Introduction to State Plane Coordinates

Lynn I. Call, PLS

6:00PM Introductions

The Earth is not Flat

Three Surfaces

Primary Geodetic Reference System

Map Projections

10 Minute Break

NAD83 Definitions

RCW 58.20 & WAC 332-130-060

What Datum/Epoch is it?

Why do we care?

Using Agency Data

10 Minute Break

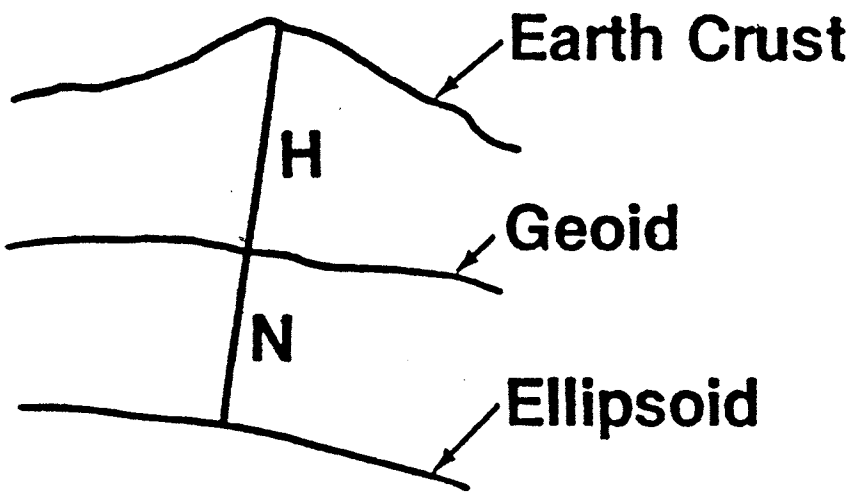
Sample Exercise

Questions

9:00PM Goodbye!

THE GEOID

The geoid is the equipotential surface of the earth's attraction and rotation which, on the average, coincides with mean sea level in the open ocean.

