



New Brunswick Control Monument Database Information

Explanation of fields
and
Glossary of terms

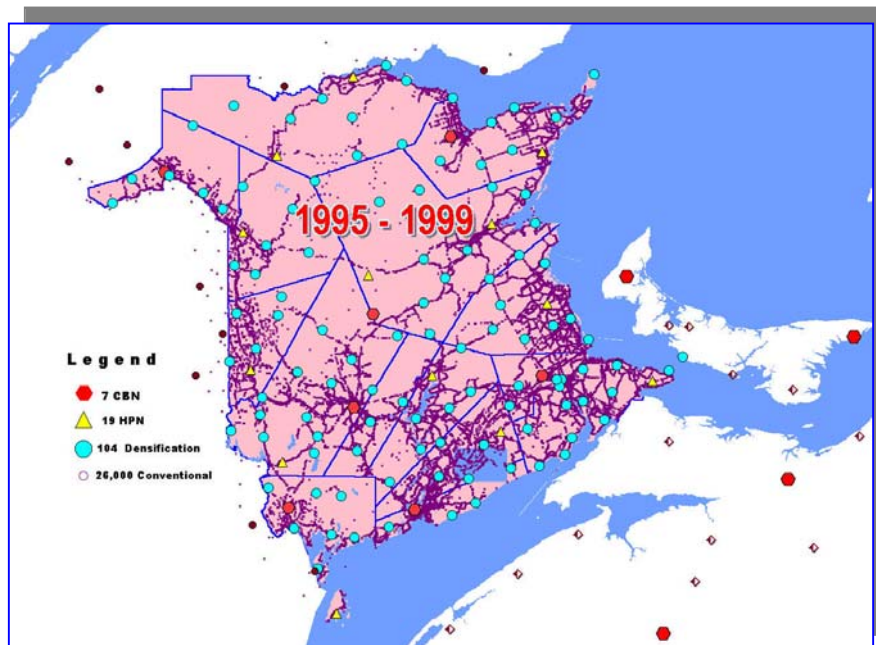
Historia

Survey control network:

Since the late 50s New Brunswick has built a very dense survey control network on the ground. As many as 26,000 stations were established over 40 years and will be referred as *the old or conventional network* in this document. In December of 1996 the physical field maintenance of this network was abandoned and a GPS based network of approximately 135 stations replaced the conventional network. This new network also became the infrastructure for a new reference system and will be identified as the *New Brunswick High Precision Network (NBHPN)*.

In 1999 Service New Brunswick amended the Surveys Act to change the reference system from the former Average Terrestrial System of 1977 (ATS77) for NAD83 (CSRS) which is a specific realization of the North American Datum of 1983 (NAD83). The **C**anadian **S**patial **R**eference **S**ystem (CSRS) is a national standard for georeferencing across the country. The NBHPN is an integral part and further subset of this reference system. Natural Resources Canada and more particularly the Geodetic Survey Division (GSD) has the primary role to maintain the Canadian Spatial Reference System, ensure its compatibility with current positioning technology, and to facilitate efficient access to it. www.geod.nrcan.gc.ca. Similarly all provinces have further densified this network into High Precision Networks and fully maintain these networks in each jurisdiction.

Even though SNB is not doing the physical maintenance of the conventional network, we still have the responsibility to maintain the historical data produced for this network. For this reason the database contains all the values that were published for each of these monuments over the years.



Main search page



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NB Survey Control Network - Search

NBSCN Search | **Monument Numbers** | **Rectangular Area** | **Radius** | **View Map Index** | **High Precision Network**

Please choose a search option from the list below...

-  **Monument Numbers**
Provides the capability to retrieve information on monuments by entering monument numbers.
-  **Rectangular Area**
Provides the capability to retrieve information on one or more monuments by defining a rectangular search area.
-  **Radius**
Provides the capability to retrieve info of one or more monuments by using a central coordinate and searching using a certain radius in (KM).
-  **View Map Index**
1:50,000 NTS map index for the conventional network.
-  **NB High Precision Network**
This page will provide interactive capability to retrieve information on a NB HIGH Precision monument simply by clicking on the symbol on map.
-  **Downloads**
Download all database information in a zipped comma delimited format file ([nbcontrol.zip](#)-1.9mb).
-  Download NBHPN full size Map Index and enlargements in GIF format ([NBMaps.zip](#) -595K).
-  Download User Guide with Glossary (PDF) ([UserGuide.pdf](#)~1 mb).

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The main search page gives various searching capabilities. If you need the data to plot the monuments on a GIS or other graphical package, download the NBCONTROL.ZIP file, which contains, in a text comma delimited format, all the data in the database.

Searching Capabilities

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NB Survey Control Network - Search

NBSCN Search Monument Numbers Rectangular Area Radius View Map Index High Precision Network

Enter Monument Number:

Add or Remove

Search

Current Search List:
5234
941002

VIEW Map Index

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Option 1:
Entering a single number or building a list can search the database. Points can be added or removed from the list before submission.

Option 2:
Entering two corners of a rectangle to select all monuments within these limits can perform a search.

