CITY OF GREATER SUDBURY's MTM Zone81 Map Projection

Information being supplied is in CGS's (new) custom Modified Transverse Mercator (MTM) map projection known as Zone81. Zone81 is a modernized version of CGS's previous "Zone53" in which its design was based.

The information below is neither comprehensive nor instruction in any regards to map projection(s). It is provided with the assumption that users posses adequate knowledge of Map Projections.

Zone81's Parameter Determination Used The Following:

Representative CGS GRS80 Ellipsoid Height: <u>224m</u>
> Approximately CGVD28 Orthometric Elevation: 260m (elevation that the Zone53 Plane is located)

Representative CGS GRS80 Ellipsoid Radius: <u>6369154.153m</u>

Zone81 Parameters

Central Meridian:	<u>81W</u> (aka -81)
Origin Latitude:	<u>0</u>
False Northing:	<u>-4,302,242.022</u> (this is a negative value)
False Easting:	<u>150,000</u>
Scale Factor (at CM):	<u>1.00003517</u>
Units:	<u>Meters</u>

Zone81 Features:

<u>Like its predecessor (Zone53);</u>
> is optimized for both CGS's geography and topography
> *may* be used as a Local System with minimal error (<10ppm in most CGS communities)
> may be converted to/from UTM accurately with simple math and pocket calculator
> has distinguishable coordinates that uniquely identifies coordinates as being Zone81

<u>Unique to Zone81 (as compared to Zone53);</u>
Northing Coordinates start with "**8**" and Easting Coordinates start with "**1**"
> …to better distinguish Northings from Eastings adding clarity and remove ambiguity

Coordinates (in CGS) remain a constant number of significant digits
Scale Factor has only 8 decimal places (where Zone53's has 11)
Optimized for the NAD83-CSRS Datum (GRS80 Ellipsoid) and is more compatible with GPS

Zone81 is <u>not</u> intended to be used with any other datum (i.e., NAD27 or NAD83-Original).

*Notes:

- Map Projections are from the ellipsoid;
  - Elevation Factors must be determined with Ellipsoid Heights (not orthometric elevations)
- Elevation Factor (only): For lower orders of <u>2-dimensional</u> (horizontal) accuracy in/for CGS;
  - An average geoidal seperation of 36m *may* be applied (i.e., orthometric-36m=ellipsoidal)

- Zone81's Plane is (**already**) located at (or scaled to) a GRS80 Ellipsoidal Height of 224m;
    - 224m must be subtracted from your ellipsoid height when determining elevation factors
        - You need only apply the factor for the amount your height differs from Zone81's
        - Use caution to apply the correction the right way (are you above or below 224m)
- NRCan's HT2 geoid model is currently recommended as having enough accuracy to reconcile the effects of vertical on determined horizontal coordinates for *most* purposes.
- Testing of MTM Zone81 Grid Coordinates in all CGS communities has determined:
    - Typically; Grid Distances = Ground Distances better than 10ppm (<10mm error per 1km)
        - This is not a guarantee. Users are responsible to perform their own verification.
- Most lower orders of work and/or geographically small projects *may* use Zone81 coordinates as a "Local Coordinate System" with Scale Factor = 1.0 (grid = ground)
- The user accepts responsibility for all errors resulting from ignoring combined elevation and scale (grid) factors (i.e., equating Zone81 grid distances to ground), and it is recommended that potential errors be examined for the project area and considered against the project's requirements, standards and specifications prior to making a determination of suitability of this practice.

*WARNING/CAUTION: When projects are of significantly large area and/or cover long distances, in locations of significant relief, areas of low elevation distant from the Central Meridian, areas of high elevation near the Central Meridian, or when accuracy requirements are high and/or true accuracy must be ascertained, it is recommended that Zone81 be used as a proper projection (like any other - i.e., UTM) with full/proper use of its projection parameters in combination with information in regards to height. If/when Zone81 is defined and used correctly with parameters above; there is **no error** due to its use.

MTM Zone81 2D-Coordinate Conversion to/from UTM Zone-17: (same datum)

Where:
MTM Zone81 Scale Factor / UTM Scale Factor = Conversion Factor
Then Conversion Factor = 1.00003517 / 0.9996 = <u>1.000435344</u>

Conversion from UTM to Zone81:

Northing
((Northing-5,150,000) x 1.000435344) + 850,000

Easting
((Easting-500,000) x 1.000435344) + 150,000

Conversion from Zone81 to UTM:

Northing
((Northing-850,000) / 1.000435344) + 5,150,000

Easting
((Easting-150,000) / 1.000435344) + 500,000