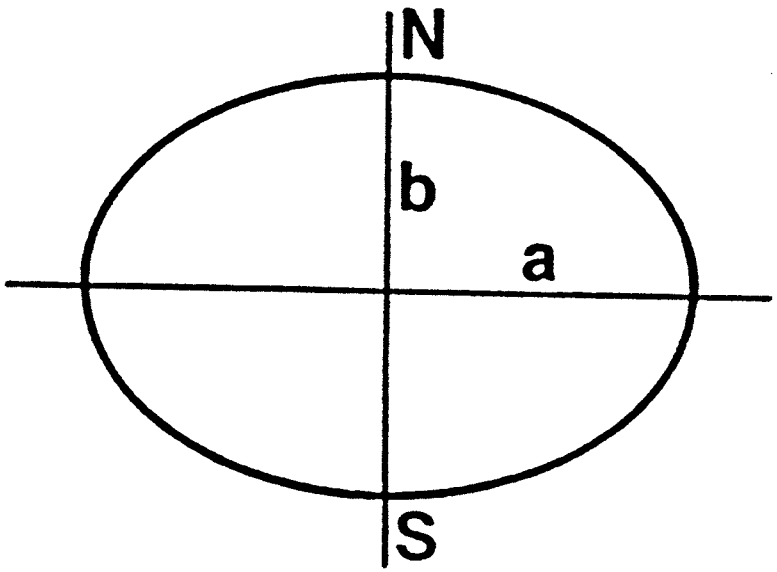


H = Height Above Sea Level

N = Geoid Height

h = H + N = Ellipsoidal Height

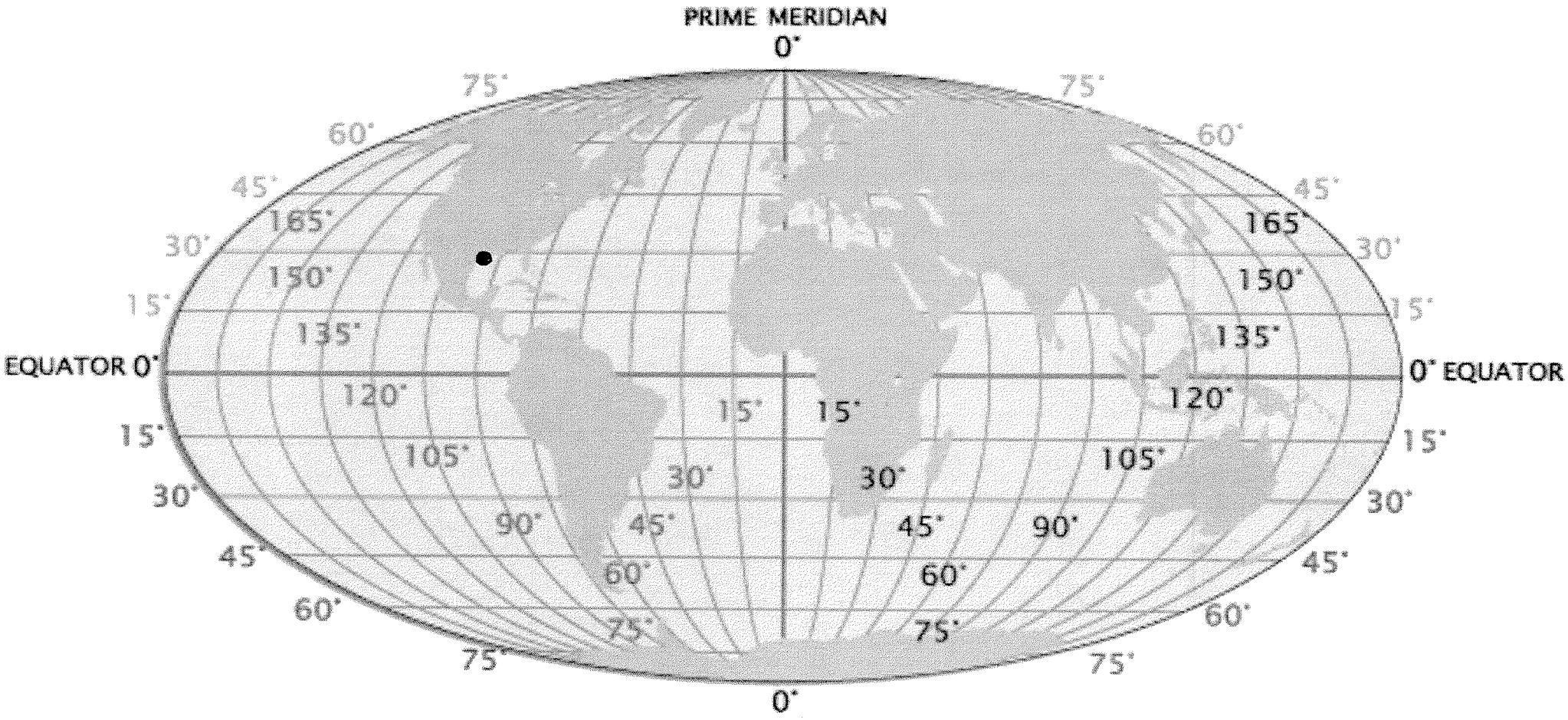
THE ELLIPSOID



a = Semi major axis

b = Semi minor axis

$$f = \frac{a - b}{a} = \text{Flattening}$$


PRIME MERIDIAN
0°
75°
60°
45°
30°
15°
165°
150°
135°
120°
105°
90°
EQUATOR 0°
0° EQUATOR

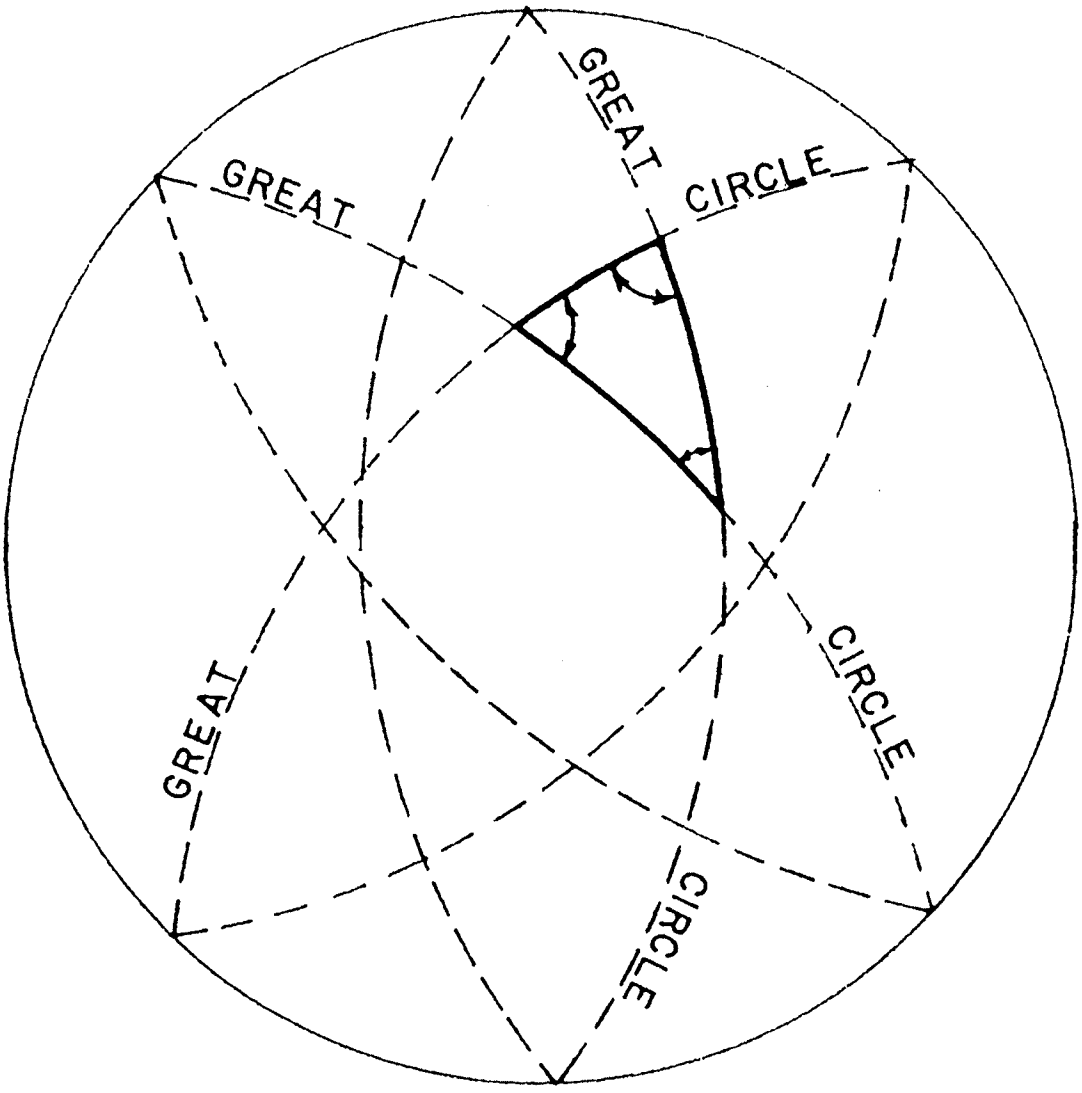
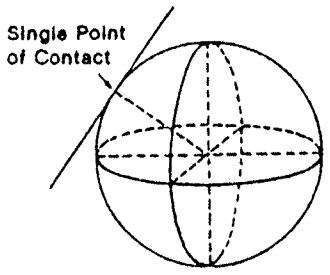
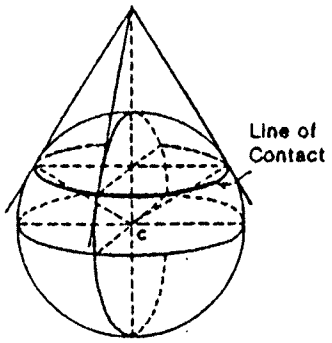


