The Joy of Geodetics

P/C Greg Shay, JN-ACN
Raleigh Sail and Power Squadron
District 27
Sept 5, 2017

Do you enjoy a good scavenger hunt, finding lost treasure, the excitement of discovery - or just performing a valuable public service while enjoying a fun-to-do off-water activity?

If yes , then participation in the Geodetic Mark Recovery Program may be just the thing for you!

Topics Covered in this Presentation

1. USPS / NOAA Partnership
2. National Geodetic Survey
3. What and Why of Markers
4. Types of Markers
5. Where Markers are Placed
6. Aids to Locate Markers
7. Planning for Marker Recoveries
8. Conducting Marker Recoveries
9. Submitting Marker Recovery Reports
10. Some Memorable Marker Recoveries

USPS Cooperative Charting / Geodetic Program

An agreement first executed between USPS and NOAA in 1963

The Geodetic Marker Recovery Program is included in the Coop Charting agreement.

The USPS Triangle and Civic Service Activities

- Vessel Safety Checks
- Waterway Clean-Ups
- Boat Shows
- Coop Charting Nautical
- Geodetic Marker Recovery

The National Geodetic Survey - Historical

Earliest roots of the Survey:

The "Survey of the Coast", our Nation's first civilian scientific agency, was established by President Thomas Jefferson in 1807. Its mission was, and still is, to survey the U.S. coastline and create nautical charts of the coast to help increase maritime safety.

Formation of the Geodetic Survey:

As the nation grew westward surveys of the U.S. interior began. In 1878 the agency was given a new name, the "U.S. Coast and Geodetic Survey" (USC&GS), which it maintained until 1970.

Current organization:

In 1970 a reorganization created the National Oceanic and Atmospheric Administration (NOAA) and a line office to it, the National Ocean Service (NOS). To acknowledge the geodetic portion of NOAA's mission, the part of NOS responsible for geodetic functions was named the "National Geodetic Survey".

Location of the National Geodetic Survey

U.S. Department of Commerce
US DOC

↑

National Oceanic and Atmospheric Administration
NOAA

NOAA is one of 9 "Units" in the US DOC

↑

National Ocean Service
NOS

NOS is one of 9 "Service Groups" in NOAA

↑

NGS

NGS is one of 7 "Functions" in NOS

What are Geodetic Survey Markers?

Geodetic markers are highly accurate surveying reference points established on the surface of the earth by local, state, and national agencies (e.g. NGS). NGS maintains a database of the markers.

Some Synonyms:

- Survey Marker
- Survey Mark
- Survey Datum
- Survey Point
- Control Point
- Benchmark *
- Station Mark
- Passive Monument

* "Bench Mark" (two words) is a specific type of vertical mark

What is a Marker Recovery?

Marker Recovery is the act of locating a geodetic marker in the field and reporting its condition along with any new or supplemental information on its location relative to surroundings.

USPS Geodetic Recovery Reporting Steps

1) Geodetic Marker Recovered

2) Recovery Report Submitted to USPS

3) Report Reviewed by USPS for Acceptance

4) Compliant Report forwarded to NGS

5) NGS Updates Database

Why is Marker Recovery Important?

Geodetic survey markers are placed to establish "key permanent survey points" on the earth's surface. Preservation of the markers is of utmost importance to users (surveyors, map makers, builders, engineers, and other professionals). Users need to know which marks are still viable, missing, or need maintenance. Many valuable geodetic marks are destroyed by construction, new roads, erosion, or for other causes.

Damaged Marker
Out of Service

Mark Registry in the Geodetic Survey Database

PID (Permanent Identifier) - All marks in the NGS Database have a unique PID consisting of 2 letters + 4 digits. The PID does not appear on the disk.

PID Examples: **DK0943, EZ8211**

Designation (Name) – Nearly all marks also have a Designation stamped on the disk and also recorded in the NGS Database.

Designation Examples: name of a person, place, thing, or an alpha numeric.

