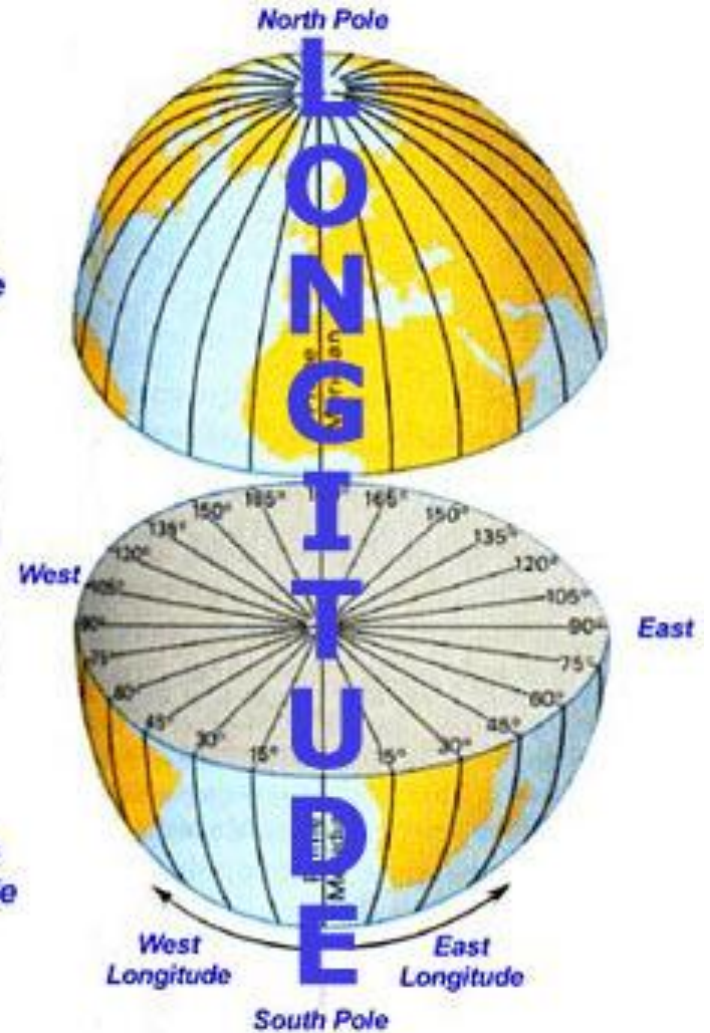
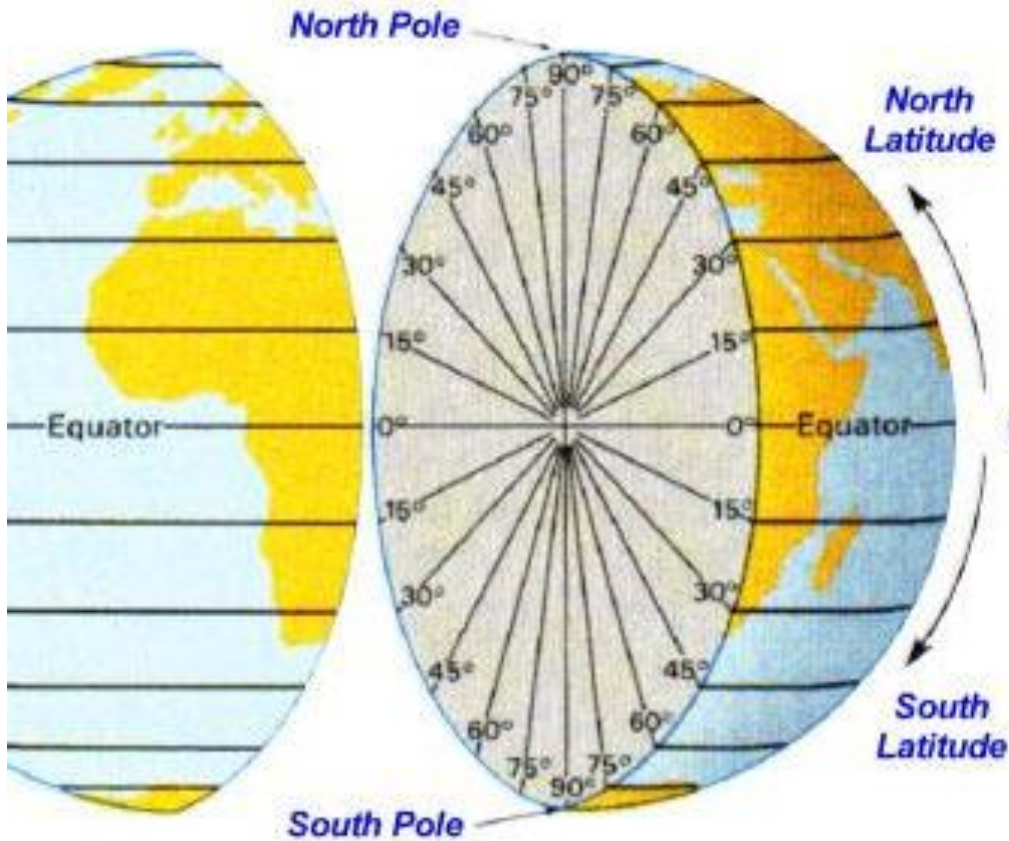
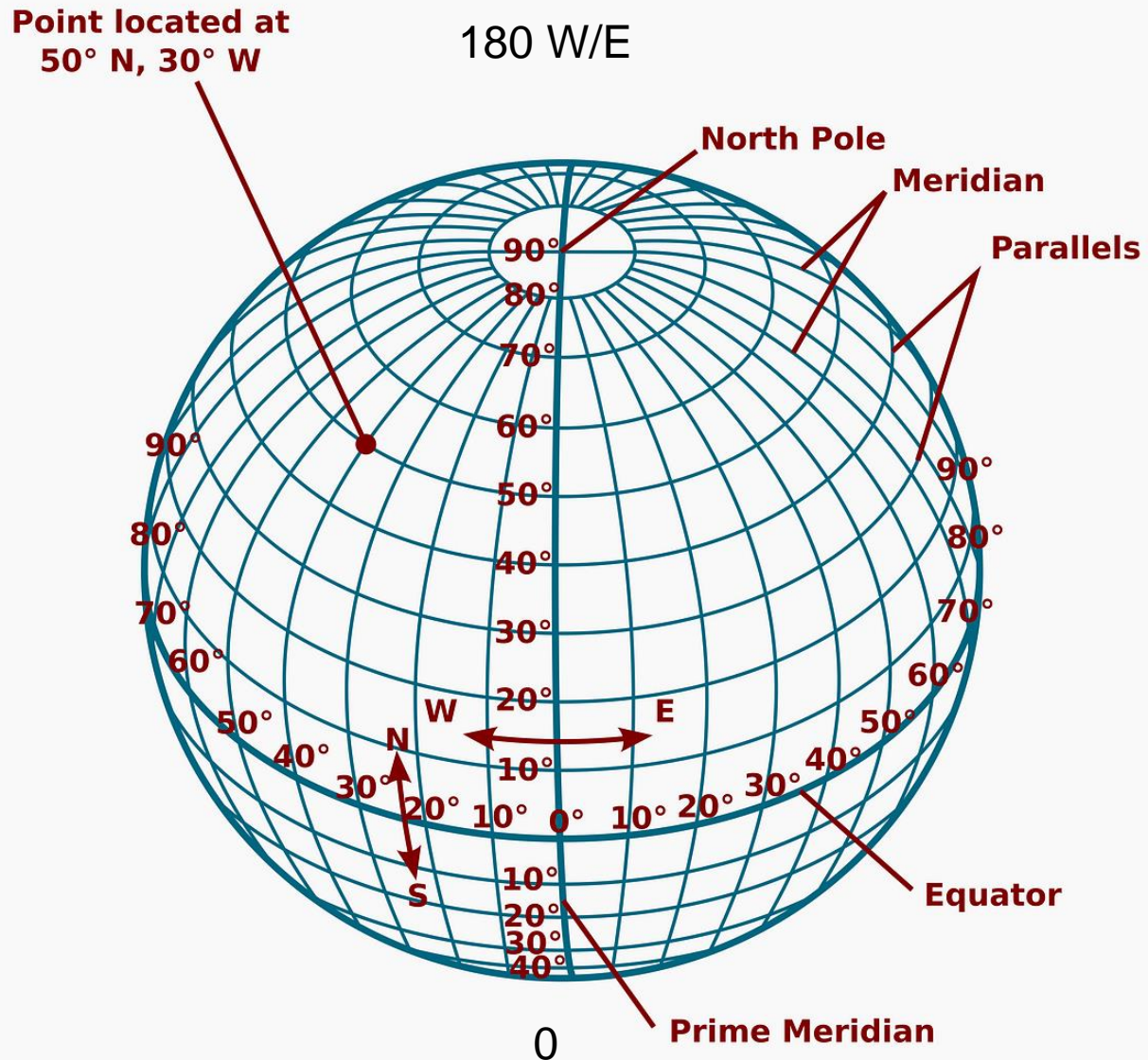


Coordinates – review: Latitude/Longitude (Geographic = Graticule)