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NB Survey Control Network - Search

NBSCN Search Monument Numbers Rectangular Area Radius View Map Index High Precision Network

NB Stereographic Coordinates - NAD83 (CSRS):

First Coordinate		Second Coordinate	
Easting:	<input type="text" value="2450275"/> m	Easting:	<input type="text" value="2400200"/> m
Northing:	<input type="text" value="7528256"/> m	Northing:	<input type="text" value="7530568"/> m

Search

Geodetic Coordinates (Longitude/Latitude) - NAD83(CSRS):

First Coordinate		Second Coordinate	
Latitude:	<input type="text" value="46"/> ° <input type="text" value="32"/> ' <input type="text" value="26"/> "	Latitude:	<input type="text" value="46"/> ° <input type="text" value="56"/> ' <input type="text" value="10"/> "
Longitude:	<input type="text" value="66"/> ° <input type="text" value="30"/> ' <input type="text" value="12"/> "	Longitude:	<input type="text" value="67"/> ° <input type="text" value="22"/> ' <input type="text" value="00"/> "

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Option 3:
The simplest is by a radius search. Give an approximate coordinate and search for all points within this radius. The radius has to be in kilometer and **cannot be greater than 10 km.**

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NB Survey Control Network - Search

NBSCN Search Monument Numbers Rectangular Area Radius View Map Index High Precision Network

NB Stereographic Coordinates - NAD83 (CSRS):

Coordinate of Center

Easting: m

Northing: m

Radius: km

Search

Geodetic Coordinates (Longitude/Latitude) - NAD83(CSRS):

Coordinate of Center

Latitude: ° ' "

Longitude: ° ' "

Radius: km

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Maps for references

Choose an Inset

- ALMA - Alma - 118
- ALMA - Alma - 119
- BA10 - Bathurst City - 16
- BA24 - Bathurst - 16
- CAMP - Campbellton - 6
- CHAT - Chatham - 37
- CHIP - Chipman - 83
- DALH - Dalhousie - 2
- EDMN - Edmundston - 21
- FTON - Fredericton - 98

Enlargements (Insets) for Urban areas

Map Legend:

- BLAZEBLAST
- EDMUNSTON
- FREDERICTON
- SANT JUVIN
- MONCTON

Gives access to PDF images of the maps and insets.

Caution: Most of the maps are in the 0.6 mb so it may take several minutes to download on a slow internet connection. Available on CD-ROM from the SNB web site.

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NB Survey Control Network - Search

NBSCN Search Monument Rectangular Area Radius View Map Index High Precision Network

Map Legend

- Canadian Base Network (CBN)
- Canadian Base Network (CBN) - BaseNet
- High Precision Pillar
- High Precision Densification
- Densification of Integrated Survey Area
- See Enlargements

Click on an area of interest on the map for an enlargement

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NB Survey Control Network - Search

Main Search Page Monument Numbers Rectangular Area Radius View Map Index High Precision Network

Return to Index Map

Map Legend

- Canadian Base Network (CBN)
- Canadian Base Network (CBN) - BaseNet
- High Precision Pillar
- High Precision Densification
- Densification of Integrated Survey Area
- See Enlargements

Click on symbol to retrieve information on NBHPN monument

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Interactive access by clicking on a symbol or number for the **NBHPN ONLY**

Selection List

Once you have made a selection, e.g. a coordinate and all points within 5 km from it, a selection list of multiple pages will appear. Click on any of the little check boxes to view details on the ones checked. The selected stations have to be viewed before you can proceed to another page because the program will not remember the selections from page to page. A warning message as seen in the grey box below will appear whenever you try to move to/from another page if you have checkmarks in the selection boxes.



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NB Survey Control Network - Search

BACK		Results					
#	Monument	Classification	NB Stereographic - NAD83 (CSRS)		Geodetic - NAD83 (CSRS)		
			East (m)	North (m)	Latitude	Longitude	
<input type="checkbox"/>	1	1587	D1	2497943.873	7494848.669	46° 27' 13.1453"	66° 31' 36.3546"
<input type="checkbox"/>	2	1588	D1	2501426.636	7501594.511	46° 30' 51.6380"	66° 28' 53.0704"
<input type="checkbox"/>	3	1589	D1	2501476.295	7501140.525	46° 30' 36.9338"	66° 28' 50.7458"
<input type="checkbox"/>	4	1591	D1	2509975.642	7498068.858	46° 28' 57.1879"	66° 22' 12.2723"
<input type="checkbox"/>	5	13501	D1	2508403.264	7497000.208	46° 28' 22.6532"	66° 23' 26.0656"
<input type="checkbox"/>	6	13502	D1	2507666.272	7496347.091	46° 28' 01.5314"	66° 24' 00.6535"
<input type="checkbox"/>	7	13503	D1	2507276.045	7496026.051	46° 27' 51.1489"	66° 24' 18.9629"
<input type="checkbox"/>	8	13504	D1	2507045.334	7495814.673	46° 27' 44.3115"	66° 24' 29.7881"
<input type="checkbox"/>	9	13505	D1	2506643.737	7495338.906	46° 27' 28.9168"	66° 24' 48.6352"
<input type="checkbox"/>	10	13506	D1	2506152.658	7495104.301	46° 27' 21.3351"	66° 25' 11.6611"
<input type="checkbox"/>	11	13507	D1	2505971.144	7494724.030	46° 27' 09.0246"	66° 25' 20.1851"
<input type="checkbox"/>	12	13508	D1	2505886.231	7494488.371	46° 27' 01.3946"	66° 25' 24.1750"
<input type="checkbox"/>	13	13509	D1	2505859.663	7493738.570	46° 26' 37.1105"	66° 25' 25.4538"
<input type="checkbox"/>	14	13510	D1	2505480.963	7493292.495	46° 26' 22.6742"	66° 25' 43.2161"
<input type="checkbox"/>	15	13511	D1	2503554.716	7491486.312	46° 25' 24.2208"	66° 27' 13.5105"