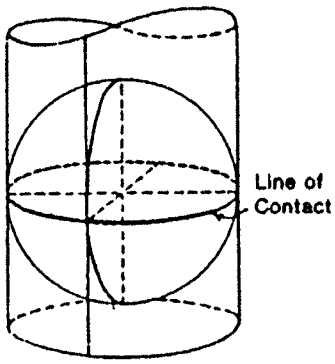
Figure 1.2 Spherical Triangle



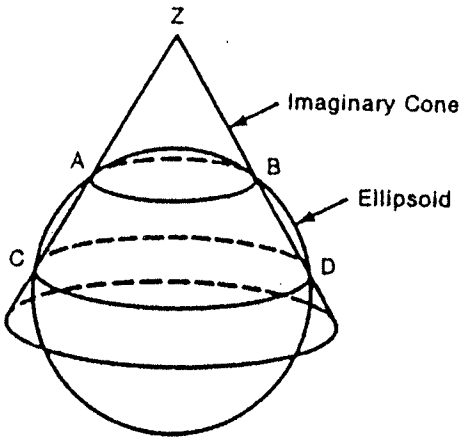
PLANE



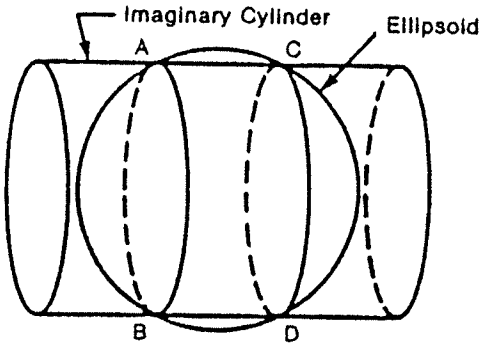
CONE



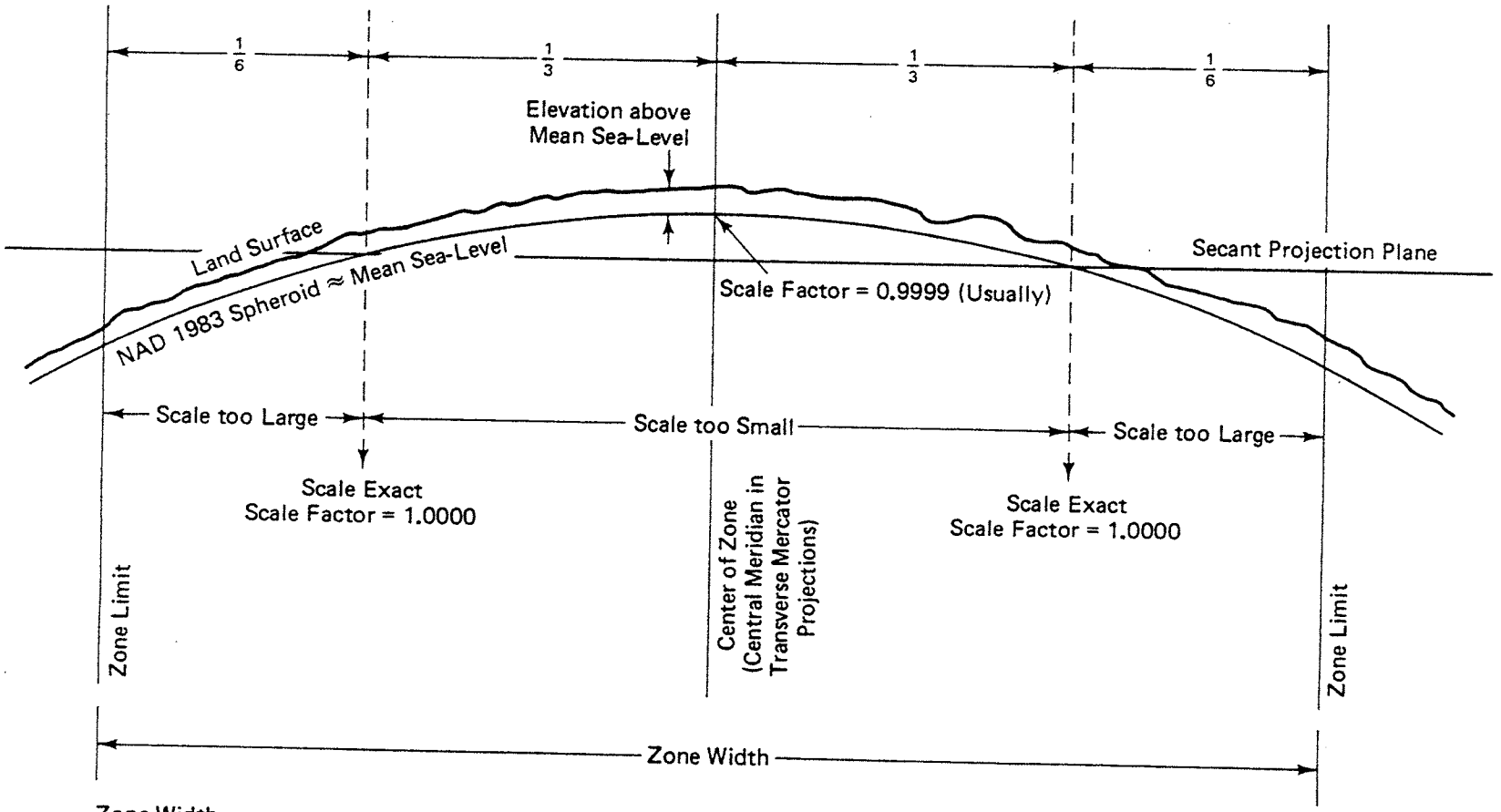
CYLINDER



Lambert Conformal
Conic Projection



Transverse
Mercator Projection

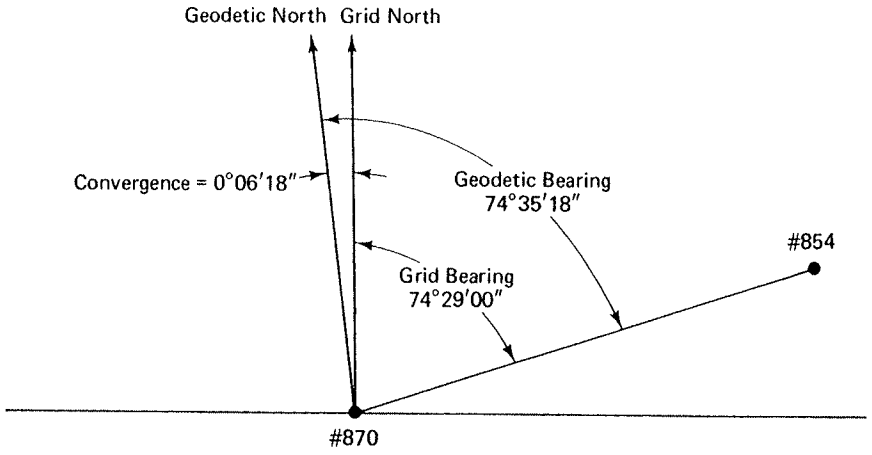


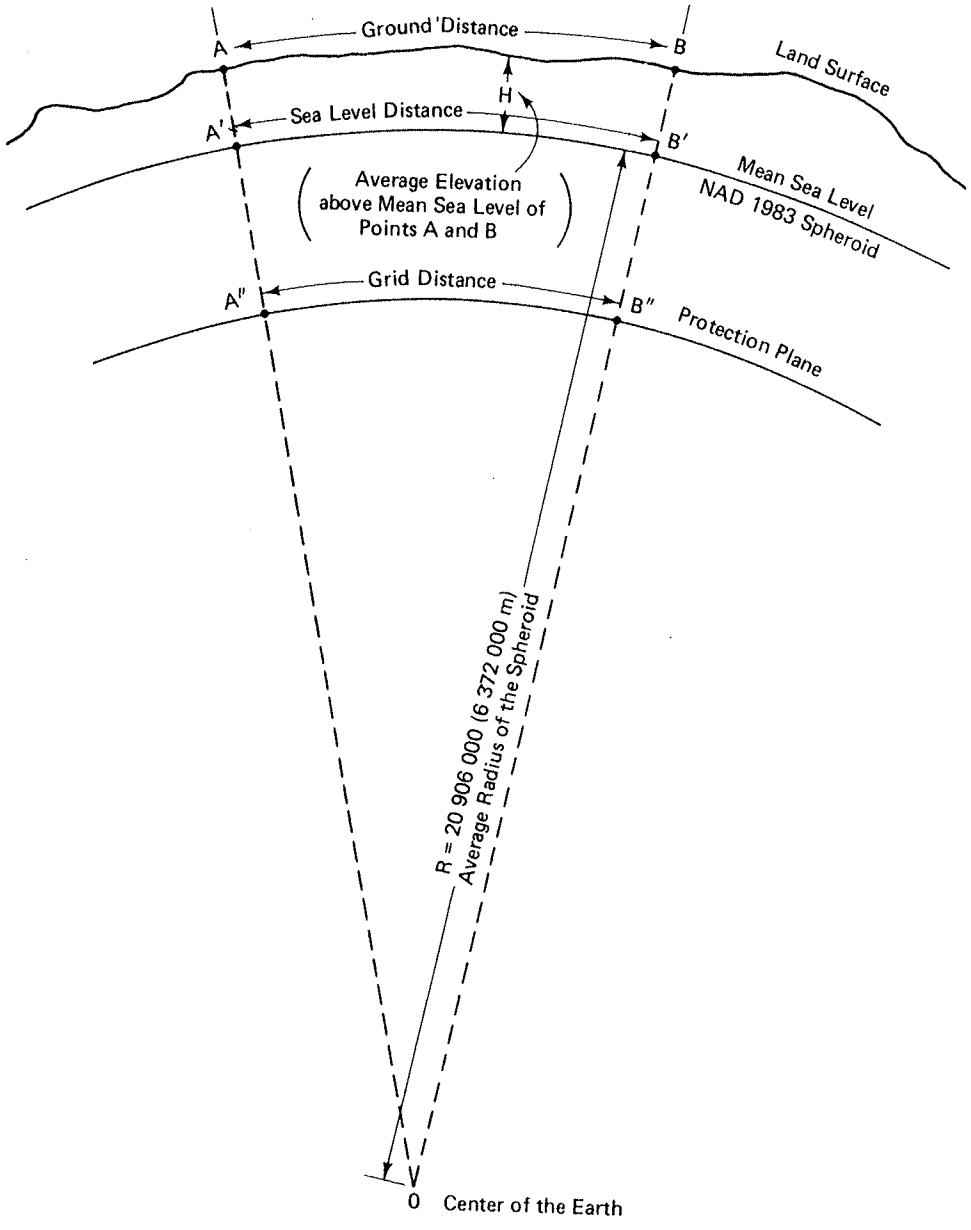
Zone Width

About 158 Miles for State Plane Coordinate Systems:

- East-West Orientation for Transverse Mercator Projections.
- North-South Orientation for Lambert Projections.

FIGURE 11.16 Section of the projection plane and the earth's surface for State Plane grids (secant projection).


Geodetic North
Grid North
Convergence = 0°06'18"
Geodetic Bearing
74°35'18"
#854
Grid Bearing
74°29'00"
#870


A
Ground Distance
B
Land Surface
H
A'
Sea Level Distance
B'
Mean Sea Level
NAD 1983 Spheroid
Average Elevation
above Mean Sea Level of
Points A and B
A"
Grid Distance
B"
Protection Plane
R = 20 906 000 (6 372 000 m)
Average Radius of the Spheroid
0
Center of the Earth

NOAA Manual NOS NGS 5

State Plane Coordinate System of 1983

James E. Stem

National Geodetic Survey
Rockville, MD
January 1989

Reprinted with minor corrections
March 1990

Reprinted August 1990

U.S. DEPARTMENT OF COMMERCE
C. William Verity, Secretary

National Oceanic and Atmospheric Administration
William E. Evans, Under Secretary

National Ocean Service
Thomas J. Maginnis, Assistant Administrator

Charting and Geodetic Services
R. Adm. Wesley V. Hull

For sale by the National Geodetic Information Center, NOAA, Rockville, MD 20852

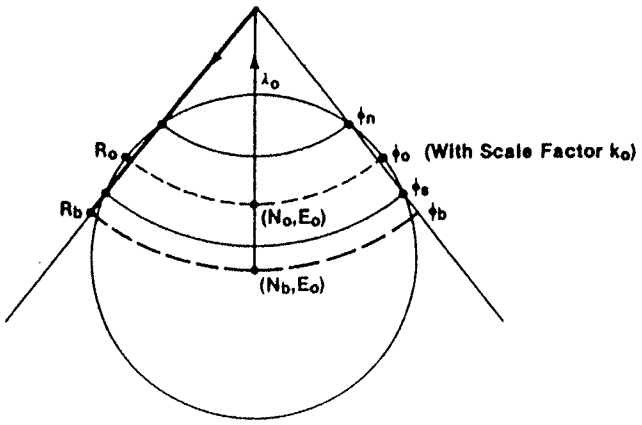
APPENDIX C.--CONSTANTS FOR THE LAMBERT PROJECTION BY THE POLYNOMIAL COEFFICIENT METHOD

Constants		Description
Bs	=	Southern standard parallel
Bn	=	Northern standard parallel
Bb	=	Latitude of grid origin
Lo	=	Longitude of the true and grid origin, the "central meridian"
Nb	=	Northing value at grid orgin "Bb"
Eo	=	Easting value at the origin "Lo"
Bo	=	Latitude of the true projection origin, the "central parallel"
SinBo	=	Sine of Bo
Rb	=	Mapping radius at Bb
Ro	=	Mapping radius at Bo
K	=	Mapping radius at the equator
No	=	Northing value at the true projection origin "Bo"
ko	=	Central parallel grid scale factor
Mo	=	Scaled radius of curvature in the meridian at "Bo"
ro	=	Geometric mean radius of curvature at Bo scaled to the grid