LATITUDE

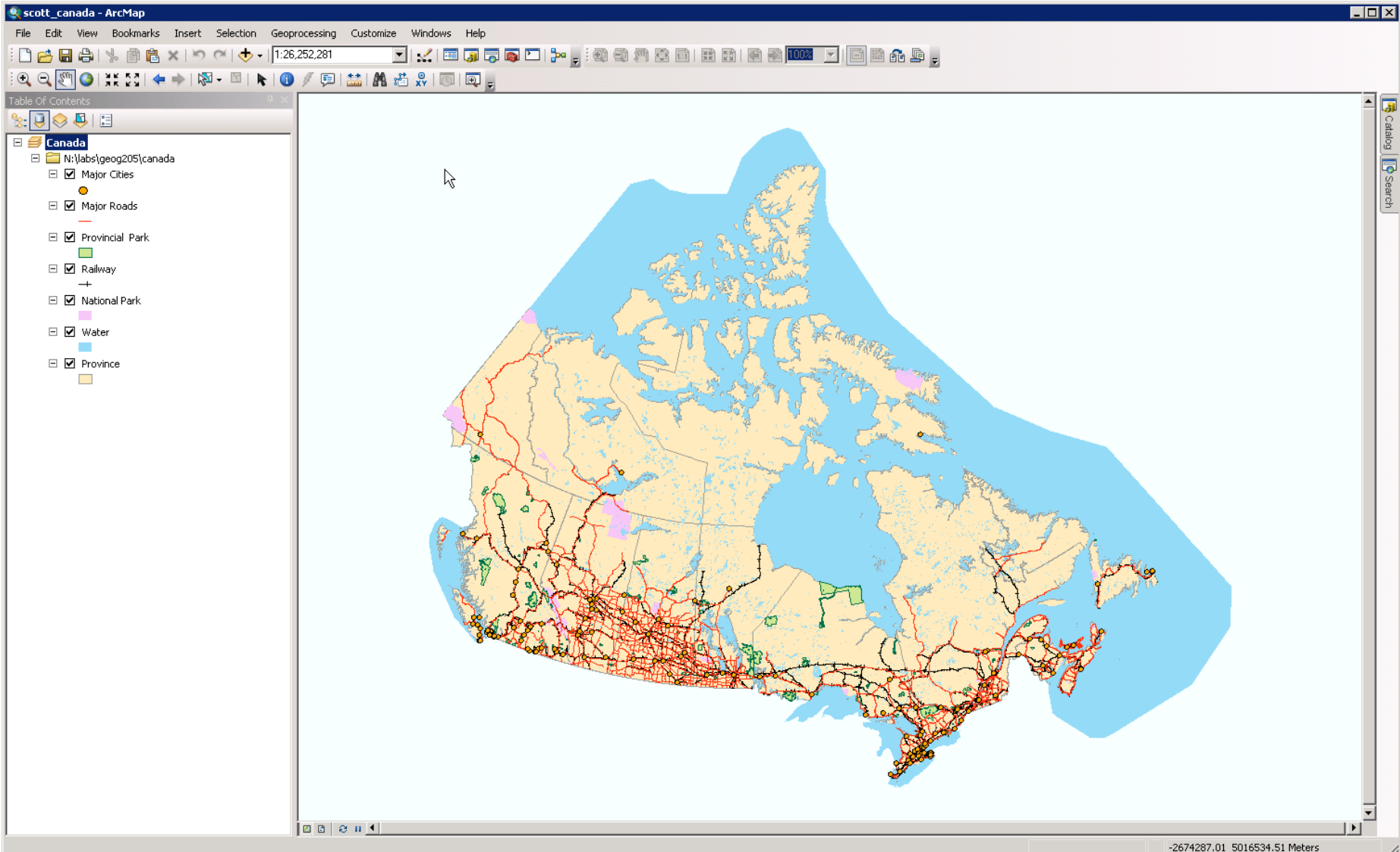


Coordinates – review: Latitude/Longitude (Geographic = Graticule)

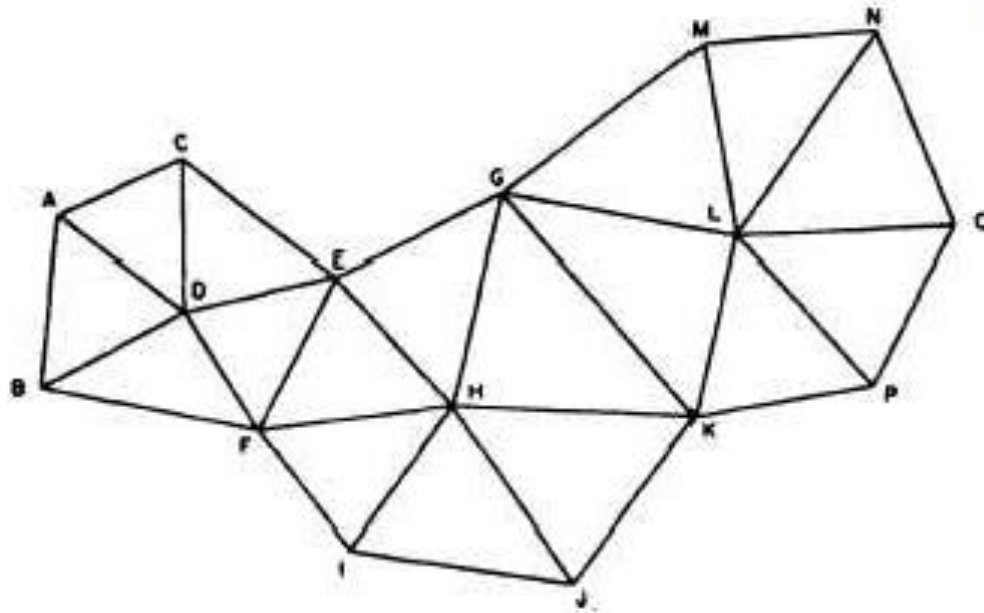


Digital map data

Where do (base) map data and layers come from ?
Mostly from aerial photography and surveying ... before 2000



Traditional surveying: triangulation



Theodolite



Or by Chain and compass



Triangulation station

Geodetic station



Since ~1945, our topographic mapping has used aerial photography:
Air photos enabled a huge reduction in natural resources fieldwork costs,
and increased how quickly and accurately large areas could be mapped



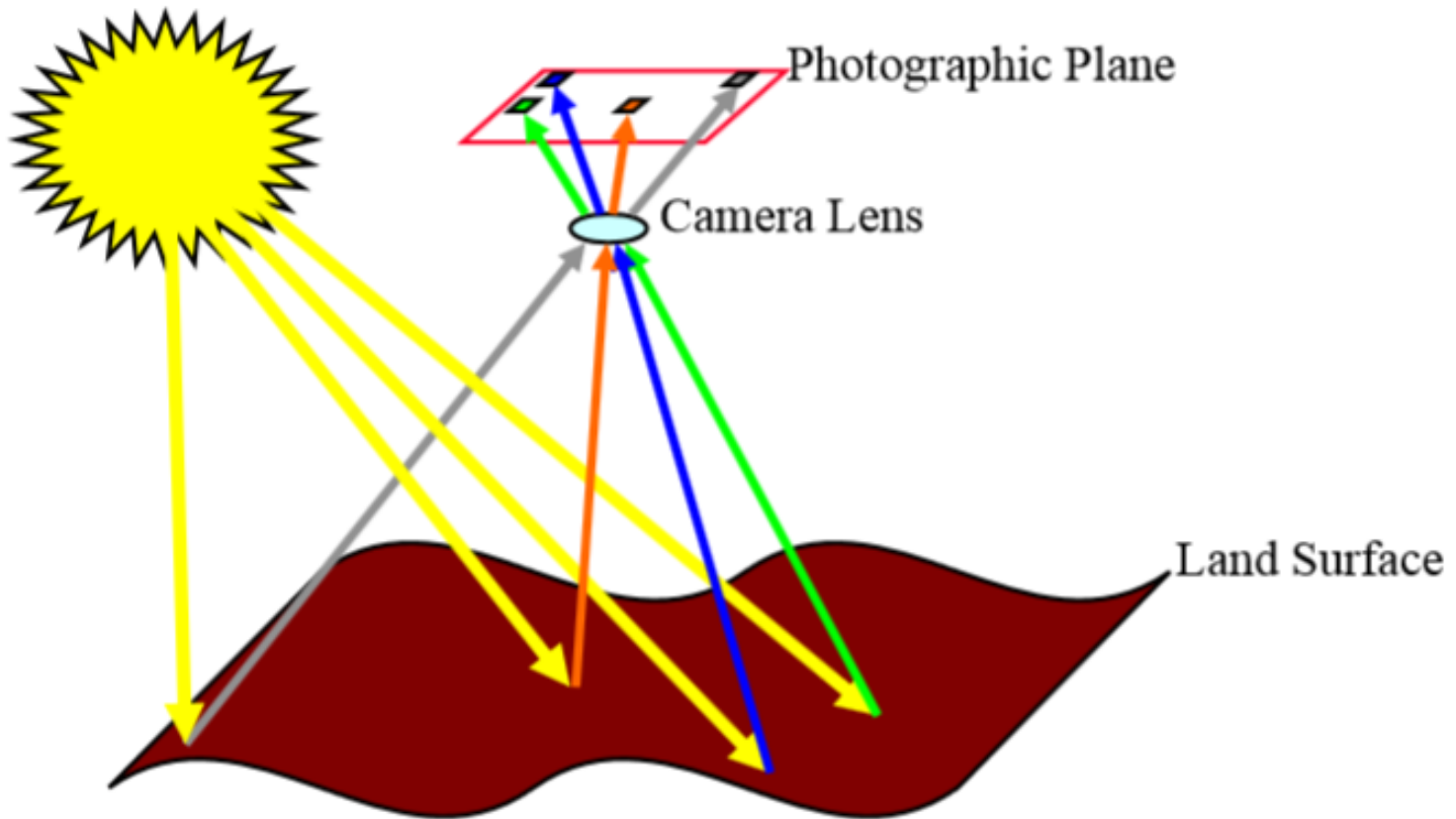
Ground points
were still
surveyed by
field crews

Athabasca Glacier, 1958

Photogrammetry: *"the science of obtaining reliable measurements from photos"*

Correction of distortions due to :

- airplane tip, tilt and swing
- radial and relief distortion



These are now corrected automatically with modern digital photography

1. Scanning

maps -> .jpg or .pdf; not editable layers

Raster maps

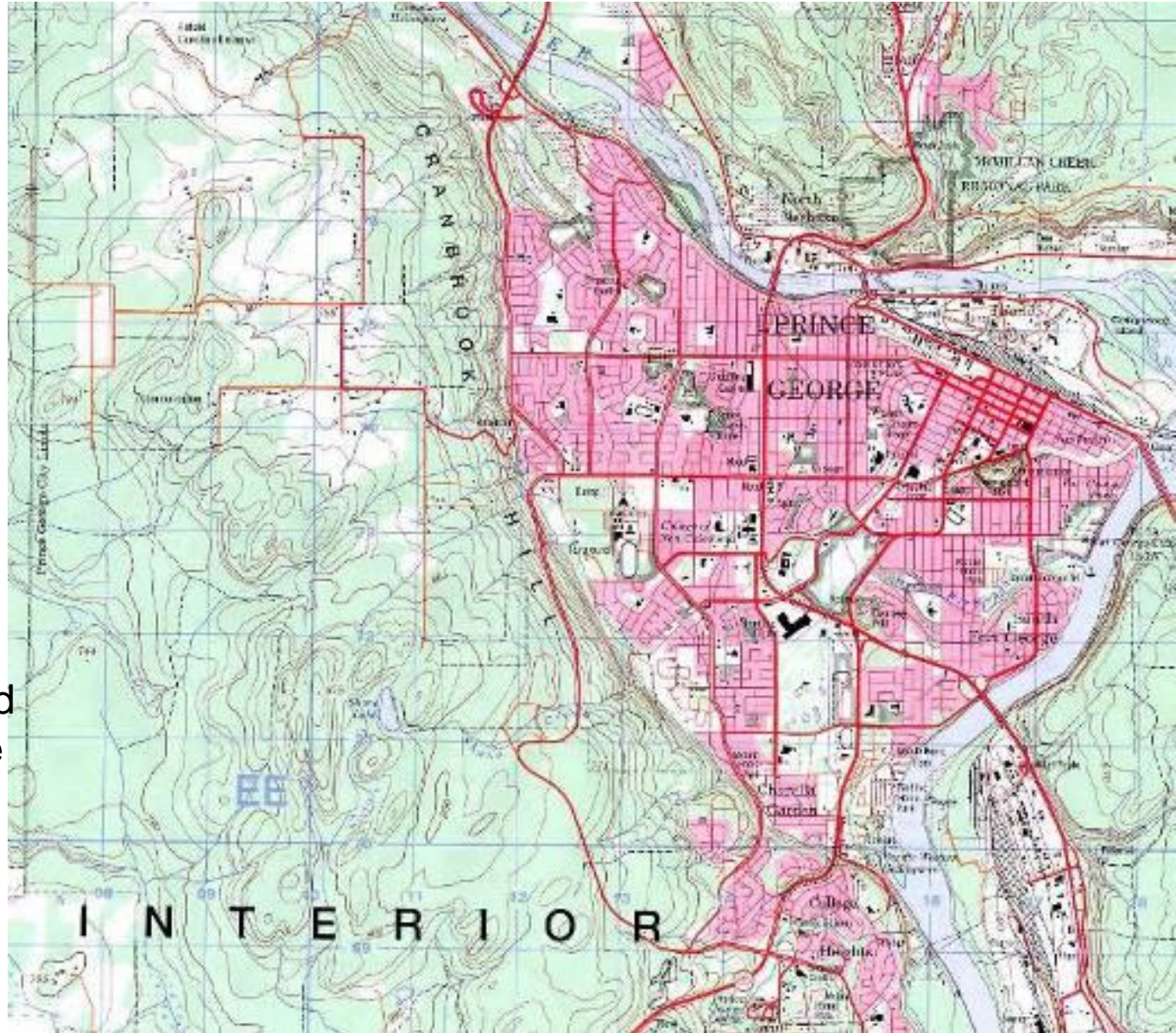
a. 'print ready'