Types of Geodetic Survey Marks

Survey Marks are of two basic types:

Horizontal Control

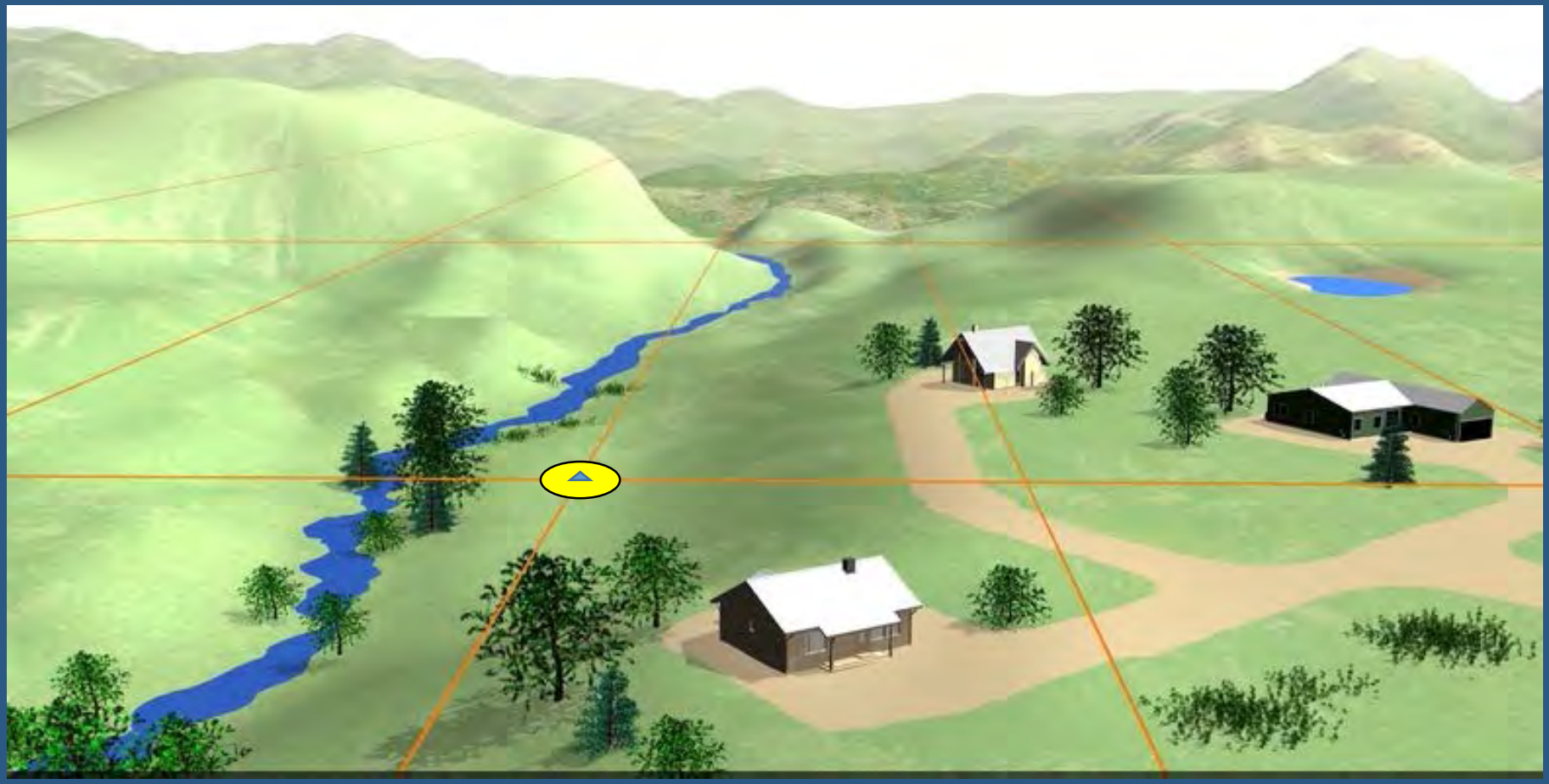
Vertical Control

Some Marks are both horizontal and vertical.

Although the advances in GPS technology have made the horizontal reference marks less of a necessity in surveying, GPS cannot measure elevations accuracy, so the vertical reference marks are still necessary for accurate surveying.