Bs, Bn, Bb, and Lo in degrees: minutes
Bo in decimal degrees
Linear units in meters

(See page 44 for equivalent notation of defining and derived constants used in the figure below.)

PARAMETERS OF A LAMBERT PROJECTION



WA N WASHINGTON NORTH ZONE # 4601

Defining Constants

```
Bs    =        47:30
Bn    =        48:44
Bb    =        47:00
Lo    =       120:50
Nb    =         0.0000
Eo    =    500000.0000
```

Computed Constants

```
Bo    =  48.1179151437
SinBo= 0.744520326553
Rb    =   5853778.6038
Ro    =   5729486.2170
No    =    124292.3869
K     =  11670409.5559
ko    = 0.999942253481
Mo    =   6370499.7054
ro    =    6380060.
```

Coefficients for GP to PC

```
L(1)  = 111186.1944
L(2)  =      9.72145
L(3)  =      5.61785
L(4)  =      0.027630
```

Coefficients for PC to GP

```
G(1)   =  8.993922319E-06
G(2)   = -7.07270E-15
G(3)   = -3.67384E-20
G(4)   = -1.4705E-27
```

Coefficients for Grid Scale Factor

```
F(1)  = 0.999942253481
F(2)  = 1.22844E-14
F(3)  = 7.08E-22
```

WA S WASHINGTON SOUTH ZONE # 4602

Defining Constants

```
Bs    =        45:50
Bn    =        47:20
Bb    =        45:20
Lo    =       120:30
Nb    =         0.0000
Eo    =    500000.0000
```

Computed Constants

```
Bo    =  46.5850847865
SinBo= 0.726395784020
Rb    =   6183952.2755
Ro    =   6044820.3632
No    =    139131.9123
K     =  11760132.9643
ko    = 0.999914597644
Mo    =   6368612.1773
ro    =    6378741.
```

Coefficients for GP to PC

```
L(1)  = 111153.2505
L(2)  =      9.75921
L(3)  =      5.62165
L(4)  =      0.026539
```

Coefficients for PC to GP

```
G(1)   =  8.996587928E-06
G(2)   = -7.10693E-15
G(3)   = -3.68032E-20
G(4)   = -1.3823E-27
```

Coefficients for Grid Scale Factor

```
F(1)  = 0.999914597644
F(2)  = 1.22897E-14
F(3)  = 6.73E-22
```

Chapter 58.20 RCW
WASHINGTON COORDINATE SYSTEM

RCW Sections

58.20.110 Definitions.
58.20.120 System designation -- Permitted uses.
58.20.130 Plane coordinates adopted -- Zones.
58.20.140 Designation of system -- Zones.
58.20.150 Designation of coordinates -- "N" and "E."
58.20.160 Tract in both zones -- Description.
58.20.170 Zones -- Technical definitions.
58.20.180 Recording coordinates -- Control stations.
58.20.190 Conversion of coordinates -- Metric.
58.20.200 Term -- Limited use.
58.20.210 United States survey prevails -- Conflict.
58.20.220 Real estate transactions -- Exemption.
58.20.901 Severability -- 1989 c 54.