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Microsoft Internet Explorer

Current selection must be viewed and/or printed before proceeding to next page.
 To return to current selection click 'Cancel' and choose "Get records"
 To continue and ignore current selection click 'OK'

Details for all monuments

Navigation :

Back – Will go back to previous page
NBSCN – Will go to the main search screen

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Description of terms

NB Survey Control Network

BACK NBSCN		Monument Details		HELP	
NAD83 (CSRS) Adjusted					
Station Number:	941013	Classification:	A2		
N.B. Stereographic Projection			Geodetic Coordinates		
Easting:	0.000	Latitude (N):	0		
Northing:	0.000	Longitude (W):	0		
Elevation:	336.697				
Elevation Code:	2				
Point Scale Factor:	0.999917				
Meridian Convergence:	0				
Gravity Field Components: Based on the HT1_01 model					
Geoid/Ellipsoid Separation: -20.988 m					
General					
Map Index (NB#): 44	INSET:	NOTES: HPN			
Residuals					
Difference in Easting: 0.169 m	Difference in Northing: 0.018 m	Vector: 0.170 m			
Average Terrestrial 77 (ATS77)					
N.B. Stereographic Projection		General			
Easting: 297689.440 m	Date Published: 1994/06/07	Quality: PUB	Status:		
Northing: 828653.140 m	Geoid/Ellipsoid Separation: -22.100 m (Based on the LRS model)				
New Brunswick High Precision Network Station (NBHPN)					
Reference - NAD83(CSRS)					
N.B. Stereographic Projection			Geodetic Coordinates		
Easting:	2497692.180 m	Latitude:	46° 45' 28.0998"		
Northing:	7528656.555 m	Longitude:	66° 31' 48.7559"		
Point Scale Factor:	0.999917				
Elevation Factor:	0.999947				
Meridian Convergence:	-0 1 19.06				
Gravity Field Components			Heights		
Geoid Model:	HT1_01	Ellipsoidal:	315.709 m		
N/S Deflection:	-3.660 seconds	Orthometric:	336.697 m		
EW Deflection:	-3.780 seconds	Leveled Height:	336.730 m		
Geoid/Ellipsoid Separation:	-20.988 m	Leveling Order:	2		
General			Inspection		
Published:	4/1/1999	Name:	Renous		
Owner:	SNB	Inspected:	6/1/1999		
			Status:	LOC	
SKETCH			PHOTO		

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Buttons :

These buttons will only appear when the sketch and photo is available. Otherwise they will be hidden

Monument Detail Screen

After a query is performed and the monuments are selected to view more information, a detailed screen is displayed. The content of this detail screen will vary from one monument to another depending on the data available and extracted from the database tables.

The database is formed primarily of three tables:

1. Conventional monuments (*dbo_Conventional Network*)
2. Historical Information (*dbo_History*)
3. NB High Precision monuments (*dbo_webhpn*)

Some monuments have information in one, two or even all of these tables.

Detail Screen

The detail screen has five (5) possible sections:

1. Identification	This area is designated to show the monument number and its classification
2. NAD83(CSRS) Adjusted <i>(Source: dbo_Conventional Network table)</i>	This section contains information about all the conventional control monuments that were part of the Provincial Least Square Block Adjustment. All will have at least AST77 plane coordinates and most could have Historical information. Some will not have NAD83 (CSRS) values and a special code will appear in the "Notes" field. <i>(See "Notes" explanations)</i>
3. Average Terrestrial 77 (ATS77) <i>(Source: dbo_Conventional Network table)</i>	This section contains AST77 plane coordinates for all the monuments in the old or conventional network.
4. Historical Data <i>(Source: dbo_History table)</i>	This section contains all historical coordinates for every monument again in the old network.
5. New Brunswick High Precision Network <i>(Source: dbo_Webhpn table)</i>	This section contains coordinate and pertinent information with respect to all stations in the NBHPN.

Section 1: Identification

Station number:

The number assigned by Service New Brunswick (SNB) to each coordinate marker and physically stamped as such.

Classification:

With GPS technology coordinates can be obtained in many different ways. The technique used and the time observed is not only directly related to the accuracy of the coordinates but to the reliability of the coordinates. Depending on the specification of one's survey, it might be decided that a station with 15 minutes of GPS observation might not stand the same weight as a station with 36 hours of GPS observation. This information is thus critical for the site selection.

A Provincial Standard document (*see note in next paragraph*) will explain in more details the basic requirements for field observations, technique and type of equipment to use to meet these classification levels.