Horizontal Control Marks

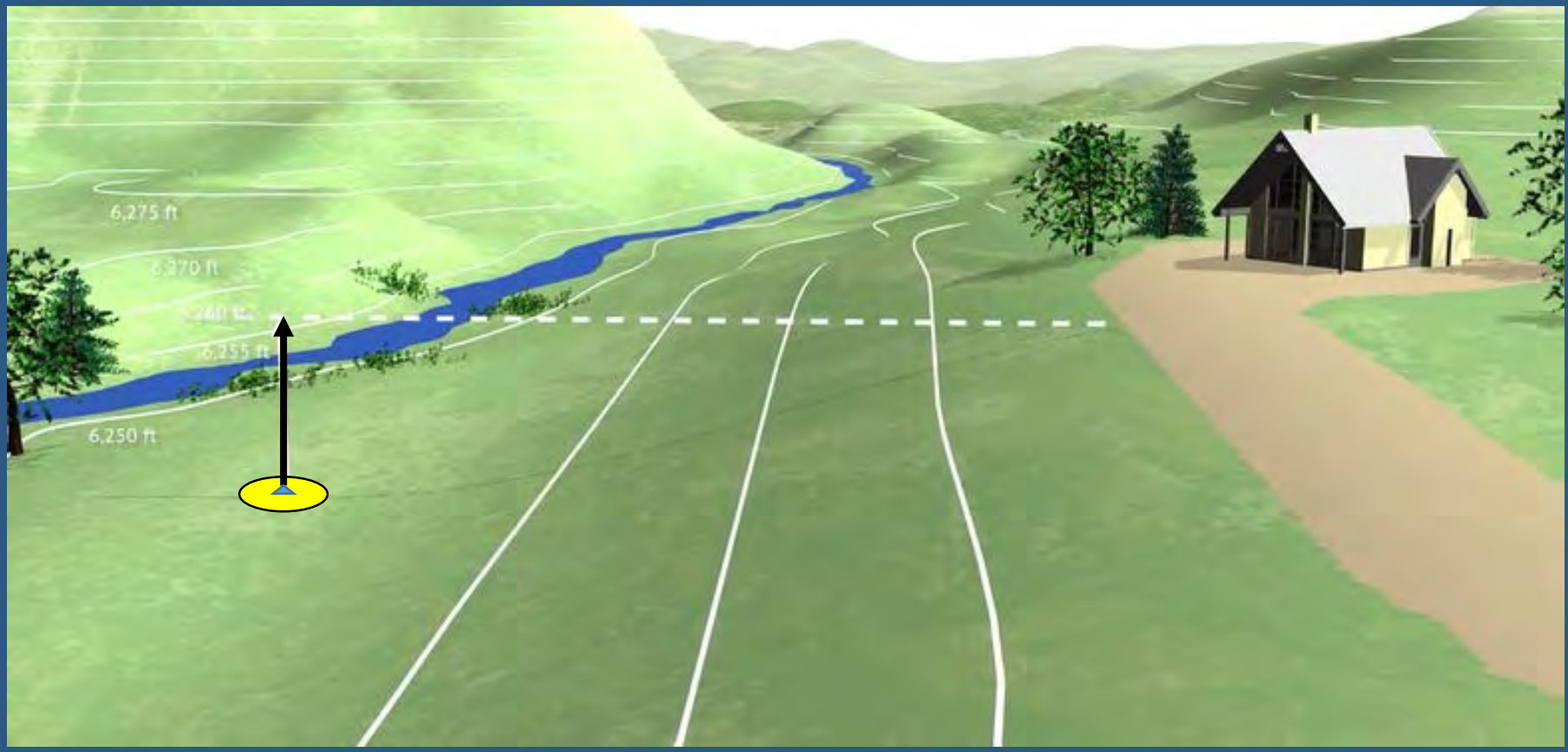
- Used for distances and directions across surface of earth
- Latitude / Longitude coordinates define position
- Current Horizontal NA Datum is NAHD 83 (1983)