58.20.110
Definitions.

Unless the context clearly requires otherwise, the definitions in this section apply throughout RCW

58.20.110 through 58.20.220 and 58.20.901:

(1) "Committee" means the interagency federal geodetic control committee or its successor;

(2) "GRS 80" means the geodetic reference system of 1980 as adopted in 1979 by the international union of geodesy and geophysics defined on an equipotential ellipsoid;

(3) "National geodetic survey" means the national ocean service's national geodetic survey of the national oceanic and atmospheric administration, United States department of commerce, or its successor;

(4) "Washington coordinate system of 1927" means the system of plane coordinates in effect under this chapter until July 1, 1990, which is based on the North American datum of 1927 as determined by the national geodetic survey of the United States department of commerce;

(5) "Washington coordinate system of 1983" means the system of plane coordinates under this chapter based on the North American datum of 1983 as determined by the national geodetic survey of the United States department of commerce.

[1989 c 54 § 9.]

58.20.120
System designation — Permitted uses.

Until July 1, 1990, the Washington coordinate system of 1927, or its successor, the Washington coordinate system of 1983, may be used in Washington for expressing positions or locations of points on the surface of the earth. On and after that date, the Washington coordinate system of 1983 shall be the designated coordinate system in Washington. The Washington coordinate system of 1927 may be used only for purposes of reference after June 30, 1990.

[1989 c 54 § 10.]

58.20.130
Plane coordinates adopted — Zones.

The system of plane coordinates which has been established by the national geodetic survey for defining and stating the positions or locations of points on the surface of the earth within the state of Washington is designated as the "Washington coordinate system of 1983."

For the purposes of this system the state is divided into a "north zone" and a "south zone."

The area now included in the following counties shall constitute the north zone: Chelan, Clallam, Douglas, Ferry, Island, Jefferson, King, Kitsap, Lincoln, Okanogan, Pend Oreille, San Juan, Skagit, Snohomish, Spokane, Stevens, Whatcom, and that part of Grant lying north of parallel 47° 30' north

latitude.

The area now included in the following counties shall constitute the south zone: Adams, Asotin, Benton, Clark, Columbia, Cowlitz, Franklin, Garfield, that part of Grant lying south of parallel 47° 30' north latitude, Grays Harbor, Kittitas, Klickitat, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, Wahkiakum, Walla Walla, Whitman and Yakima.

[1989 c 54 § 11.]

58.20.140
Designation of system — Zones.

As established for use in the north zone, the Washington coordinate system of 1983 shall be named, and in any land description in which it is used it shall be designated, the "Washington coordinate system of 1983, north zone."

As established for use in the south zone, the Washington coordinate system of 1983 shall be named, and in any land description in which it is used it shall be designated, the "Washington coordinate system of 1983, south zone."

[1989 c 54 § 12.]

58.20.150
Designation of coordinates — "N" and "E."

"N" and "E" shall be used in labeling coordinates of a point on the earth's surface and in expressing the position or location of such point relative to the origin of the appropriate zone of this system, expressed in meters and decimals of a meter. These coordinates shall be made to depend upon and conform to the coordinates, on the Washington coordinate system of 1983, of the horizontal control stations of the national geodetic survey within the state of Washington, as those coordinates have been determined, accepted, or adjusted by the survey.

[1989 c 54 § 13.]

58.20.160
Tract in both zones — Description.

When any tract of land to be defined by a single description extends from one into the other of the coordinate zones under RCW

58.20.130, the positions of all points on its boundaries may be referred to either of the zones, the zone which is used being specifically named in the description.

[1989 c 54 § 14.]

58.20.170
Zones — Technical definitions.

For purposes of more precisely defining the Washington coordinate system of 1983, the following definition by the national geodetic survey is adopted:

The Washington coordinate system of 1983, north zone, is a Lambert conformal conic projection of the GRS 80 spheroid, having standard parallels at north latitudes 47° 30' and 48° 44', along which parallels the scale shall be exact. The origin of coordinates is at the intersection of the meridian 120° 50' west of Greenwich and the parallel 47° 00' north latitude. This origin is given the coordinates: E = 500,000 meters and N = 0 meters.

The Washington coordinate system of 1983, south zone, is a Lambert conformal conic projection of the GRS 80 spheroid, having standard parallels at north latitudes 45° 50' and 47° 20', along which parallels the scale shall be exact. The origin of coordinates is at the intersection of the meridian 120° 30' west of Greenwich and the parallel 45° 20' north latitude. This origin is given the coordinates: E = 500,000 meters and N = 0 meters.

[1989 c 54 § 15.]

58.20.180
Recording coordinates — Control stations.

Coordinates based on the Washington coordinate system of 1983, purporting to define the position of a point on a land boundary, may be presented to be recorded in any public land records or deed records if the survey method used for the determination of these coordinates is established in conformity with standards and specifications prescribed by the interagency federal geodetic control committee, or its successor. These surveys shall be connected to monumented control stations that are adjusted to and published in the national network of geodetic control by the national geodetic survey and such connected horizontal control stations shall be described in the land or deed record. Standards and specifications of the committee in force on the date of the survey shall apply. In all instances where reference has been made to such coordinates in land surveys or deeds, the scale and sea level factors shall be stated for the survey lines used in computing ground distances and areas.

The position of the Washington coordinate system of 1983 shall be marked on the ground by horizontal geodetic control stations which have been established in conformity with the survey standards adopted by the committee and whose geodetic positions have been rigorously adjusted on the North American datum of 1983, and whose coordinates have been computed and published on the system defined in RCW

58.20.110 through 58.20.220 and 58.20.901. Any such control station may be used to establish a survey connection with the Washington coordinate system of 1983.

[1989 c 54 § 16.]

58.20.190
Conversion of coordinates — Metric.

Any conversion of coordinates between the meter and the United States survey foot shall be based upon the length of the meter being equal to exactly 39.37 inches.

[1989 c 54 § 17.]

58.20.200
Term — Limited use.

The use of the term "Washington coordinate system of 1983" on any map, report of survey, or other document, shall be limited to coordinates based on the Washington coordinate system of 1983 as defined in this chapter.

[1989 c 54 § 18.]

58.20.210
United States survey prevails — Conflict.

Whenever coordinates based on the Washington coordinate system of 1983 are used to describe any tract of land which in the same document is also described by reference to any subdivision, line or corner of the United States public land surveys, the description by coordinates shall be construed as supplemental to the basic description of such subdivision, line, or corner contained in the official plats and field notes filed of record, and in the event of any conflict the description by reference to the subdivision, line, or corner of the United States public land surveys shall prevail over the description by coordinates.

[1989 c 54 § 19.]

58.20.220
Real estate transactions — Exemption.

Nothing contained in this chapter shall require any purchaser or mortgagee to rely on a description, any part of which depends exclusively upon the Washington coordinate system of 1927 or 1983.

[1989 c 54 § 20.]