The following classification gives the information related to each monument. (*Note: These classifications were not finalised at the time of preparing this document and thus may change*)

Types	Classification	Spacing	Observation Methods and/or Equipment
ACP (Active Control Point)	AA	500 to 1500 km	GPS
CBN	A1	100 to 500 km	GPS
HPN (Pillars)	A2	40 to 100 km	GPS
HPN Densification	A3	10 to 20 km	GPS
ISA Densification	B1	5 to 10 km	GPS
ISA Legal Survey Control	B2	< 10 km	GPS
GPS Observed monument for legal survey	B3	<10 km	GPS
Temporary Control	C1	<3km	GPS
CDGPS	C2	N/A	GPS
Conventional * (2 nd order)	D1	< 5km	Conventional Equipment

Section 2: NAD83 (CSRS) Adjusted

Coordinates (See glossary for definition)

Included in this section are the mapping plane Easting (X) and Northing (Y) coordinates, elevation, elevation code, point scale factor and meridian convergence. The coordinates are in reference to NAD83 (CSRS) but they are derived from the re-adjustment of the old network. Values are thus **A RE-COMPUTATION OF THE ATS77 VALUES INTO NAD83 (CSRS)** using the same observations used to generate ATS77 values with the NBHPN points as constraining points.

The NAD83 (CSRS) Adjusted values carry the exiting distortion from the ATS77 network. They **ARE NOT DERIVED FROM GPS OBSERVATIONS AND MAY VARY FROM OBSERVED VALUES.**

Elevation:

This field contains orthometric (sea-level) heights as published by the former LRIS and NBGIC on paper or microfiche systems. The elevations are in reference to the Canadian Vertical Datum of 1928 (CGVD28).

Elevation Code:

Implies the precision, SNB estimates, on the published elevation according to the following table:

Code	Implies
-1	+/- 10 metres
0	+/- 1 metre
1	+/- 1 decimetre
2	+/- 1 centimetre
3	+/- 1 millimetre

Point Scale Factor:

(See Glossary)

Meridian Convergence:

Contains the meridian convergence for this particular station. Units are in degrees minutes and seconds. The algebraic sign of the convergence is such that to obtain a geodetic azimuth from a grid azimuth the meridian convergence is algebraically added to the grid azimuth.

Gravity Field Components

Geoid ellipsoid separation:

(See Glossary)

General

Map Index (NB#):

When LRIS was the responsible agency for the three Maritime Provinces they used and cross-indexed the National Topographic Series Map (1:50,000) as reference maps to show the location of all monuments across the Maritimes. It also served to divide the provinces into maintenance regions for which five were in New Brunswick. An index of these maps (PDF format) can be viewed and accessed if you choose the "View Map Index" button showed on the Home page.

Inset:

Because of the density and closeness of monuments in some urban areas it was difficult to plot and identify each individual monuments on the NTS map scale, so enlargement maps or insets were frequently produced at the scale of 1:10,000.

Notes:

This field is used to carry various abbreviation codes, which are defined as:

Abbr.	Meaning
NB	Monument is part of the former or conventional network
BLOCK	No values are published because these particular monuments failed during the Least Square BLOCK Adjustment. They showed high residuals indicating possible problems with the original observations and no coordinates were computed.
HPN	Monument is part of the NB High Precision Network
HPN2	<p>The four following HPN stations (24105, 24126 and 25121) share a duplicate number with a monument in the conventional network. These HPN are federal stations established by the Geodetic Surveys division (GSD) and SNB accepted the federal numbers rather than cross-indexing them as LRIS had done. None are close or in the same area so the coordinates should be intuitive to the proper location .</p> <p>GSD# 24105 (HPN) is also physically the same as former LRIS# 19171 from the conventional NB network GSD# 24126 (HPN) is also physically the same as former LRIS# 19163 from the conventional NB network GSD# 25100 (HPN) is also physically the same as former LRIS# 19111 from the conventional NB network GSD# 25121 (HPN) is also physically the same as former LRIS# 19217 from the conventional NB network</p> <p>Note:</p> <ul style="list-style-type: none">• The database will display both occurrences of the monuments. The classification "D1" indicates the conventional monument while "A3" the NBHPN monument. NAD27 Historical information displayed in the HPN area is also for the conventional monuments with the same number.• Searching 24105,24126 and 25121 will automatically show all occurrences (see screen captures below)
HPN3	<p>These Federal stations are part of the NBHPN for which we used the original Federal numbers. They can be found as the following cross-indexed stations in the conventional NB network:</p> <p>17105 (HPN) is the same as 19123 from the conventional NB network 621013 (HPN) is the same as 19120 from the conventional NB network 721200 (HPN) is the same as 19277 from the conventional NB network</p>
NEARPT	Values removed during the pre-analysis for the ESTPM model and the creation of the NB Grid shift for NBGeocalc. These monuments are not part of the mathematical model so they have no effects on the results.

Screen captures

The screenshots show the following data:

Search Page (Left):

#	Monument	Classification
1	19171	D1
2	24105	A3
3	24105	D1

Search Page (Middle):

#	Monument	Classification	NB St
1	19163	D1	259
2	24126	A3	
3	24126	D1	252

Search Results Page (Right):

#	Monument	Classification	NB Stereographic - NAD83 (CSRS)		Geodetic - NAD83 (CSRS)	
			East (m)	North (m)	Latitude	Longitude
1	19217	D1	2626208.640	7494801.436	46° 26' 29.1415"	64° 51' 26.6811"
2	25121	A3				
3	25121	D1	2415865.761	7496984.663	46° 28' 03.4461"	67° 35' 43.7902"

Residuals:

Is the difference of a single observation from the adjusted value of that observation – a measure of the variability of a group of observations. The information in this section is used to give an appreciation on the differences encountered if one compared the values coming directly from the least square adjustment (published value) versus the values generated by NBGeocalc (transformed value).