Usually pdf

b. **Georeferenced**
(with coordinates)

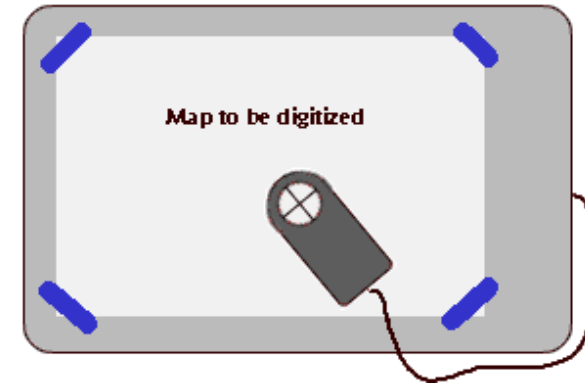
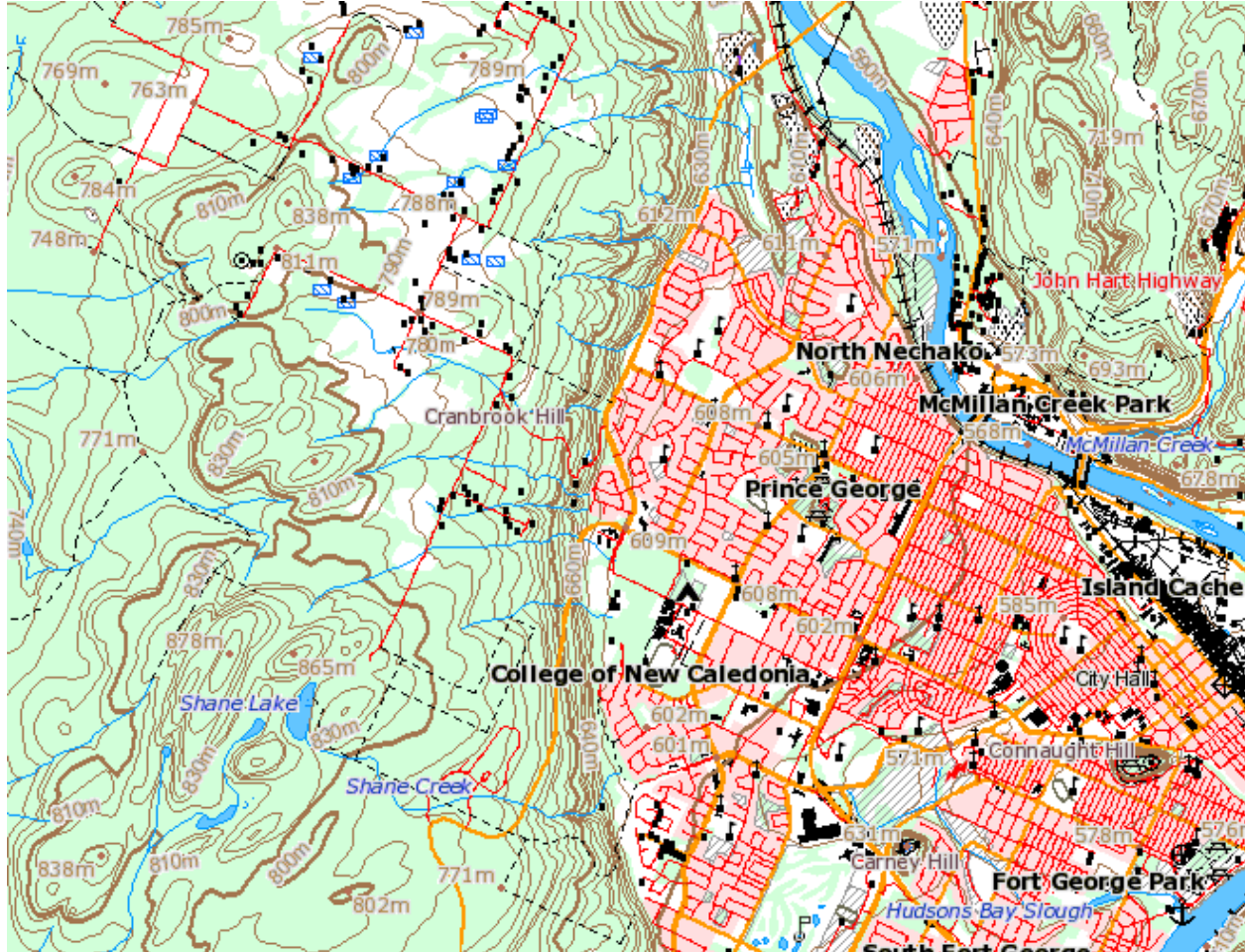
e.g. geotiff

b. Now may be loaded
on your GPS / iPhone



2. Digitizing

Tracing lines on maps using a tablet with map taped down (pre-1995), or onscreen 'heads-up' 1995 ->



GIS technician jobs
1980s / 90s – all Canada
topo maps digitised from
printed maps by 1995

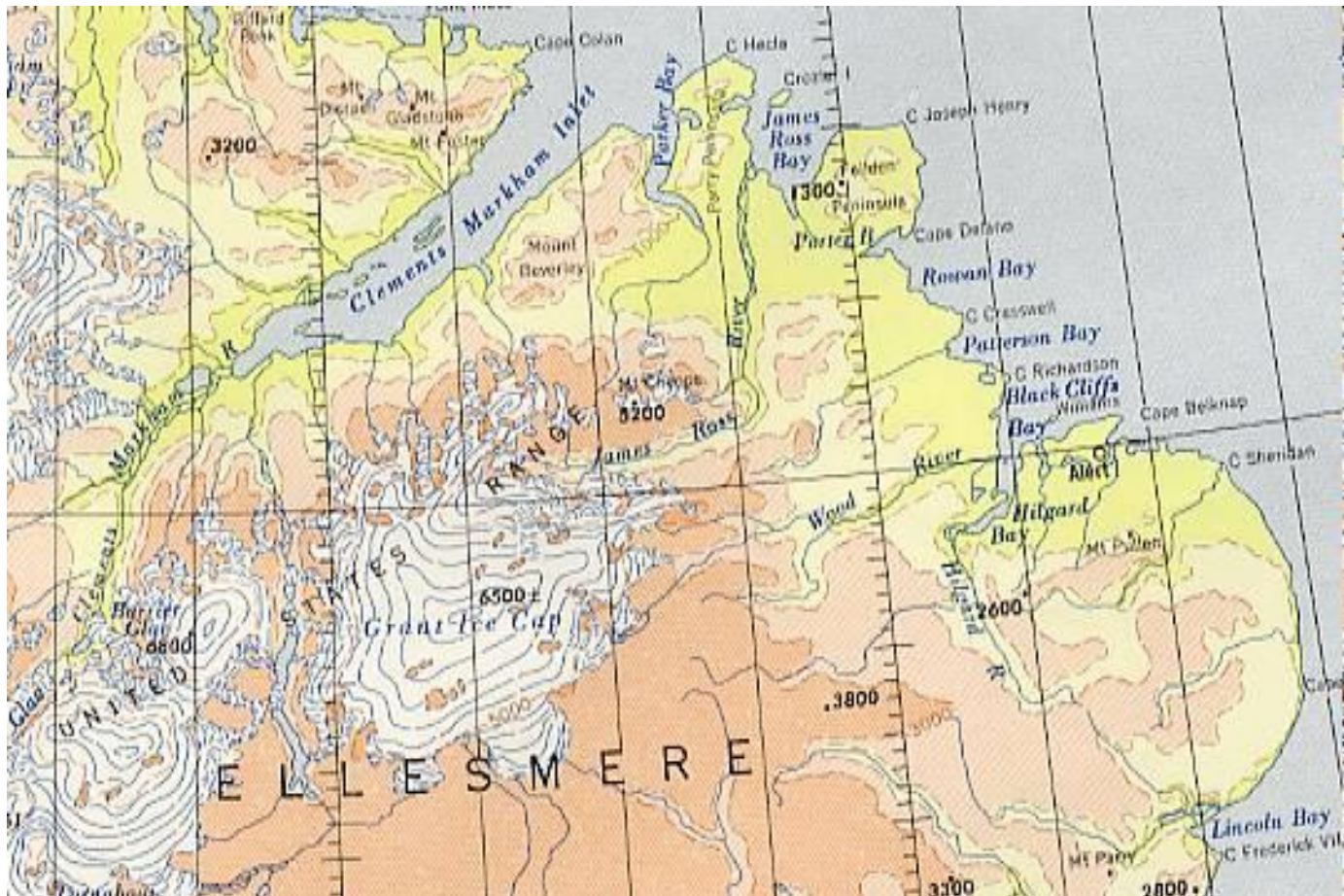


Purchase cost \$500 per map
sheet - free after 2007 in
Canada, varies by country.

3. Datasets

a. Global data (small scale)

- The largest scale for the whole world covered is 1:1,000,000. (1cm = 10km)
- The [Digital Chart of the World](#) (DCW) was completed in 1993.
- Digitised from the printed International Map of the World (IMW) maps
- It is not suitable for mapping at larger scales.