58.20.901
Severability — 1989 c 54.

If any provision of this act or its application to any person or circumstance is held invalid, the remainder of the act or the application of the provision to other persons or circumstances is not affected.

[1989 c 54 § 21.]

Inside the Legislature
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- TVW
- Washington Courts
- OFM Fiscal Note Website

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WACs > Title 332 > Chapter 332-130 > Section 332-130-060

332-130-050 << 332-130-060 >> 332-130-070

Agency filings affecting this section

WAC 332-130-060
Local geodetic control survey standards.

The following standards shall apply to local geodetic control surveys:

The datum for the horizontal control network in Washington shall be NAD83 as officially adjusted and published by the National Geodetic Survey of the United States Department of Commerce or as established in accordance with chapter 58.20 RCW. The datum tag and coordinate epoch date (if pertinent) shall be reported on all documents prepared, which show local geodetic control; e.g., NAD83 (1991), NAD83 (CORS) (2002.00), NAD83 (NSRS) (2005.50) and other future [standards].

[Statutory Authority: Chapter 58.24 RCW. 05-13-104, § 332-130-060, filed 6/17/05, effective 7/18/05. Statutory Authority: RCW 58.24.040(1). 91-19-013 (Order 581), § 332-130-060, filed 9/9/91, effective 10/10/91; 89-11-028 (Order 561), § 332-130-060, filed 5/11/89; Order 275, § 332-130-060, filed 5/2/77.]

Notes:

Reviser's note: RCW 34.05.395 requires the use of underlining and deletion marks to indicate amendments to existing rules, and deems ineffectual changes not filed by the agency in this manner. The bracketed material in the above section does not appear to conform to the statutory requirement.

SURVEY DATUMS IN WASHINGTON STATE

Datum	Reference Ellipsoid	Semi-Major Axis	Inverse Flattening
NAD 27	CLARKE 1866	6,378,145 M	298.25
NAD 83	GRS 80	6,378,137.0 M	298.257 222 101
DoD GPS	WGS 84	6,378,137.0 M	298.257 223 563

NAD 27 - Meade Ranch Kansas held fixed

NAD 83(1986)

NAD 83(1991) - Washington/Oregon HARN

NAD 83(CORS) - Multiple Epochs

NAD 83(1998) - Washington FBN 1998

NAD 83(NSRS2007) - 70000 Points - 700 CORS Points held fixed - GPS and Traverse Data

NAD 83(2011) - 81055 Points - 1195 CORS Points held fixed - GPS only

LOCAL COORDINATE SHIFTS

NAD 27 to NAD 83(1986) → 59’ South & 122’ East (+360,000’ offset West)

NAD 83(1986) to NAD 83(1991) → 0.71’ North & 0.35’ East

NAD 83(1991) to NAD 83(NSRS2007) → 0.24’ North & 0.23’ East

NAD 83(NSRS2007) to NAD 83(2011) → 0.10’ North & 0.19’ East

Land Survey Services

Introduction
- Survey Control
- Survey Control (mobile)
- Survey Control Map
- GPS Base Station Data
- Plat Map Forms

The Land Surveying division, a part of the Civic Services Department, produces and maintains specialized maps and data. Survey staff provide the following services:

- Land surveying and mapping services for city staff in support of capital improvement projects, resource management, accident and crime scene investigations and land use actions.
- Preservation of historical survey monuments required to accurately locate property boundaries, easements and public rights of way.
- Creation and maintenance of geodetic control networks for use by survey and mapping professionals.

If you need more generalized mapping services, the Geographic Information Systems (GIS) Services division can help you.

Contact Information

Land Surveying
450 110th Ave. NE
P.O. Box 90012
Bellevue, WA 98009
Contact: Lynn Call, Survey Manager
Phone: 425-452-6460
E-mail: lcall@bellevuewa.gov
Contact: Jeff Collin, Field Supervisor
Phone: 425-452-4339
E-mail: jcollin@bellevuewa.gov

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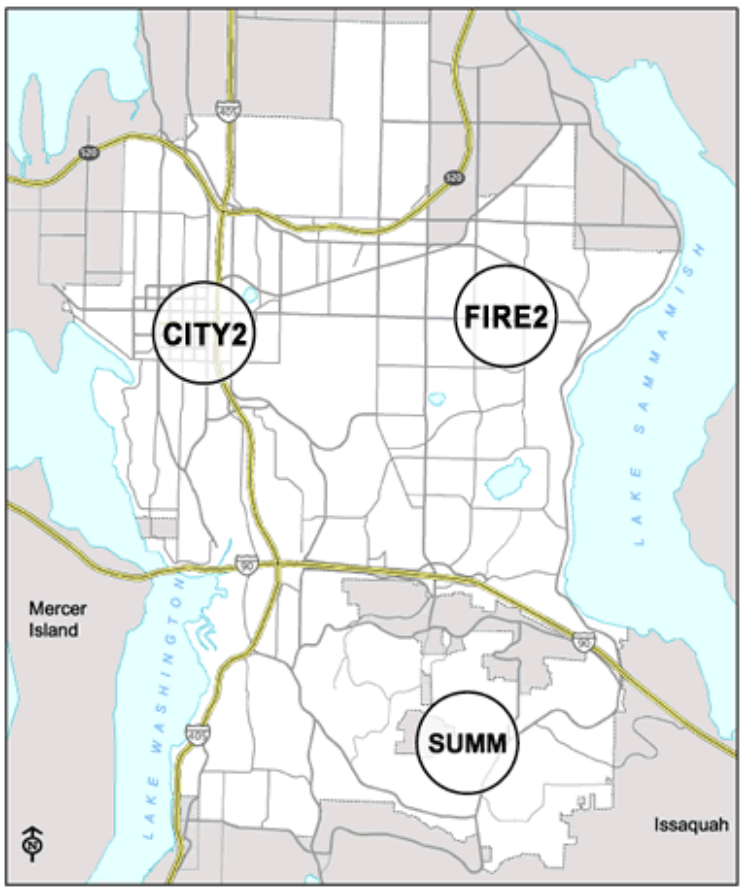
CITY OF Bellevue