Picture modified from NOAA Video Library

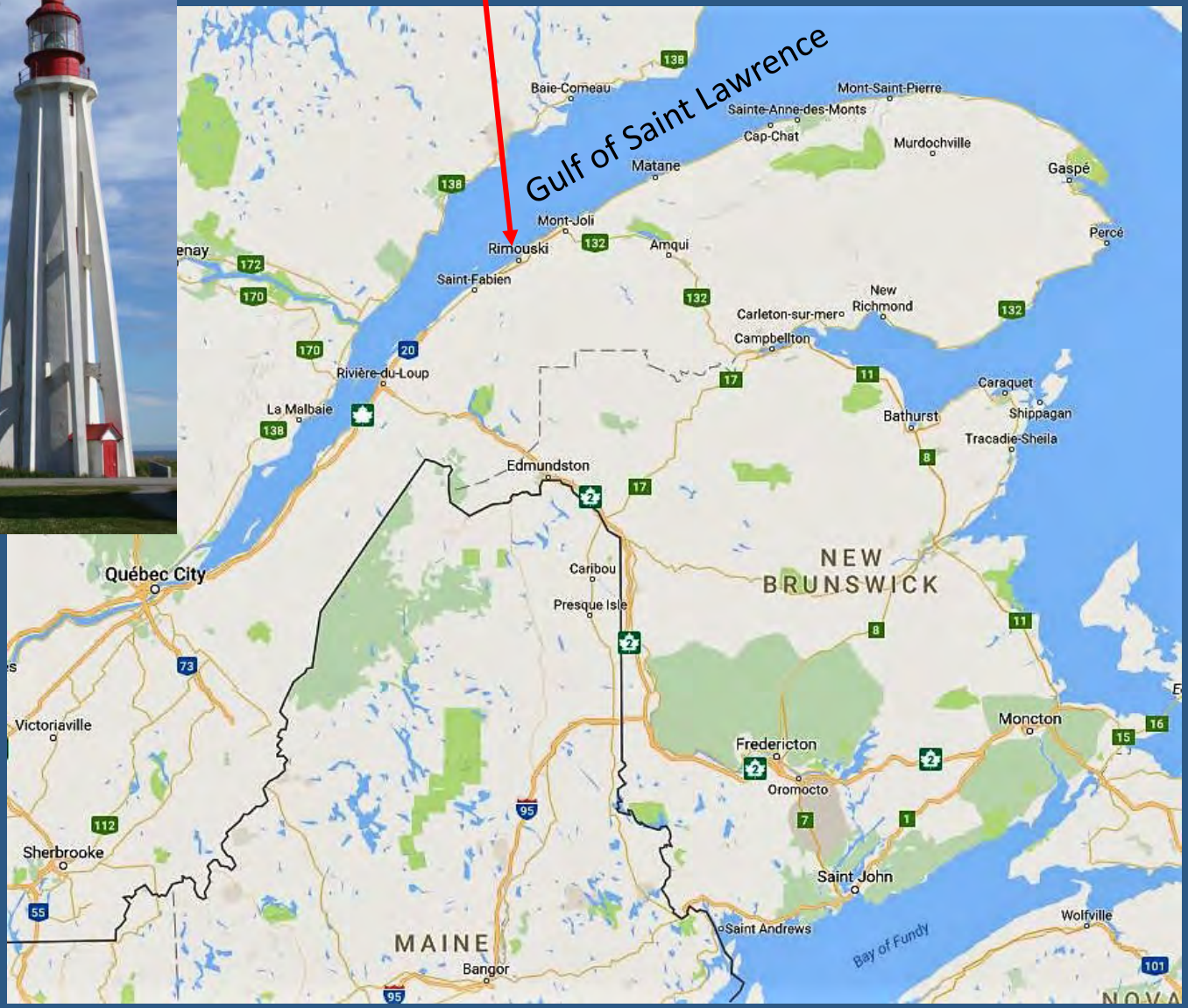
Vertical Control Marks

- Used for elevations, water depths, flood plains
- Current NA Vertical Datum is NAVD 88 (1988)
- The “0” elevation reference point is the mean tide at Father Point tidal station, Rimouski, Quebec CAN



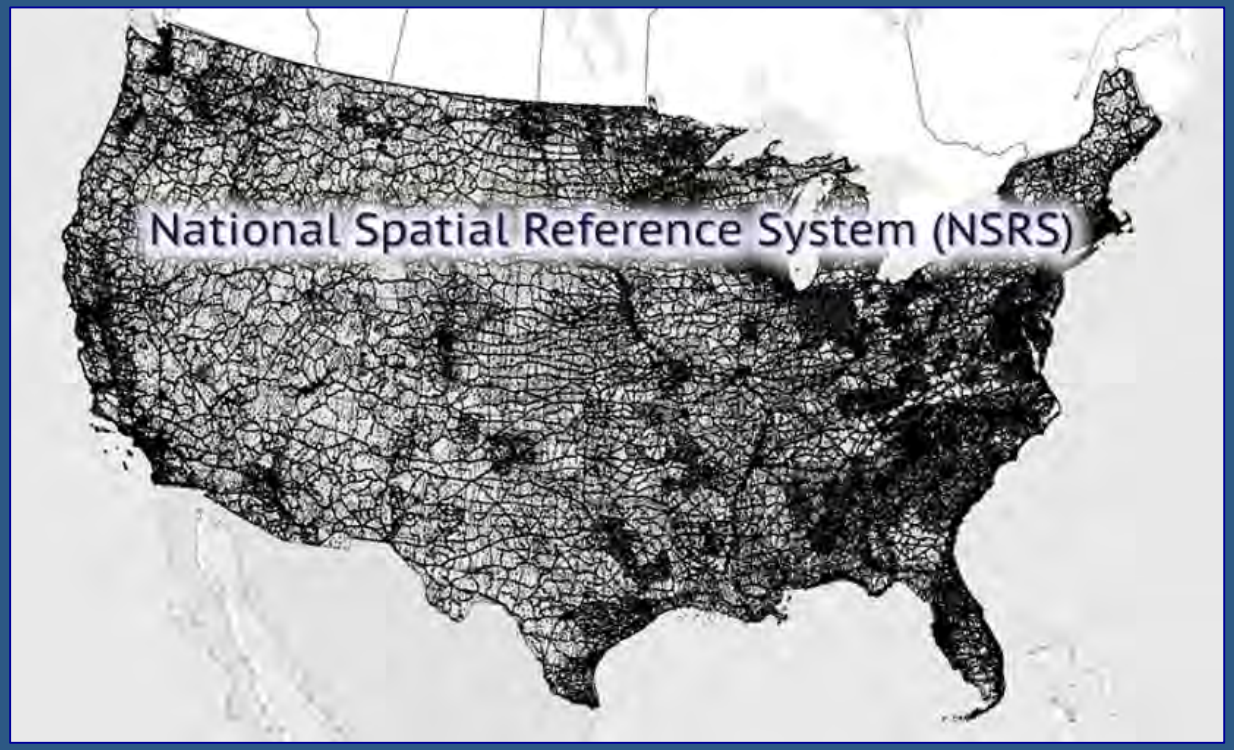
Picture modified from NOAA Video Library