If the differences are large, they indicate a discrepancy and possible problems other monuments in the area. One should consider alternatives, maybe another monument in the area with smaller residuals, otherwise you should expect that converting existing ATS77 coordinates with NBGeocalc might not agree with your existing local coordinates.

The vector field is the resultant component between DE and DN.

Where

DE = Difference in Easting = (Published – NBGeocalc value)
 DN = Difference in Northing = (Published – NBGeocalc value)

and

$$\text{Vector} = \sqrt{\text{DE}^2 + \text{DN}^2}$$

Section 3: Average Terrestrial System (ATS77)

Coordinates

(Refer to Glossary for details. The difference is the Reference System. In this section all plane coordinates are in reference to ATS77).

Date Published:

Date the values for this particular monument became official and showed-up on publication media.

Geoid ellipsoid separation:

(Refer to Glossary for details). Units are in metres.

Quality:

Some qualifiers assigned by LRIS in order to identify the data and its source

Code	Description
ADD(2)	Added for table synchronisation
DPUB	Discontinued Publication
NVAL	No value
PPUB	Pre-Publication
PROV	Provisional value
PUB	Published value
SCAL	Scaled value
TRAN	Transformed value

Status:

The physical status of a monument after SNB's last annual field inspection. *(See Glossary for the abbreviations)*

Section 4: Historical Data

The following fields are found under a columnar format

Easting (X) & Northing (Y):

- In New Brunswick the plane coordinates could be referenced to as much as three (3) Datums or Reference Systems over the years.

Elevation:

- orthometric or sea-level heights available at the time. The heights would be in the same units as the Reference System listed.

Date of publication:

- is the date the values were made official

Reference System (Datum & Projection):

- The possible codes and their meanings are:

Code	Units	Explanation
NAD27	Feet	1927 North American datum w.r.t. the NB Stereographic Double Projection. Used from the late 50's to 1977
ATS77	metres	1977 Average Terrestrial System w.r.t. the NB Stereographic Double Projection. Used between 1977 and 1999
NA83ADJ*	metres	NAD83 (CSRS) adjusted values. GPS observations were performed on this station and probably has been reclassified as part of the NBHPN. Started in April 1999. Note: In time some of the existing conventional monuments from the old system will get observed with GPS and probably considered to be part of the HPN network. If so, their NAD83 (CSRS) Adjusted values would be retired to the Historical Section and the observed values would become the official NAD83 (CSRS) values.

Code:

- Condition code established by LRIS

Code	Explanation
*	Coordinates were transformed from ATS77 (m) to NAD27 (ft)
#	Coordinates were scaled from a map
R	Redefined ATS77 coordinates or elevation (m)
P	Value prior to "Date Published" – Usually transformed from ATS77 (m) to NAD27 (ft)

Section 5: New Brunswick High Precision Network (NBHPN) Reference – NAD83 (CSRS)

Coordinates

Refer to Glossary for details. The coordinates in this section are different from the adjusted values shown in Section 2. The HPN coordinates were the constraining values used to readjust the old network from ATS77 to NAD83 (CSRS) so this is also the reason why all HPN stations will have zero values in the adjusted section 2.

Gravity Field Components

Geoid Model: Various models are available to represent the Geoid. The model listed here is the one used to determine the Geoid/Ellipsoid Separation listed below and also the one used to determine the field for **Orthometric Height (H)** in this section.

N/S and E/W

Deflections: The two components of the deflection of the vertical (*Refer to Glossary for details*)

Geoid/Ellipsoid

Separation: (*Refer to Glossary for details*)

Heights

Ellipsoidal (h)

The height above the ellipsoid. Ellipsoidal height is a geometrical, not a physical parameter and is what is given by GPS techniques.

Orthometric (H)

The height above mean sea level (MSL). Orthometric height is a physical parameter and is what is given by most conventional surveying techniques. It is the level surface that a body of water will conform to. In this section (H) is obtained using the GPS observed ellipsoidal height (h) and correcting it with the Geoid/Ellipsoid separation (N) and the geoid model. For all pillar type HPN this value can be compared with the leveled height. (*Refer to Glossary for details*)

Leveled

Leveled height. This value is the equivalent of the Orthometric height. The difference is in the technique used to obtain this value (*Refer to Glossary for definition*)

Leveling Order

A number from 1-3 will appear in this field if the monument was leveled. (*Refer to Glossary for details*)

General

Published

Date of making the values in this field official

Owner

Name of the Owner and/or Agency responsible for the monument. Privately owned monuments are not for public access. If you want to occupy this monument it will be your responsibility to contact and make arrangements with the owners. In cases of public Agencies the public has access for occupation of the monument only. Some restrictions may apply for vehicle access etc... Refer to the note sections of the sketches for details.

Inspection**Name**

All NBHPN monuments with a classification at the A# and B# level will have a name assigned to it. Usually the name is related to the owner or community it is located.

Inspected

The date of the last field inspection by SNB.