Land Survey Services

GPS Base Station Data

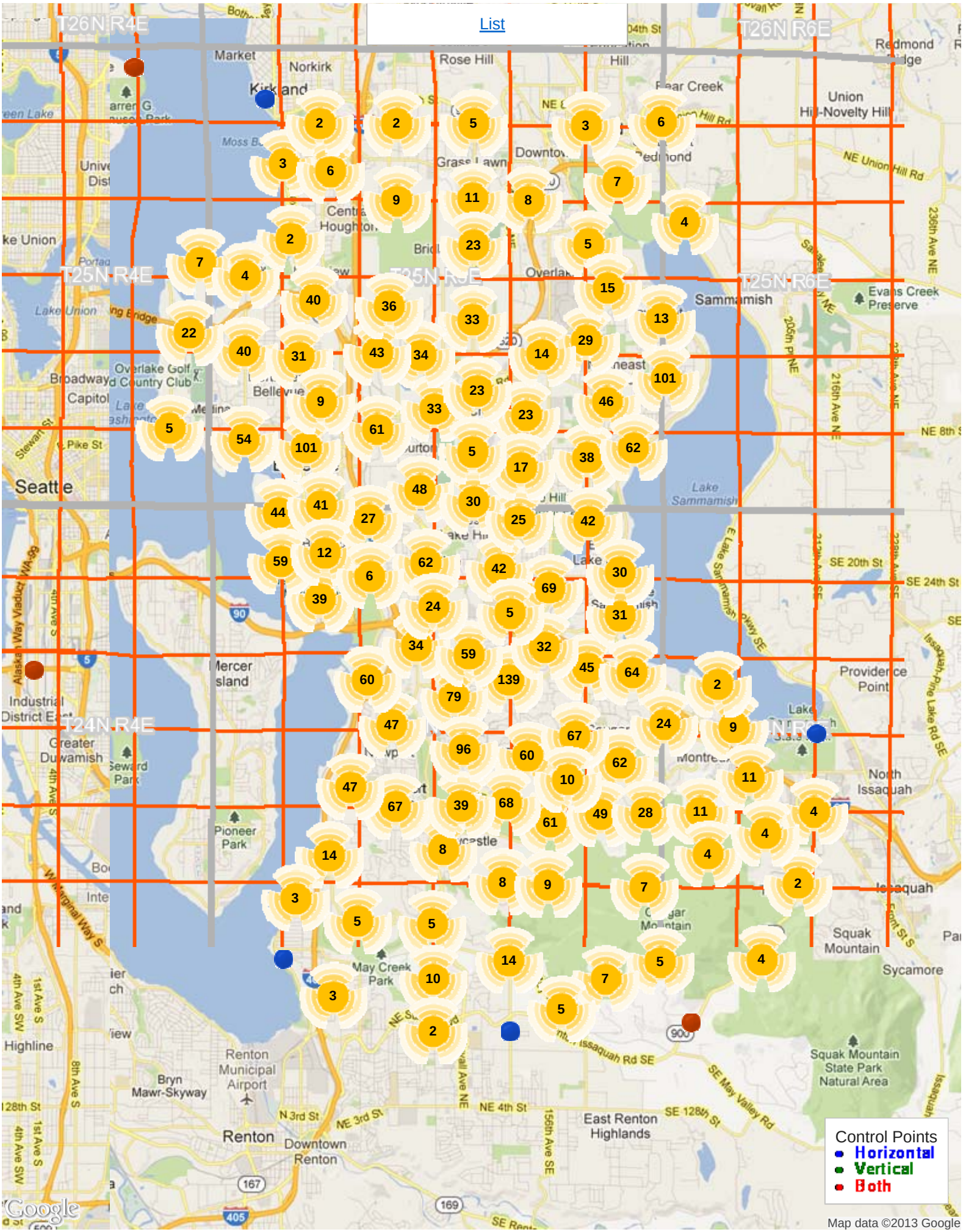
Download GPS data from Bellevue's base stations by clicking a station on the map below. One-second epoch data for the past 60 days is available in two formats, RINEX 2.11 and Trimble T02.

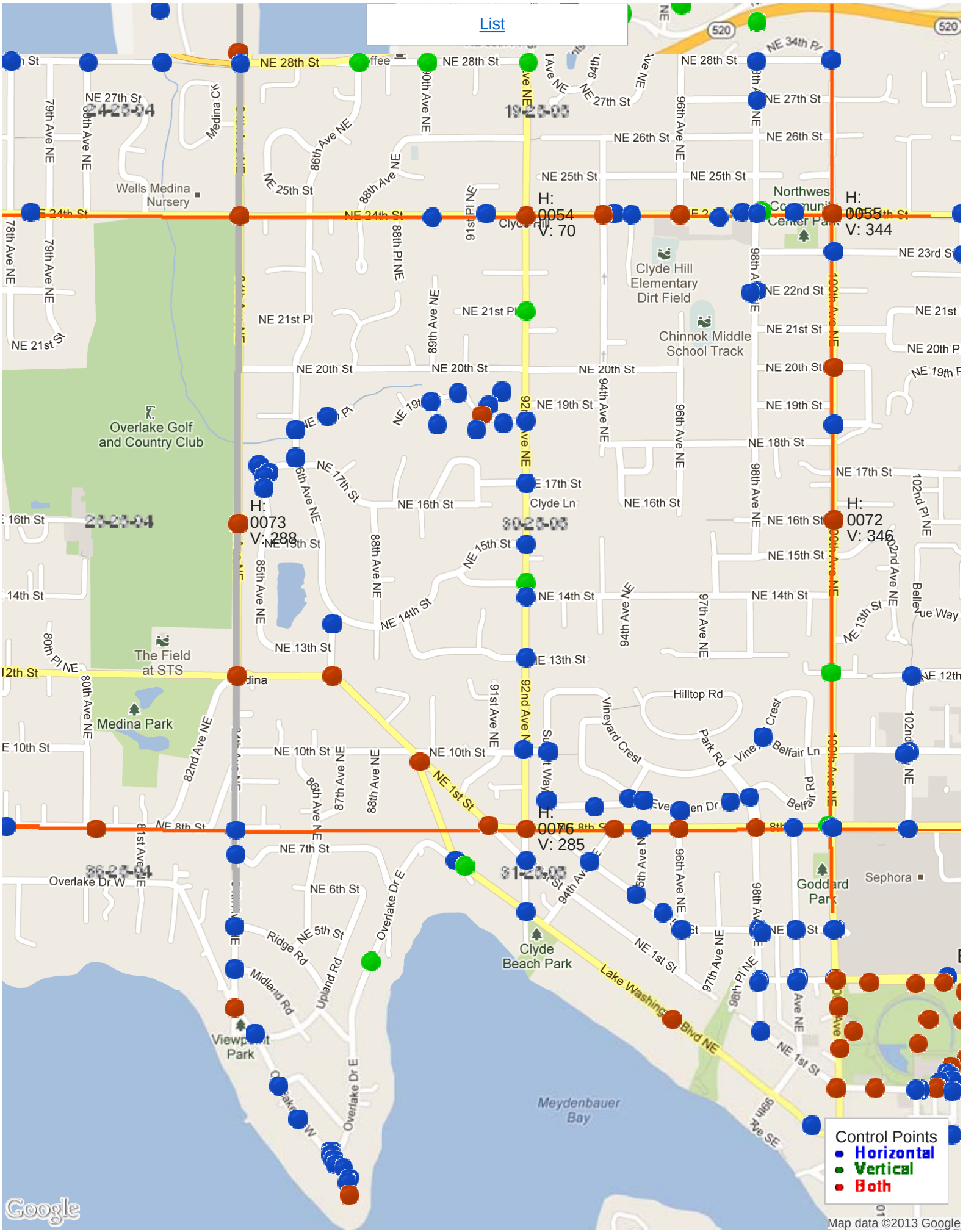


Contact Information

Land Surveying
450 110th Ave. NE
P.O. Box 90012
Bellevue, WA 98009
Contact: Lynn Call, Survey Manager
Phone: 425-452-6460
E-mail: lcall@bellevuewa.gov
Contact: Jeff Collin, Field Supervisor
Phone: 425-452-4339
E-mail: jcollin@bellevuewa.gov

iReport Request Ask


List
T26N R4E
T26N R6E
T25N R4E
T25N R6E
T24N R4E
Market
Norkirk
Kirkland
Rose Hill
Redmond
Union Hill-Novelty Hill
Bear Creek
Grass Lawn
Downtown
Redmond
Central Houghton
Bridle
Overlake
Sammamish
Evans Creek Preserve
Lake Union
Broadway
Capitol
Overlake Golf and Country Club
Bellevue
Seattle
Lake Sammamish
Mercer Island
Industrial District East
Greater Duwamish
Seward Park
Pioneer Park
Providence Point
North Issaquah
Issaquah
Squak Mountain
Sycamore
May Creek Park
Highline
Renton Municipal Airport
Bryn Mawr-Skyway
Renton
Downtown Renton
East Renton Highlands
Squak Mountain State Park Natural Area
Control Points
Horizontal
Vertical
Both
Map data ©2013 Google