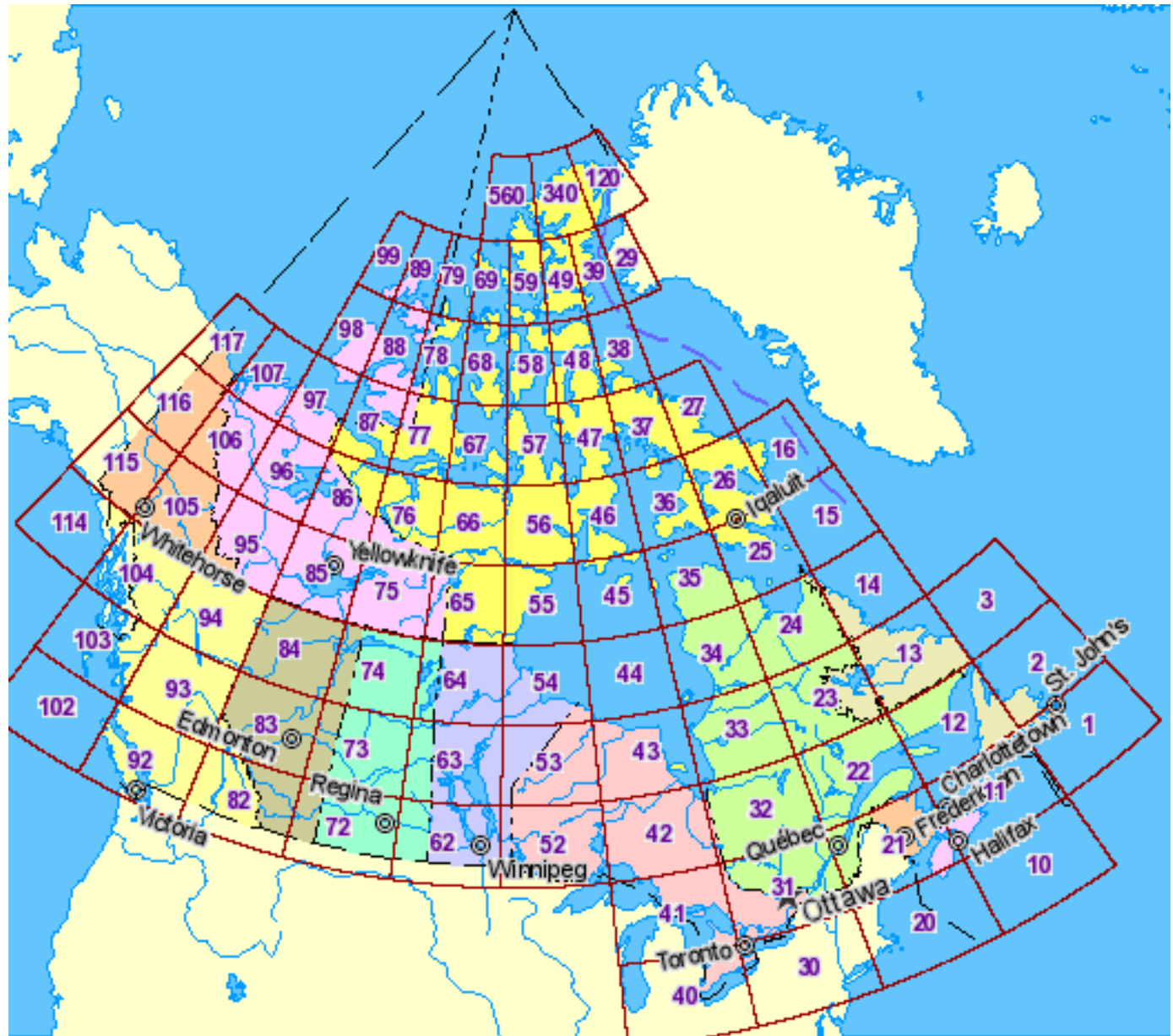


b. Canada is divided into 1:1,000,000 sheets, numbered 1-117
Each is 8° longitude x 4° latitude, mapped by 1960 (digital in 1993)

National Topographic System (NTS) / Series

Digital: National
Topographic
DataBase (NTDB)