Status:

The physical status of a monument after SNB's last annual field inspection. *(See Glossary for the abbreviations)*

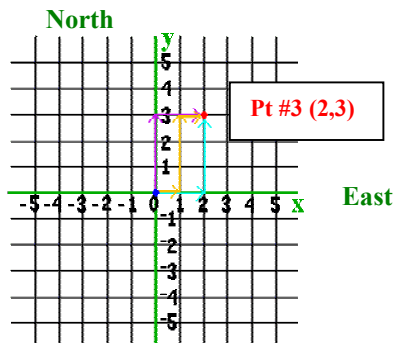
Glossary

- ACP** Unattended GPS tracking stations referred to as Active Control Points
- CACS** Canadian Active Control System. The Geodetic Survey Division of Geomatics Canada, in partnership with Geological Survey of Canada, is presently operating the Canadian Active Control System. The system consists of several ACP, which continuously record carrier phase and pseudo-range measurements for all satellites of the Global Positioning System (GPS) within station view. The data collected at each ACP is retrieved on a daily basis by a central processing facility in Ottawa.
- CDGPS** Canada-Wide Differential GPS. The Canada-wide Differential GPS (CDGPS) Service is a GPS corrections distribution service that will enable all Canadians (and beyond) to derive better (i.e. sub-metre to 3 metres at 95% confidence level) GPS-based positions than the autonomous GPS positions (i.e. up to 20 metres)
- CBN** Canadian Base Network. The CBN is a network of pillar monuments with forced-centering plates, positioned three-dimensionally with GPS to centimetre-level accuracy with respect to the CACS. It provides the link between the existing framework and CACS. As well as being a GPS control network, the CBN can serve as a monitoring network for deformation studies of the Canadian landmass. The CBN was established in a cooperative effort with Provincial agencies.
- Combined Scale Factor (CDF)** Combined scale factor is the ratio of the line scale factor to the elevation factor.

$$CDF = \frac{LSF}{EF}$$

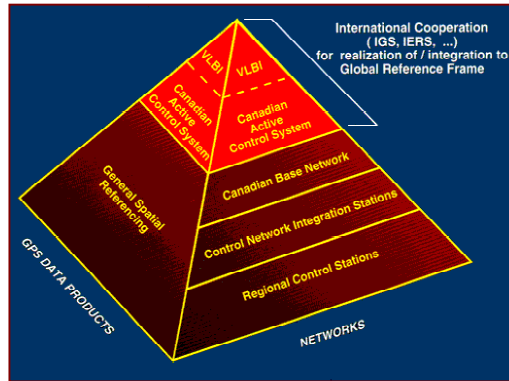
- Coordinates** A numeric value representing the linear or angular distance from an origin defined in a coordinate system. It is usually displayed as a unique ordered pair of numbers. On the coordinate plane the first number in the ordered pair identifies the position with regard to the x-axis while the second number identifies the position on the y-axis.

- Coordinates, Plane** (with respect to the NB Stereographic Double Projection as defined in Glossary)
- Easting (X) values in metres
 - Northing (Y) values in metres



CSRS

Canadian Spatial Reference System, which is based on primary vertical and horizontal networks of groundbased survey control and other georeferencing networks.



Datum

A mathematical definition of the size, shape, origin, and orientation of the earth. As everybody knows, the world is not flat. Actually, it is not round either: it is flattened at the Poles. It resembles a three dimensional ellipse called an *ellipsoid*. A datum defines how a coordinate system is seated over the ellipsoid. The origin of the new NAD83 system is the centre of mass of the Earth, whereas the old North American Datum 1927 (NAD27) had a different origin, making it useful only in North America. GPS receivers also use the centre of mass of the Earth as their system's origin.

Deflection of the Vertical

The deflection of the vertical is the angle between the normal to the ellipsoid and the normal to the Geoid at the observation station. The angle ζ is split into two components;

- ζ the deflection (E/W Deflection) in the meridian plane and
- η the deflection (N/S Deflection) in the prime-vertical plane.

The components of the deflection of the vertical, (ζ, η) are used to reduce direction observations from the terrain to the ellipsoid.

Elevation Scale Factor (EF)

The elevation scale factor is the inverse ratio between a spatial distance between two points on the terrain and the corresponding distance on the ellipsoid, that is, to obtain the distance on the ellipsoid multiply the spatial distance by the scale factor.

$$EF = \left(1 + \frac{h^T}{R} \right)$$

where

$$R = 6379222.285 \text{ m}$$

$$h^T = \text{Mean Ellipsoidal height}$$

Ellipsoid

The ellipsoid is the surface on which geodetic computations take place. An ellipsoid can be defined by a number of mathematical characteristics. As our knowledge of the world has increased over the centuries, we have come to know the dimensions and shape of the world more accurately. The new, more accurate model is called Geodetic Reference System 1980 (GRS80).

Geoid

The Geoid is the figure of the earth considered as a mean sea-level surface

extended continuously through the continents (non-technical definition). It is the reference surface for levelling. The height of a point with respect to the geoid is the orthometric height or most commonly called sea-level height.

Geoid ellipsoid separation (N) Is the distance between the ellipsoid and geoid at a specific point and is also known as the *Geoid Undulation*. The separation added to the orthometric (sea level) height (H), results in the ellipsoid height (h).

The computation of the elements are beyond the scope of this document, however, the following formulae is of particular importance with the use of GPS.