List
H: 0054 V: 70
H: 0055 V: 344
H: 0073 V: 288
H: 0072 V: 346
H: 0076 V: 285
NE 28th St
NE 24th St
NE 27th St
NE 26th St
NE 25th St
NE 23rd St
NE 22nd St
NE 21st St
NE 21st Pl
NE 20th St
NE 19th St
NE 18th St
NE 17th St
NE 16th St
NE 15th St
NE 14th St
NE 13th St
NE 12th
NE 10th St
NE 8th St
NE 7th St
NE 6th St
NE 5th St
NE 1st St
Clyde Ln
Hilltop Rd
Overlake Dr W
Overlake Dr E
Ridge Rd
Midland Rd
Upland Rd
Lake Washington Blvd NE
Meydenbauer Bay
Clyde Beach Park
Medina Park
Overlake Golf and Country Club
The Field at STS
Wells Medina Nursery
Clyde Hill Elementary Dirt Field
Chinnok Middle School Track
Goddard Park
Sephora
Control Points
Horizontal
Vertical
Both
Google
Map data ©2013 Google

Bellevue Survey Control Monuments

Export to CSV

Horizontal Control - NAD 83(2011) - Washington North Zone

Horiz. Id	Location	Description	Northing (US Feet)	Easting (US Feet)
0054	92ND AVE NE & NE 24TH ST.	CONCRETE MON W/ 2" DIA BRASS CAP W/ PUNCH MK IN CASE; TOP MON TO TOP RIM CASE 1.67 FEET.	233587.736	1299065.081
0600	IN ASPHALT SHOULDER WEST END SW RADIUS @ 89TH PL NE & NE 24TH ST.	PK NAIL W/COB DISK #600.	233583.354	1298255.949
0601	IN ASPHALT SHOULDER NORTH SIDE NE 24TH ST 133'+/- EAST OF 91ST AVE NE.	PK NAIL W/COB DISK #601.	233610.945	1298718.655
3190	EASTERLY OF 2 MONS @ INTERSECTION NE 24TH ST & 94TH AVE NE.	CONCRETE MON W/ 2" DIA BRASS DISC W/ PUNCH MK (EAST SIDE DISC) IN CASE; TOP MON TO TOP RIM CASE 1.11 FEET.	233579.517	1299735.332
3191	WESTERLY OF 2 MONS @ INTERSECTION NE 24TH ST & 94TH AVE NE.	CONCRETE MON W/ 2" DIA BRASS DISC W/ PUNCH MK IN CASE; TOP MON TO TOP RIM CASE 1.25 FEET.	233579.585	1299730.557

Export to CSV

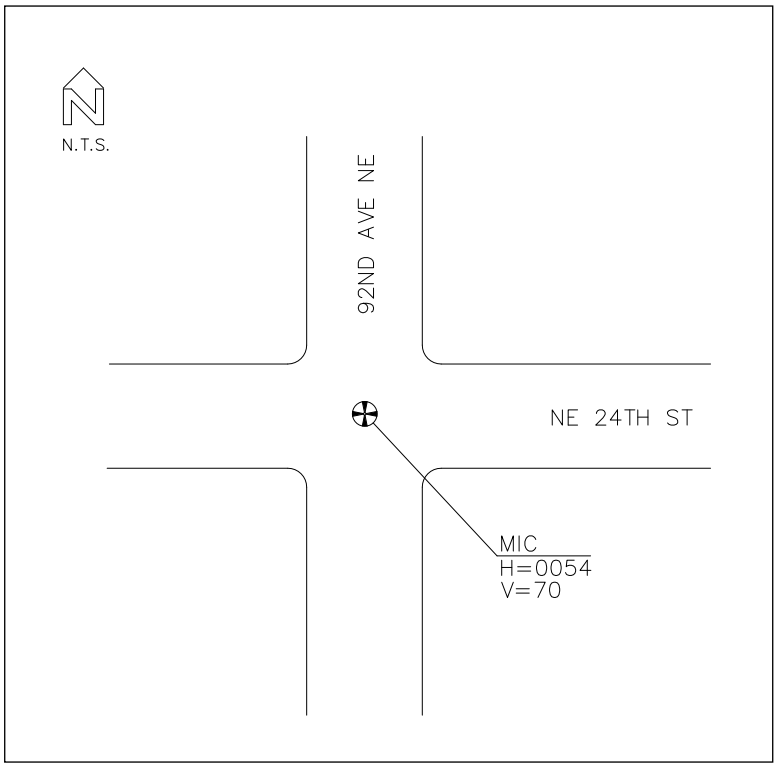
Vertical Control - NAVD 88

Vert. Id	Location	Description	Elev. (US Feet)
70	92ND AVE NE & NE 24TH ST.	CONCRETE MON W/ 2" DIA BRASS CAP W/ PUNCH MK IN CASE; TOP MON TO TOP RIM CASE 1.67 FEET.	292.534
843	EASTERLY OF 2 MONS @ INTERSECTION NE 24TH ST & 94TH AVE NE.	CONCRETE MON W/ 2" DIA BRASS DISC W/ PUNCH MK (EAST SIDE DISC) IN CASE; TOP MON TO TOP RIM CASE 1.11 FEET.	343.756

SURVEY STATION DATA CARD

January 23, 2013

VICINITY DIAGRAM



HORIZONTAL STATION: 0054

LOCATION:

92ND AVE NE & NE 24TH ST.

DESCRIPTION:

CONCRETE MON W/ 2" DIA BRASS CAP W/ PUNCH MK IN CASE; TOP MON TO TOP RIM CASE 1.67 FEET.

LAST VISITED: 31-Aug-11

HORIZONTAL DATUM:	NAD 83(2011) - Washington North Zone			
NORTHING:	71,197.684	Meters (± .005)	233,587.736	US Feet (± .018)
EASTING:	395,955.829	Meters (± .003)	1,299,065.081	US Feet (± .010)
SCALE FACTOR:	.9999780000	Grid	.9999677423	Combined
CONVERGENCE ANGLE:	-01 01 50.86			
LATITUDE:	N 47 37 55.03031			
LONGITUDE:	W 122 13 04.22629			
ELLIPSOID HEIGHT:	65.449	Meters (± .012)	214.727	US Feet (± .038)

VERTICAL DATUM: NAVD 88 **BENCH MARK:** 70

ORTHOMETRIC ELEVATION: 89.165 Meters (± .002) 292.534 US Feet (± .008)

ACCURACY ESTIMATES AT 95% CONFIDENCE LEVEL.