Small-scale

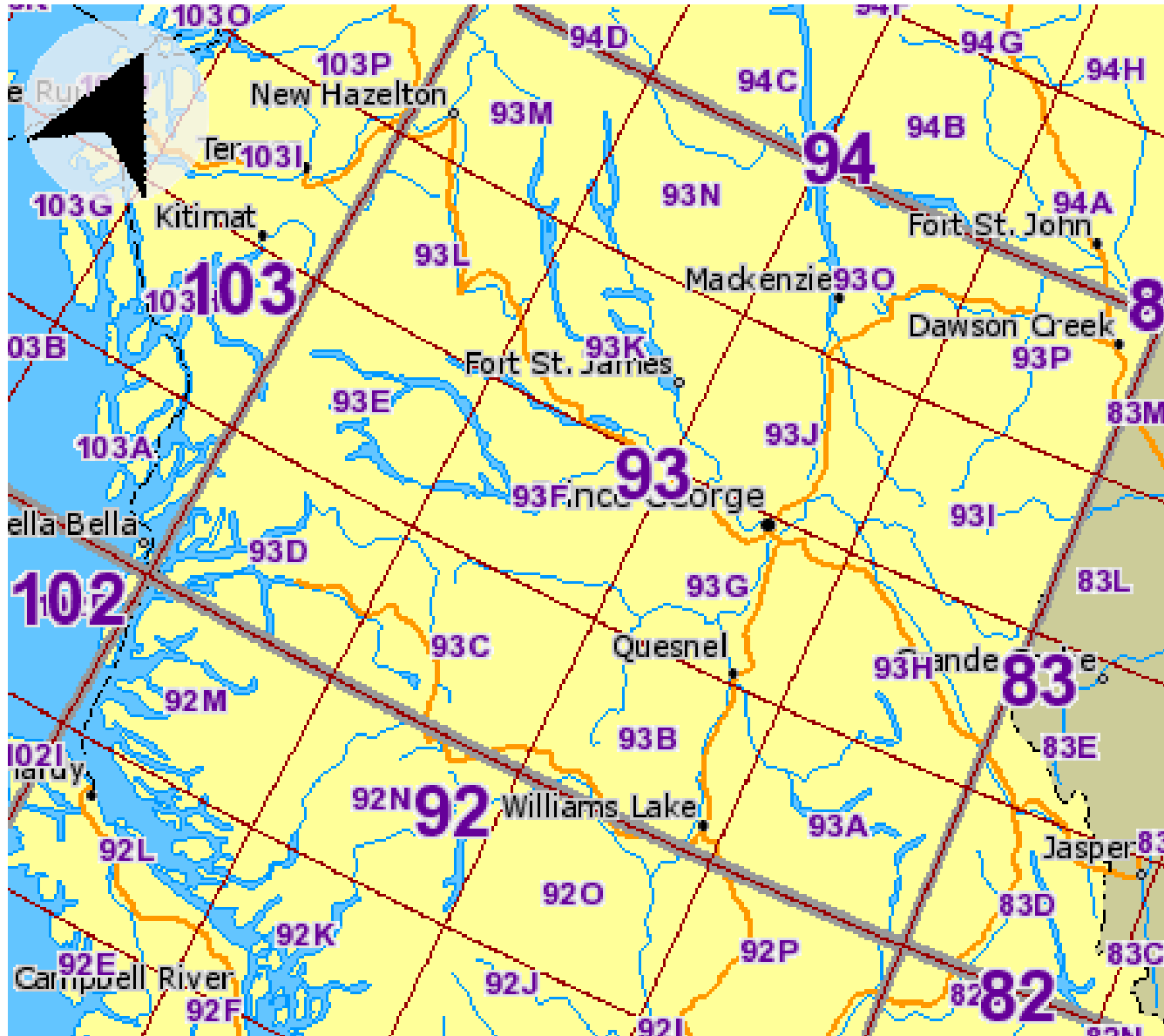


1:1,000,000 maps are divided into (16) 1:250,000 sheets, completed 1970

c. 1:250,000

Digital: 1990s

Medium-scale



1:250,000 corresponds to 1 cm = 2.5 km

then into 16 x 1:50,000 (A-P), completed for provinces ~1994

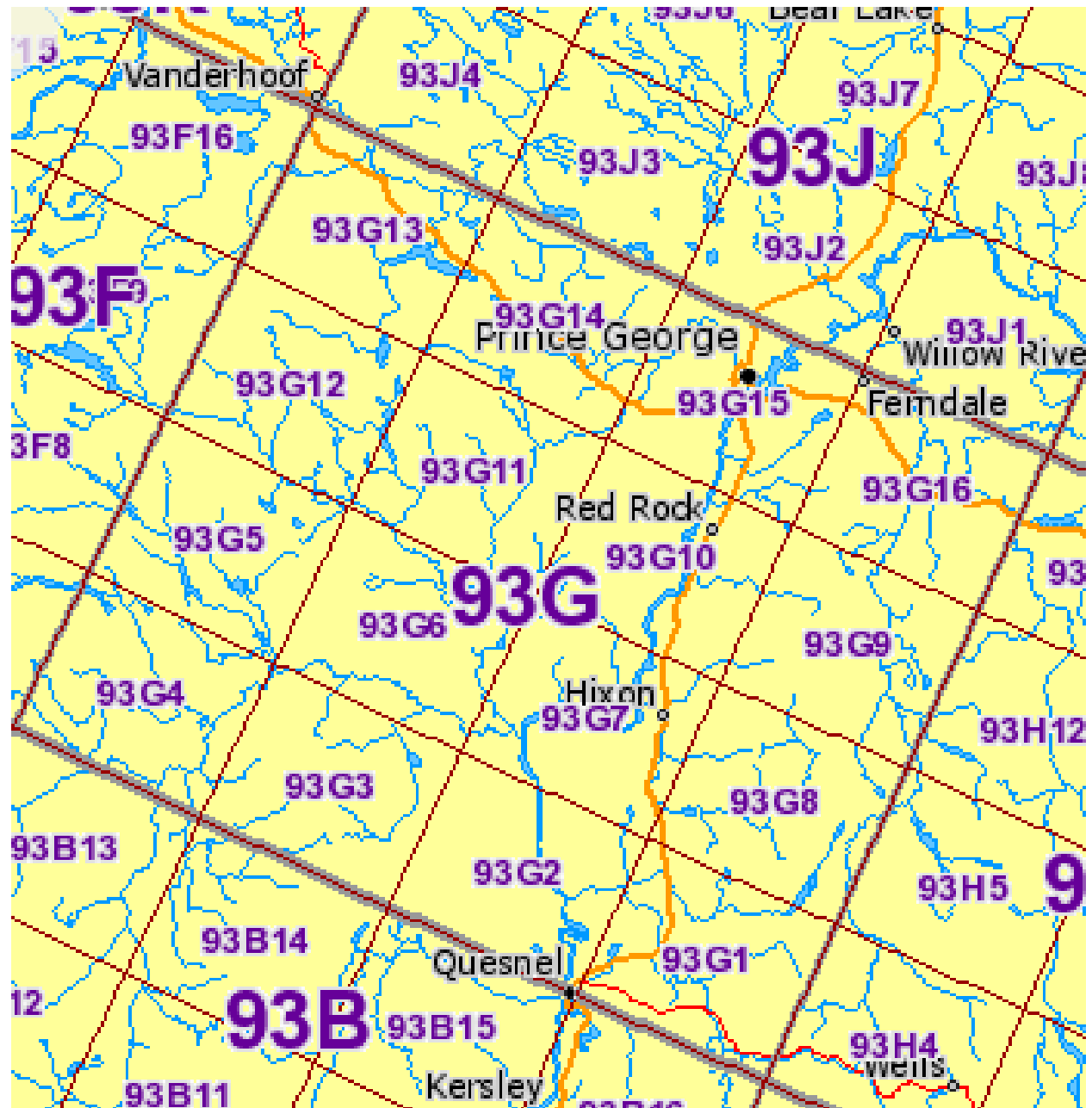
d. 1:50,000
large-scale

BC: 1168 maps

Canada: 13,377

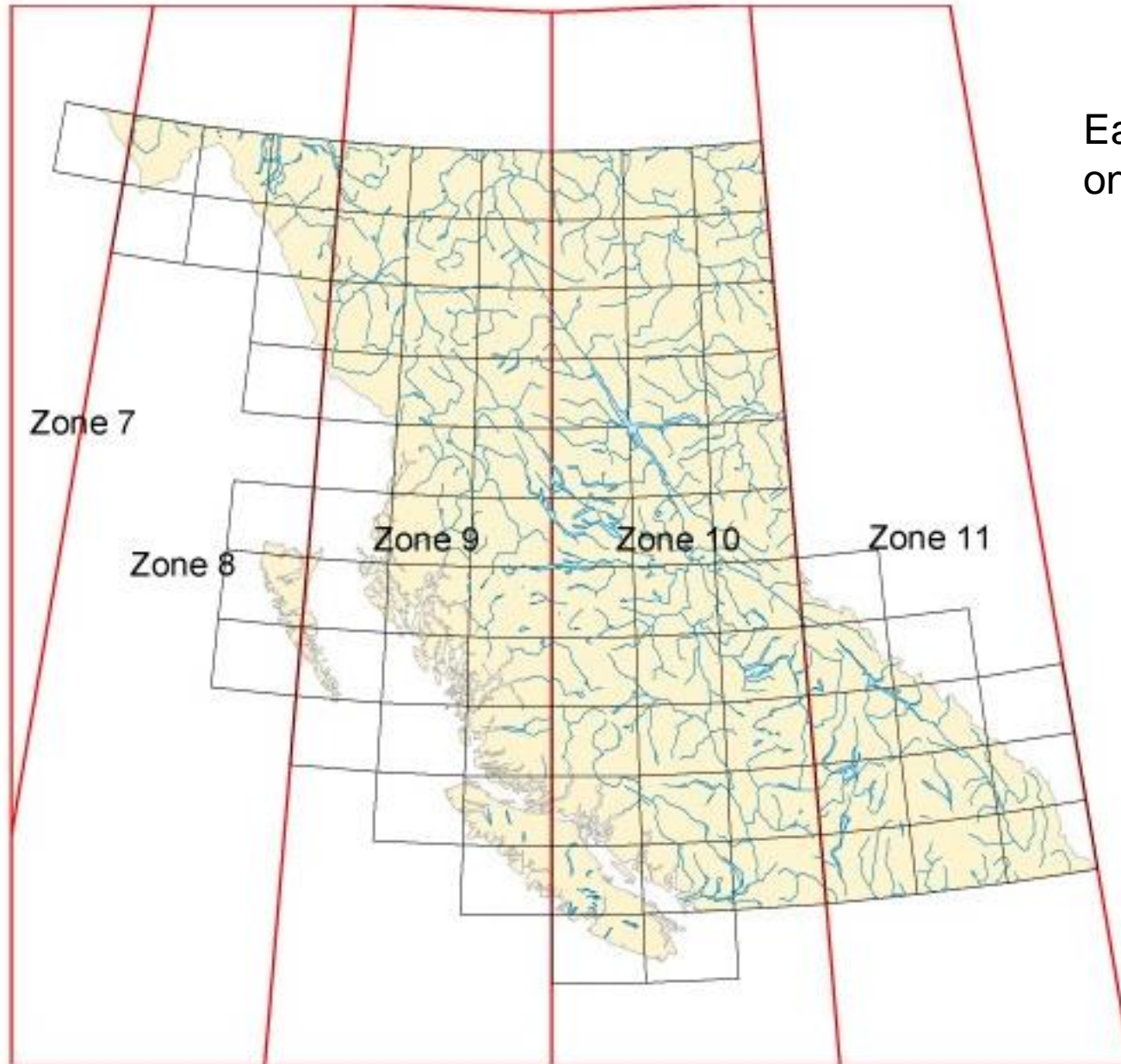
Digital 2005

Canada Completed
2012



1:50,000 corresponds to 1cm = 0.5 km

BC: UTM zones and 1:250,000 (and 1:50,000) topographic maps



Each map fits within one UTM zone

NTS (National Topographic System) -> National Topographic Database (NTDB)

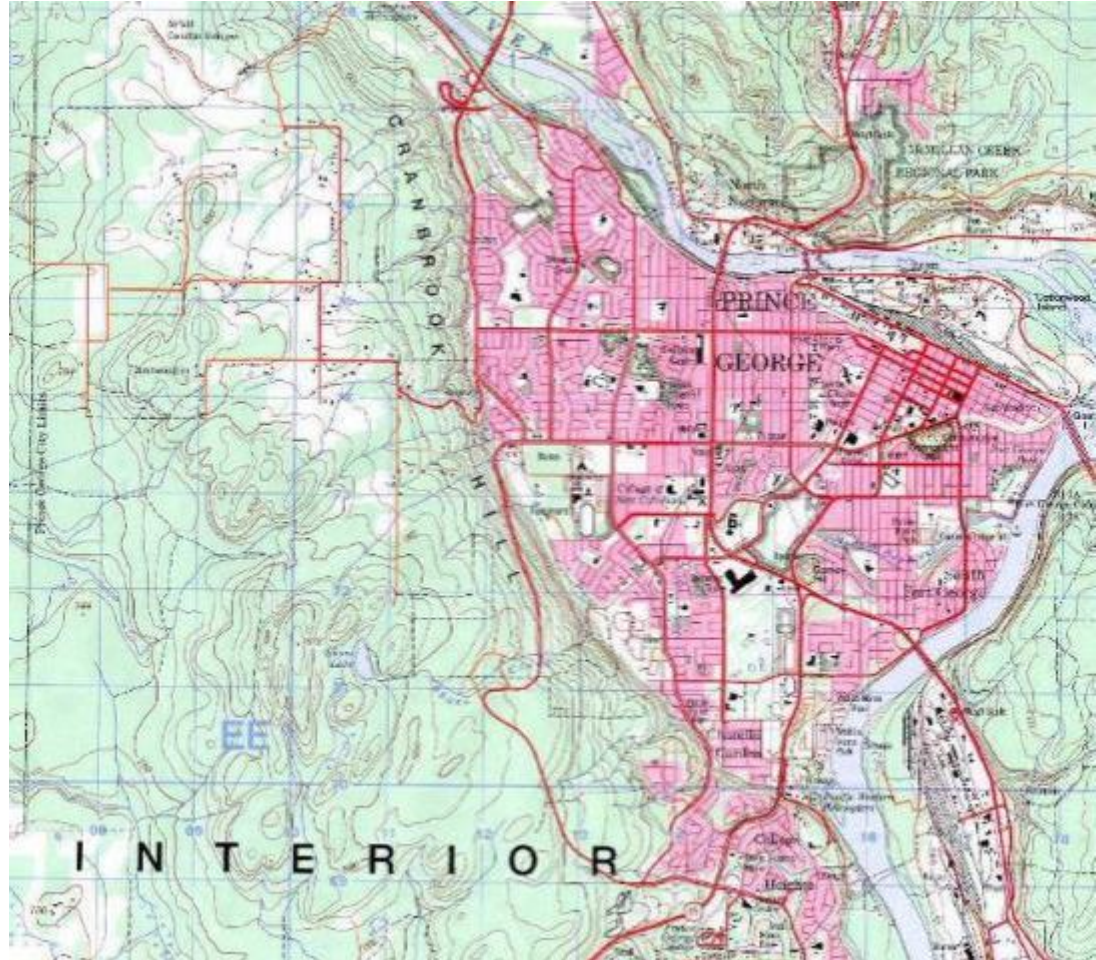
All Canada 13,377 maps:

1:50,000 Prince George: sheet 93G15

Printed NTS maps (Library)

Scanned map (pdf) – Raster image - ‘print-ready’ or georeferenced e.g. for GPS / background- Canada Opendata

Digital layers online for mapping – every point, line, area feature manually digitised
(but not all current)
e.g. only roads are updated



The promise of digital mapping (since 1975)

- **Data for everyone much are now free since ~2010**

... but not always, varies by country / province / scale / data type

- **‘Seamless’ databasepost-2015: map sheet /Area of Interest (AOI)**

- **Frequent updating municipal, not provincial / federal**

- **Errors of interpretation and change ... always with us**

Federal: NTS (analogue maps) -> NTDB (digital) - medium to large scale

1:50,000 and 1:250,000

Since spring 2007 freely downloadable from geogratis.cgdi.gc.ca

August 2017: <https://maps.canada.ca/czs/index-en.html>

by map sheet or Area of Interest (AOI)

[Natural Resources Canada](#) > [Earth Sciences Sector](#) > GeoGratis

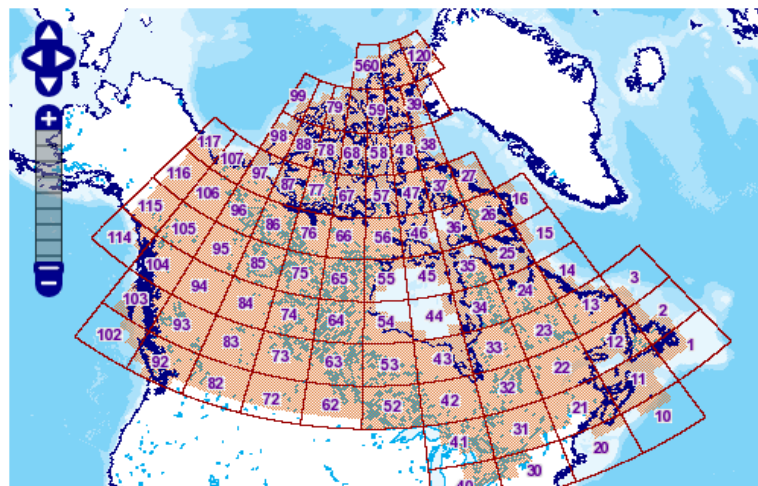
GeoGratis
GeoGratis Home
Site Map
GeoGratis Help
Register to users list
Licence Agreement
Collections
All Collections
Search by Keywords
Search by Product
Services
Toporama WMS
Related Links
Download Directory
FAQ
Geomatic 101
Glossary & Acronyms
Other Portals
GeoBase
GeoConnections
GeoConnections Discovery Portal

National Topographic Data Base (NTDB), Canada

The National Topographic Data Base (NTDB) comprises digital vector data sets that cover the entire Canadian landmass. Geomatics Canada has digitized and structured thousands of topographic maps, cr... [\[More details\]](#) [\[Documentation\]](#) [\[Data Discrepancies\]](#)

Access the [FTP download directory](#) in order to quickly download a large amount of data.