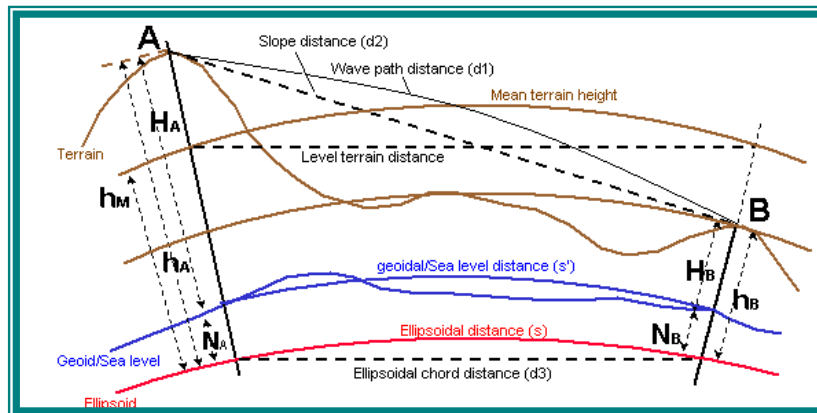
$$h = H + N$$

where

h = is the ellipsoid height (*height usually obtained with GPS*)

H = is the orthometric height (*sea-level*) (*usually obtained with spirit levelling*)

N = is the geoid ellipsoid separation



Geoid Models

Ht1_01:

The GSD95 geoid model adjusted to the Canadian primary vertical control (CGVD28) by means of 1323 NAD83 (CSRS98) ellipsoidal heights throughout Canada. Ht1_01 makes possible direct transformation of NAD83 (CSRS98) ellipsoidal heights to CGVD28 orthometric heights (Mainville, Craymer and Blackie, 1997).

$$HT1_01 = GSD95 + HRG97 + Transformation\ ITRF96-NAD83\ (CSRS98)$$

Ht97:

The GSD95 geoid model adjusted to the Canadian primary vertical control (CGVD28) by means of 1323 NAD83 (CSRS96) ellipsoidal heights throughout Canada. Ht97 makes possible direct transformation of NAD83 (CSRS96) ellipsoidal heights to CGVD28 orthometric heights (Mainville, Craymer and Blackie, 1997).

$$HT97 = GSD95 + HRG97 + Transformation\ ITRF92-NAD83\ (CSRS96)$$

GSD95:

Scientific model of the geoid in Canada determined solely from gravity data collected up to 1995. The calculation method is spherical 2D-FFT (Véronneau, 1997).

The difference between GSD95 (NAD83) and HT1_01 gives the corrector surface (HRG97)

GSD91: Scientific model of the geoid in Canada determined solely from gravity data collected up to 1991. The calculation method is Cartesian FFT (Véronneau and Mainville, 1992).

CGG2000: Canadian Gravimetric Geoid model 2000 is a scientific model of the geoid for North America solely from gravity data collected up to 2000. The CGG2000 geoid model is adjusted to the Canadian primary vertical control (CGVD28) by means of 1285 NAD83 (CSRS98) ellipsoidal heights throughout Canada and is the replacement of GSD95.

Geodetic Control Monument A survey monument with precisely known horizontal and/or vertical coordinates.

GPS GPS is a navigation system based on a network of satellites that send out radio signals. The system provides accurate positions at any time, in any weather, any place in the world. That means we can use the GPS to tell us where we are, which direction to travel, how far north or south we are and how far east or west we've travelled, a whole lot easier than in the days of the explorers.

Gravity Field Components Two elements of the gravity field are important for geodetic position computations, namely:

- Deflection of the vertical ζ
- the geoid ellipsoid separation (N)

HPN High Precision Network. A survey control network based on GPS observed stations tied the CSRS

ISA Integrated Survey Area in Saint John

Latitude The geodetic latitude is the angle described by the line normal to the reference ellipsoid at the point of interest and the plane of the equator. Latitudes are considered positive north of the equator and negative south of the equator.

Leveling Geodetic leveling is a long-established technique used to measure elevation differences between successive benchmarks and, by repeated surveys, to measure elevation changes (vertical displacements) as a function of time. Leveling has been used as a geodetic measurement system for more than a century. During conventional geodetic leveling, a spirit level or other type of leveling instrument (most modern levels are self-leveling and do not include a spirit level) and a pair of graduated leveling rods are used to measure the elevation difference between permanent bench marks by accumulating the elevation differences between a series of temporary turning points.

Leveling Order The different orders of vertical control are defined in terms of the allowable discrepancy between independent forward and backward levellings between bench marks as follows:

- First-Order (1) $\pm 4 \text{ mm } \sqrt{K}$
- Second-Order (2) $\pm 8 \text{ mm } \sqrt{K}$
- Third-Order (3) $\pm 24 \text{ mm } \sqrt{K}$
- Fourth-Order (4) $\pm 120 \text{ mm } \sqrt{K}$

K (kilometres) = the distance between bench marks measured along the levelling route.

*(Control Survey Standards by Geodetic Survey Division of Natural Resources Canada
PART 1--VERTICAL CONTROL)*

Line Scale Factor (LSF)

The line scale factor is the inverse ratio between a distance (between two points) on the ellipsoid and the corresponding distance on the mapping plane, that is, to obtain the distance on the mapping plane multiply the ellipsoid distance by the line scale factor.

Longitude

The geodetic longitude is the angle measured in the equatorial plane between the prime meridian (Greenwich, England) and the meridian of interest. In this document, longitudes are positive east of the prime meridian and those west of the meridian are negative.

