain shape, and man-made structures like roads and buildings

Canvec: Can get a lot of topographic data like roads, rivers, contours, etc

Canvec data extraction provides topographic data over a selected area: https://maps.canada.ca/czs/index-en.html

Canvec server: https://ftp.maps.canada.ca/pub/nrcan_rncan/vector/canvec/

DEM of Newfoundland and Labrador: https://geohub-gnl.hub.arcgis.com/maps/7203aef91a024ece843c4be4b3727dda/about

Land Use Atlas: shows a lot of administrative features such as crown lands and land titles
https://www.gov.nl.ca/landuseatlas/details/

NL Topographic Maps: A series of 1:50,000 scale topographic maps of Newfoundland and Labrador
https://geohub-gnl.hub.arcgis.com/apps/GNL::nl-150000-topographic-map-sheets/explore?path=

NRCAN: Government of Canada open data, a bit of a hodgepodge of data sources however there is a lot of valuable information in here if one were to search through it
https://search.open.canada.ca/opendata/?owner_org=nrcan-rncan

Geology Links

Geology layers: topographic data that revolves around geology and geological features, these are more specialized

NL Geo Atlas: is a strong resource that allows users to download up to date information on claims, bedrock geology, Geochem, geophysics, and Mineral Occurances
https://geoatlas.gov.nl.ca/Default.htm

Geoscience Index of Newfoundland and Labrador: Provides geoscience maps of newfoundland and labrador derived from government works and reports
https://gnl.maps.arcgis.com/apps/webappviewer/index.html?id=705785b4388d41b99b88391a246e186b

QGIS Training Links

QGIS Training Manual: https://docs.qgis.org/3.40/en/docs/training_manual/index.html