Search Datasets by Spatial Extents [How to navigate?](#)



Digital (base) map data

- 1975-85 Only printed maps (+ a wee bit from CIA)
- 1985-95 Data generated but not yet available
- 1995-2005 Data there, but not always affordable
- 2005 -> Online map viewers e.g. Google Earth
- 2015 -> More data freely downloadable
- 2020 -> Online 'in the cloud' data portals

How has all this been assembled ... ?

Spatial digital data: location and attributes

Map layers encode two different types of information:

a. Spatial location (where is it ?)

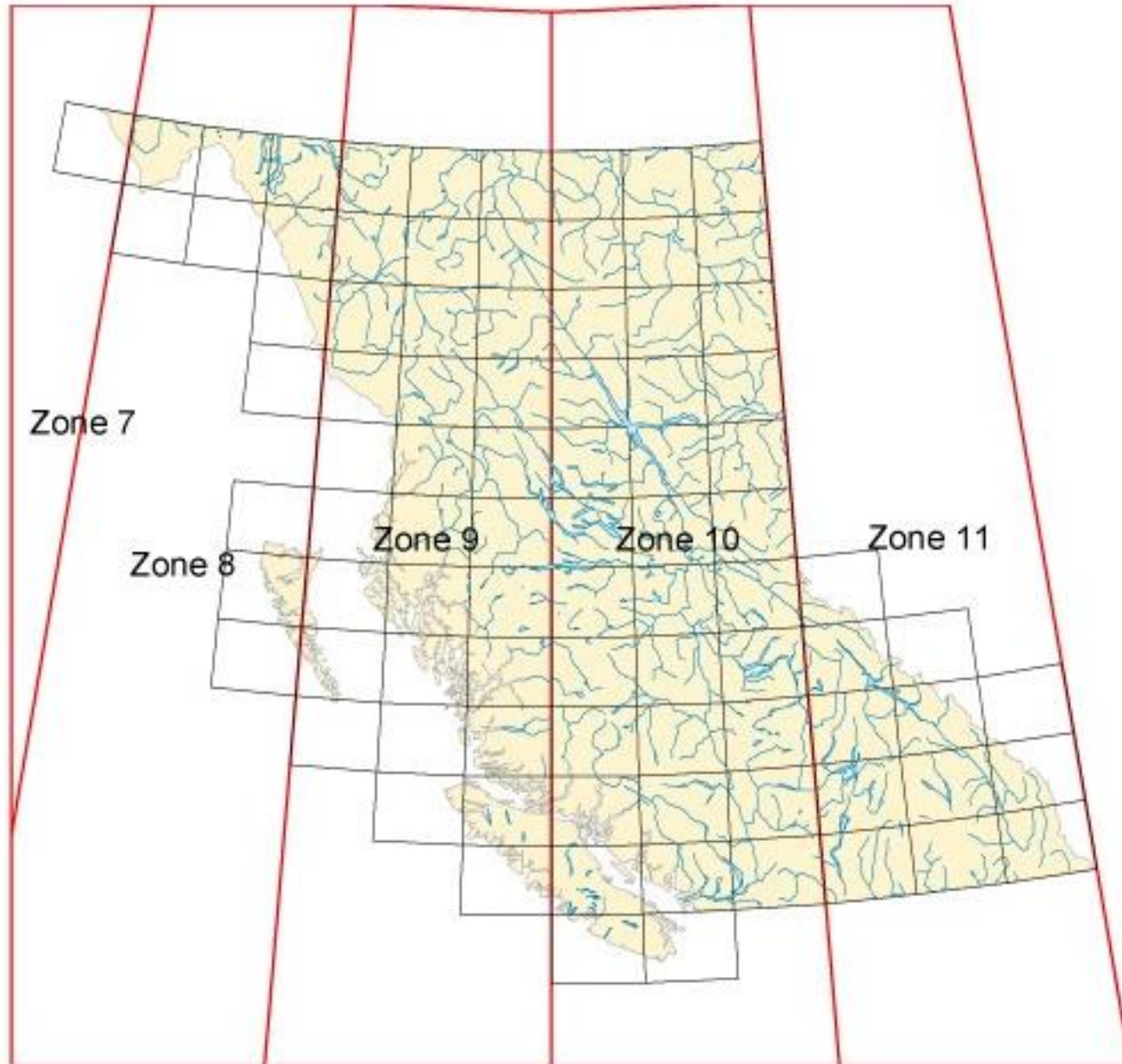
b. Attributes (what is it ?)

.....
In GIS software, these data are stored in a single 'layer'
but in multiple files - *this differs from non-GIS software*

e.g. Roads as a 'shapefile' (post 2000)

<i>roads.shp</i> <i>x-y locations</i>	<i>roads.dbf</i> <i>types of road</i>	<i>roads.shx</i> <i>index-link file</i>
<i>contours.shp</i> <i>x-y locations</i>	<i>contours.dbf</i> <i>heights</i>	<i>contours.shx</i> <i>index-link file</i>
<i>points.shp</i> <i>x-y locations</i>	<i>points.dbf</i> <i>cabins, airport, viewpoint</i>	<i>points.shx</i> <i>index-link file</i>

BC: UTM zones and 1:250,000 (and 1:50,000) topographic maps



Each map fits within one UTM zone

What if the digital data area crosses multiple UTM zones: Eastings would switch from ~700,000 at the west edge of one zone to ~300,000 at the east edge of the next.

We need a different system for mapping a province like BC

BC Albers coordinate system



BC uses UTM for local areas
e.g. zone 10 for PG

But it uses 'BC Albers' for the
whole province

As with UTM, also in metres

Unlike UTM, eastings and
northings are often both 7-digit,
both 6-digit ... or one of each.

Developed by provincial ministry
Geomaticians in Smithers, BC

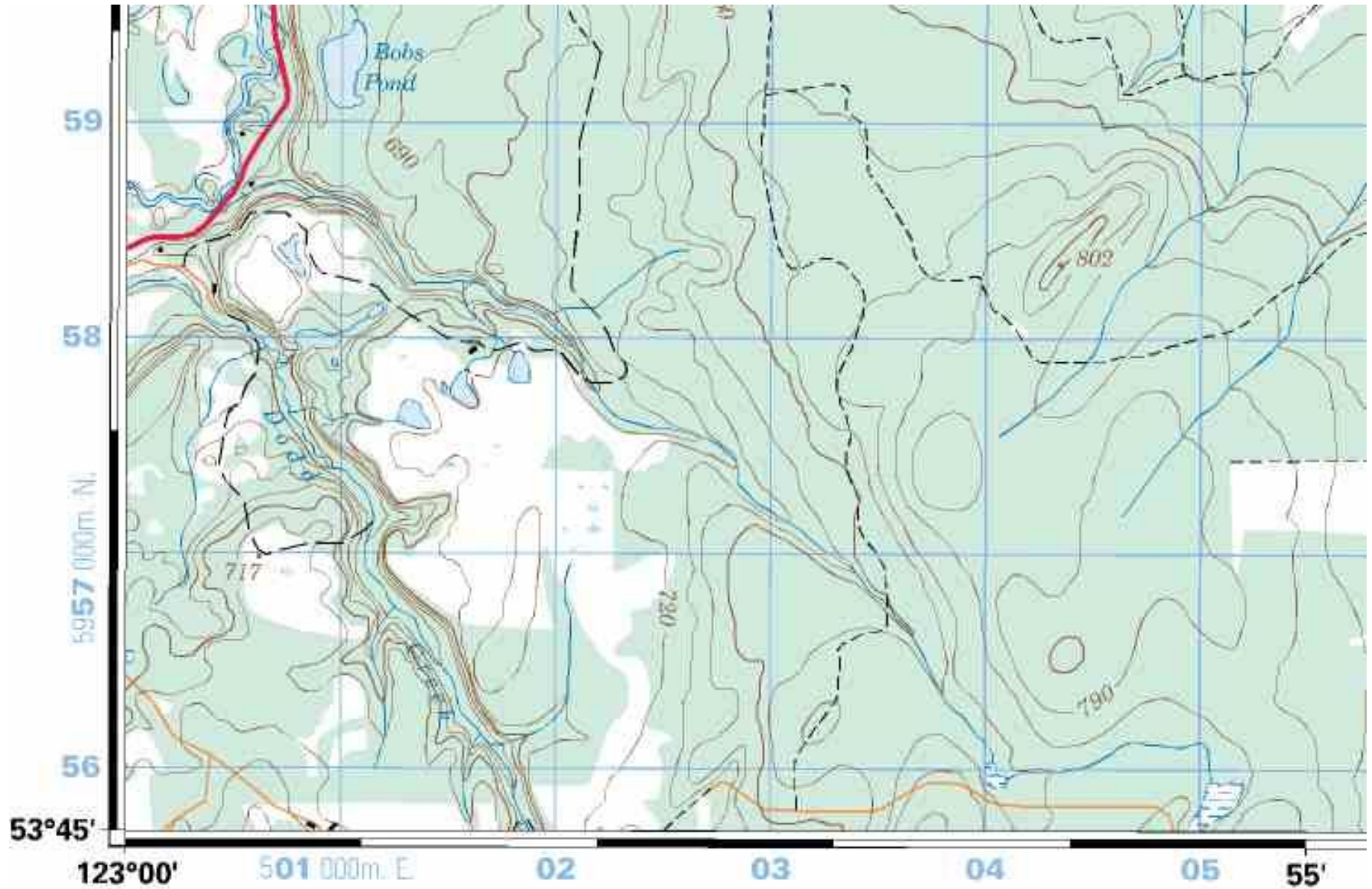
Southernmost point = ~ 48°S

British Columbia Albers Equal Area Conic
Central meridian: -126.0 Degrees West longitude
Latitude of projection origin: 45.0 Degrees North latitude