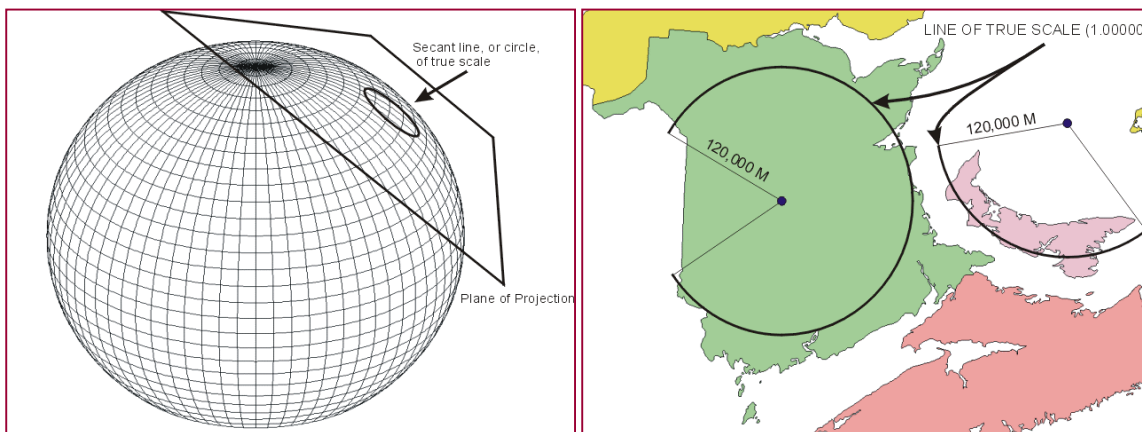
Map Projection

Map projections are mathematical formulas for transforming coordinates from a three-dimensional space to a two-dimensional space, such as a flat piece of paper. Because the Earth is a sphere, any representation of its surface on a flat sheet of paper involves distortion. Some distortions of conformality, distance, direction, scale, and area always result from this process. Some projections minimize distortions in some of these properties at the expense of maximizing errors in others. Some projections are attempts to only moderately distort all of these properties.

Three different map projections are commonly used in the Maritimes:

- i. New Brunswick and Prince Edward Island both use a Stereographic Double projection on a secant plane.
- ii. Nova Scotia uses a three-degree (3°) modified transverse Mercator (MTM) projection.
- iii. The U.T.M. projection covers all three provinces, especially in the National Topographic System (NTS).

In a Stereographic projection directions are true from the center point and scale increases away from the center point, as does distortion in area and shape.



Mean Sea Level (MSL) The average level of the sea from measurements taken over a very long period of time to account for tidal and other physical effects. Mean Sea Level is extended over land by surveys and is defined by a vertical datum.

Meridian Convergence Meridian convergence is the angle between the tangent to a projected meridian of longitude on the mapping plane and grid north.

New Brunswick Stereographic Double projection and Reference Systems

Definition	Reference System		
	NAD83(CSRS)	ATS77	NAD27
Ellipsoid:	Geodetic Reference System 1980 (GRS80)	ATS77 geocentric	Clarke Ellipsoid of 1866
a	6378137.0 metres	6378135.0 metres	-----
b	6356752.3141 metres	6356750.305 metres	-----
1/f	298.257222101	298.257 (exactly)	-----
Projection	New Brunswick Stereographic Double projection		
Origin: Latitude:	46° 30' north	46° 30' north	Mead Ranch Texas
Longitude:	66° 30' west	66° 30' west	-----
Gaussian mean radius at origin:	6379222.285 metres	6379220.286 metres	Non geocentric
Scale factor at origin:	0.999912	0.999912	-----
False Northing:	7,500,000 metres	800,000 metres	1,000,000 ft
False Easting:	2,500,000 metres	300,000 metres	1,000,000 ft

North American Datum Datum selected by geodetic agencies in Canada, USA, Mexico and Greenland to best represent to size and shape of the Earth over North America. NAD83 is the datum currently used.

NTS Maps Topographic maps produced by Natural Resources Canada conform to the *National Topographic System (NTS)* of Canada. The National Topographic System provides general-purpose topographic map coverage of the entire Canadian landmass. These maps depict, in detail, ground relief, drainage, forest cover, administrative areas, populated areas, transportation routes and facilities, and cultural features. They are available in two standard scales, 1/50 000 and 1/250 000. The maps show a geographic grid (longitude and latitude) and a Universal Transverse Mercator (UTM) grid (kilometres). <http://maps.NRCan.gc.ca/main.html>

Point Scale Factor (PSF)

The point scale factor describes at each point on the map projection the amount of distortion in length with respect to the origin. Except for the Stereographic Double projection where the point scale factors are used to compute a line scale factor, the point scale factor cannot be used in position computations. *(As published by SNB, computed with NBGeocalc or other software)*

Status

The physical status of the monument after the last field inspection. Various codes used are:

Code	Definition
DAMA	Monument is damaged but still usable
DEST	Monument was destroyed and cannot be used anymore
LOC	Monument was located intact
NACC	Monument is not accessible
NFND	Not found
REST	Monument with restricted access. Owner of property has to be contacted or other restrictions. See sketch for details

(T-t) Correction

The (T-t) correction is the angle between the tangent to a geodesic between two points projected onto the mapping plane and the grid azimuth between the same two points.