126W = 1,000,000 Eastings
45N = 0 Northings

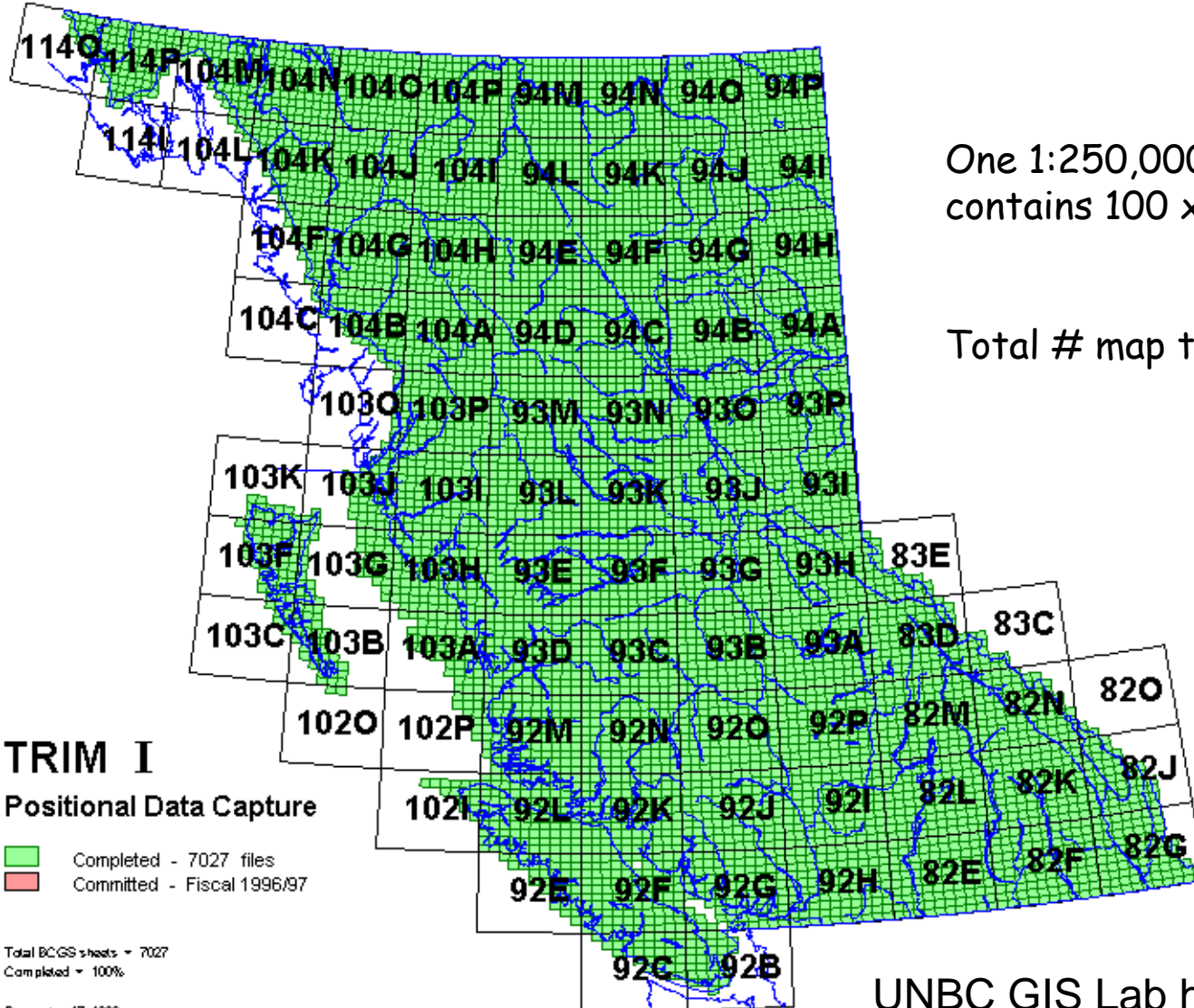
UTM : Eastings are 6-digit, Northings are 7-digit (in Canada)



Blue grid squares in this map are 1000m = 1km

BC has its own provincial data at 1:20,000

TERRAIN RESOURCE INFORMATION MANAGEMENT (TRIM)

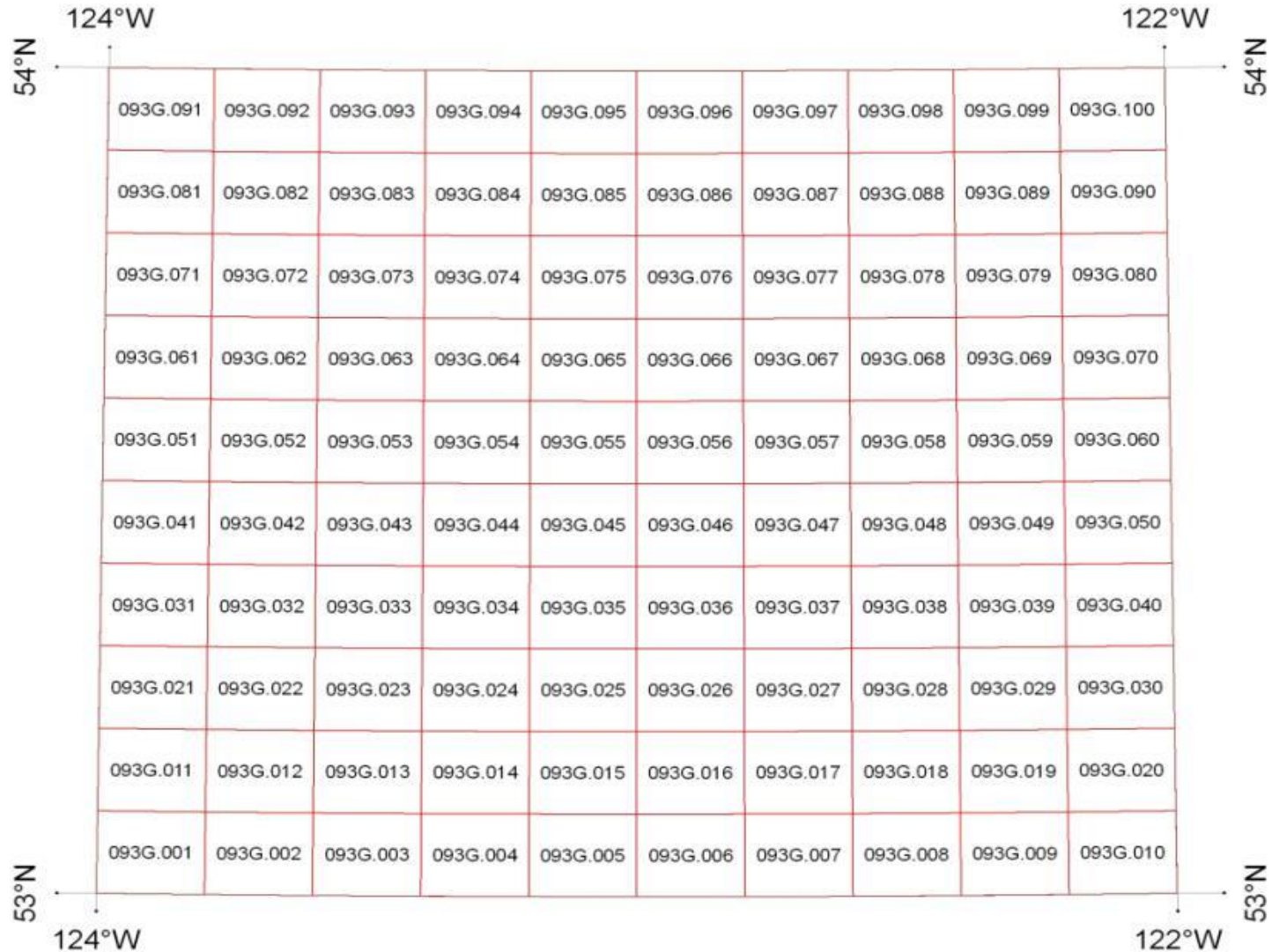


One 1:250,000 map sheet contains 100 x 1:20,000

Total # map tiles = 7027

UNBC GIS Lab has all these

Each 1:20 000 TRIM sheet is 6' latitude by 12' longitude.



Created onscreen from digital photogrammetry (not digitized from maps)
More 'current' and more detailed : 1:20,000 (from 1980s and 1990s)

TRIM BC 1:20,000 maps no longer available as printed maps



But you can pay \$38 for a T-shirt

<http://blog.oplopanax.ca/2013/06/bc-trim-maps-are-just-pdf/>

BC geographic data viewer 'imapBC'

BRITISH COLUMBIA | iMapBC

Navigation Maps & Data Sources Reports & Printing Markup Analysis Help

Full Extent Zoom In Zoom Out Pan Previous Extent Next Extent

Albers Coordinate Lat/Long UTM Feature Location District Lot

New Plot Clear All

Clicked Coordinates

Lat: 54.7229
Lon: -126.1876 Lat/Lon (DD)

Welcome to iMapBC

A window to spatial information in British Columbia

help you get started, use the "Add Provincial Layers" tool on the toolbar, under the "Maps & Data Sources" tab (or click the "I want to..." drop-down and use the "Add Provincial Layers") in order to choose the layers you wish to view on the map.

You can navigate to your area of interest by using the tools found under the Navigation tab. "Zoom In" allows you to drag a box on the map itself. Alternatively, the mouse wheel allows you to step zoom in and out. You may also right-click on the map to see additional tools.

Additional help and information can be obtained by contacting the Service Desk.

Hours of Operation: 8:00 am to 4:30 pm (PST)
Monday to Friday
Please leave a voice message if you are calling after hours

Phone (within Victoria): (250) 952-6801
Call Free (within BC): 1-866-952-6801

<https://maps.gov.bc.ca/ess/hm/imap4m/>

Summary: BC mapping coordinates

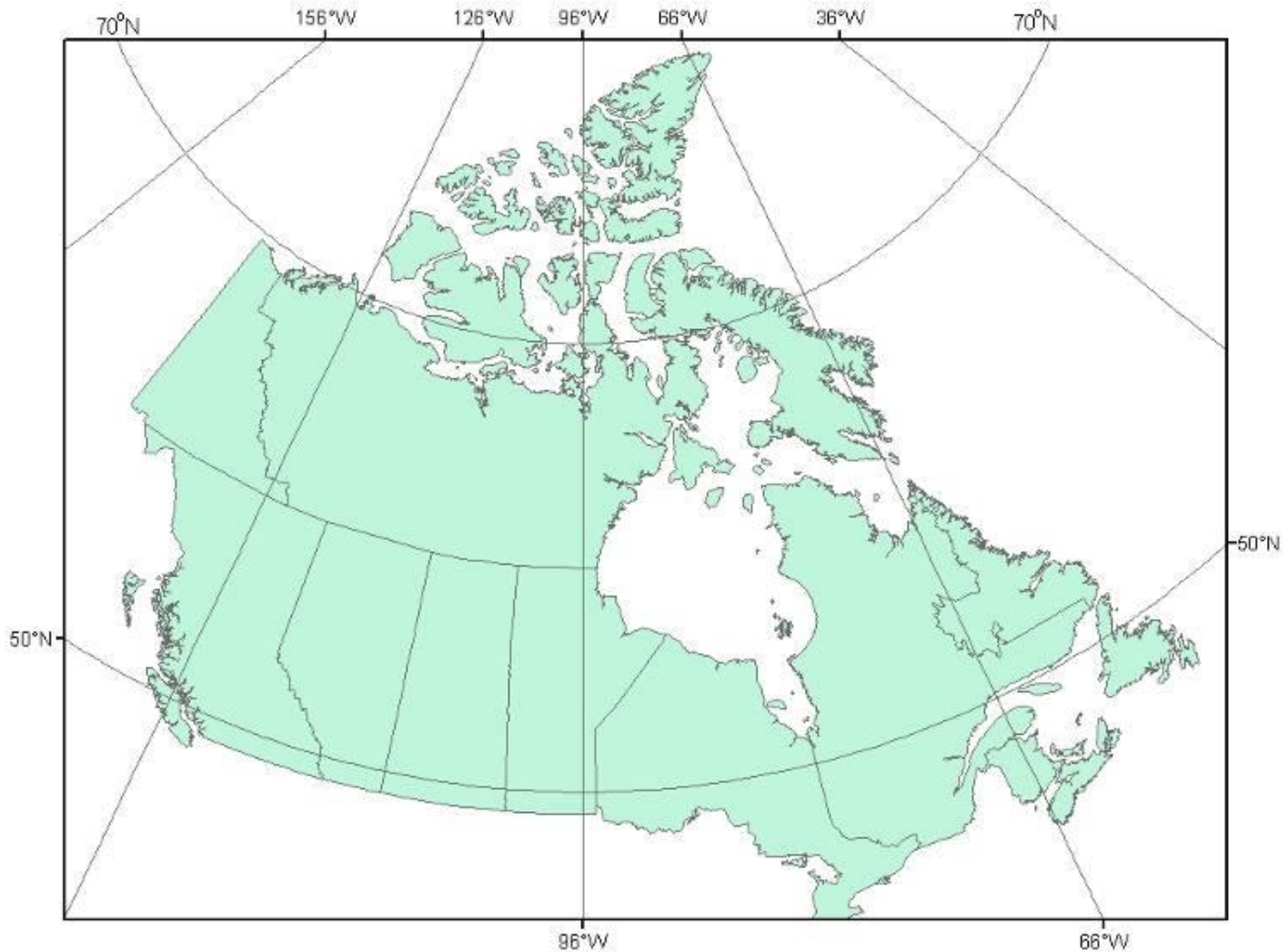
Could be one of:

1. Geographic - lat. / long. - global reference
2. UTM - zones 7-11 - local / regional mapping
3. BC Albers - BC provincial data
4. Canada Albers - Federal data

Why is it important - because we 'import' data from different sources .. and they need to line up

Canada Albers Equal Area Conic

Central Meridian: -96 Latitude Of Origin: 40



Download NTDB data using Geographic, Albers, UTM ... or Web Mercator (2019)

Municipal data - not always accessible (1:5,000)

PG data - since 2011: <https://data-cityofpg.opendata.arcgis.com/>



From digital aerial photography – downloadable from PG city site or UNBC GIS Lab

Canada summary

Municipal data: sometimes available (check around)

Provincial 1:20,000 mapping (Bold = free download)

BC, AB, MB, ON (south = 50°N), **QC** (south), **NS, NB, PEI**

NTDB mapping only (1:50,000)

SK, NL, ON (north), **QC** (north) **NT, NU, YT** *

- Yukon Geomatics: <http://www.geomaticsyukon.ca/>
- Canada: <http://canadiangis.com/data.php>

Other countries: highly variable - free download, high cost, military only

User generated data (by digitizing, GPS etc.): <http://www.openstreetmap.org>



<http://www.openstreetmap.org/#map=7/47.891/5.894>

Home Bookmarks Most Visited SeaMonkey mozilla.org mozillaZine mozdev.org

Steve Coast, 2004



OpenStreetMap
The Free Wiki World Map

Search



examples: 'Alkmaar', 'Regent Street, Cambridge', 'CB2 5AQ', or post offices near Lünen' more examples... Where am I?

OpenStreetMap is a free worldwide map, created by people like you.

The data is free to download and use under its open license. Create a user account to improve the map.

help

[Help Centre](#)
[Documentation](#)

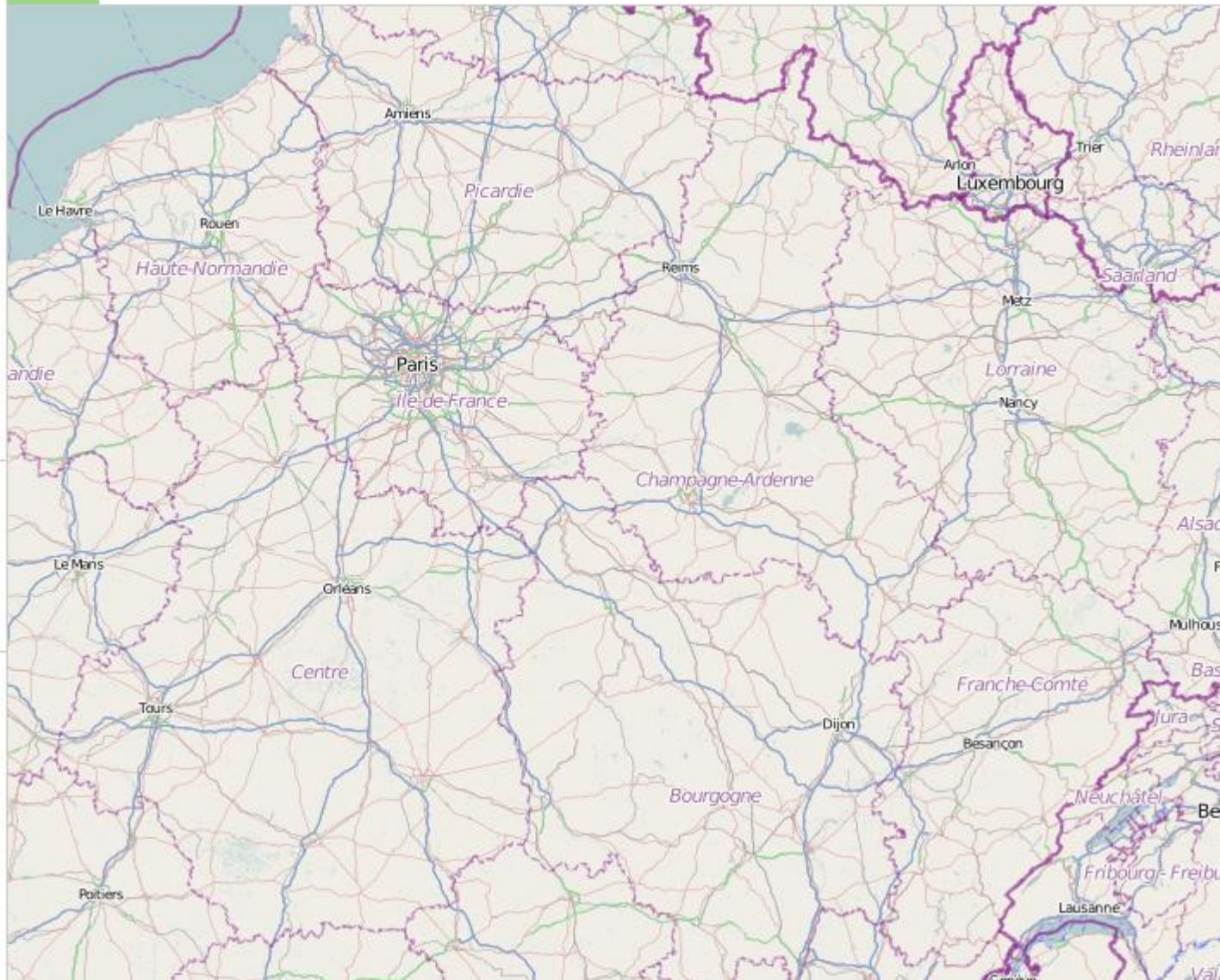
Community

[Community Blogs](#)
[Foundation](#)
[User Diaries](#)

Data

[Copyright & License](#)
[Export Data](#)

View Edit History



New millennium map data creation:

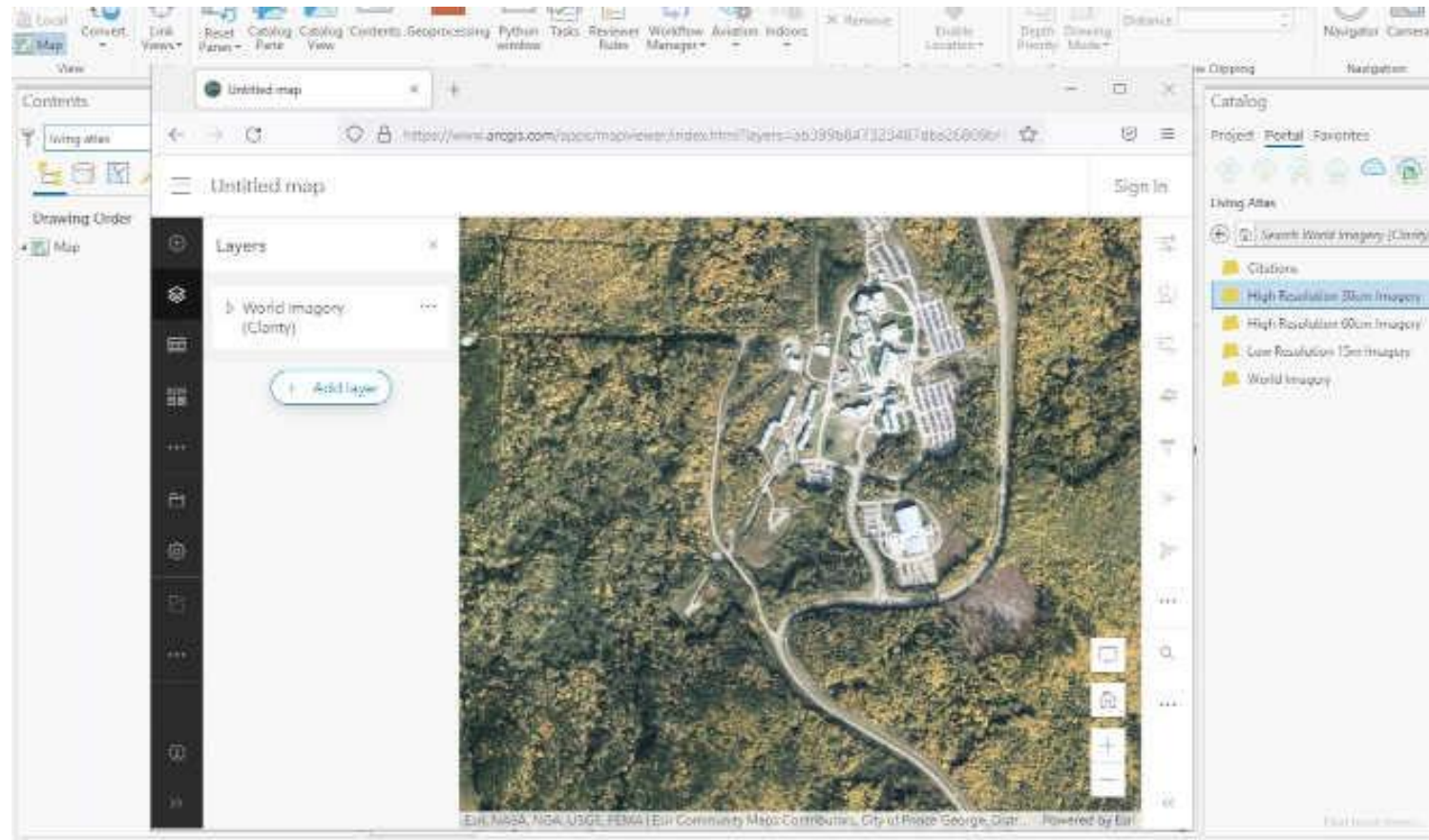
- Digital aerial photography
- Satellite imagery (remote sensing)
- Global Positioning Systems (GPS)
- UAVs (drones)
- LiDAR
- Online sources e.g. from GIS analysis

Data layers from ArcGIS online

e.g. living atlas of the world

Via the Portal

<https://livingatlas.arcgis.com>



Many thematic layers – see thematic lectures

Canada census data: <https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E>