Rimouski, Quebec, CAN



The National Spatial Reference System

The common set of reference point benchmarks from the horizontal and vertical datums in the United States make up what is known as the National Spatial Reference System (NSRS).



Picture from NOAA Video Library

Approximately 1.2 Million points (marks & GPS) based on 200 years of historical data

Physical Types of Marks in the Field

Most geodetic marks are **round metal discs** (bronze, brass, stainless steel, or aluminum) roughly 3 inches in diameter, firmly imbedded in concrete, building stone, bedrock, or on top of a long rod driven into the ground. These marks can be horizontal and/or vertical controls.

Disc Type Mark

Some geodetic marks are simply **rods** (no disc on top) – top center of the rod is the mark – rod marks are often Vertical Controls

Access Cover Closed

Access Cover Open

Rod Type Mark

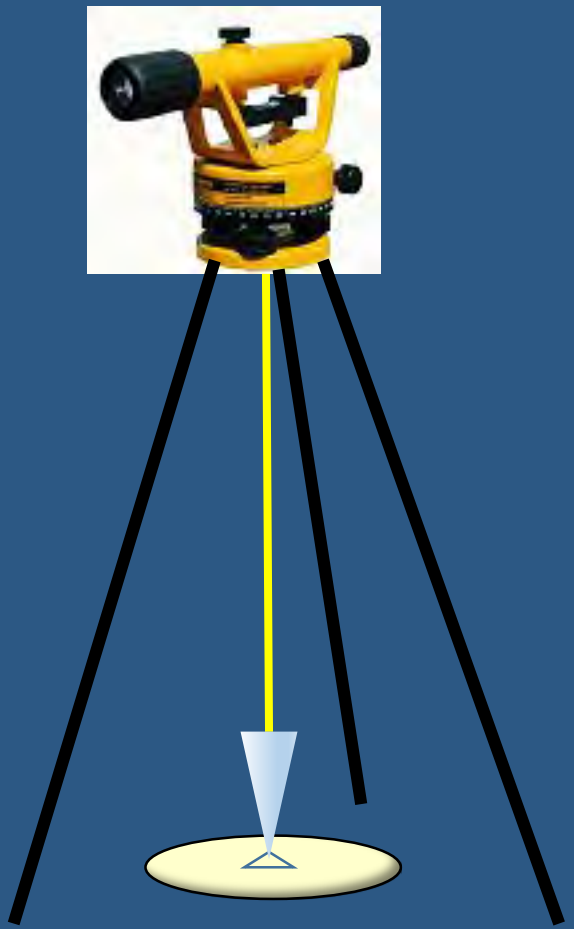
Some geodetic marks are unconventional – e.g. etched in stone, capped pipes, nails, spikes etc.

EY0044 - Columbia NC

AQ1544 – St. Augustine, FL

Unconventional Type Marks

For Surveying – Plumb bob is dropped over center point of Mark



Examples of Disc Type Marks

Some standard survey symbols on geodetic disc type marks

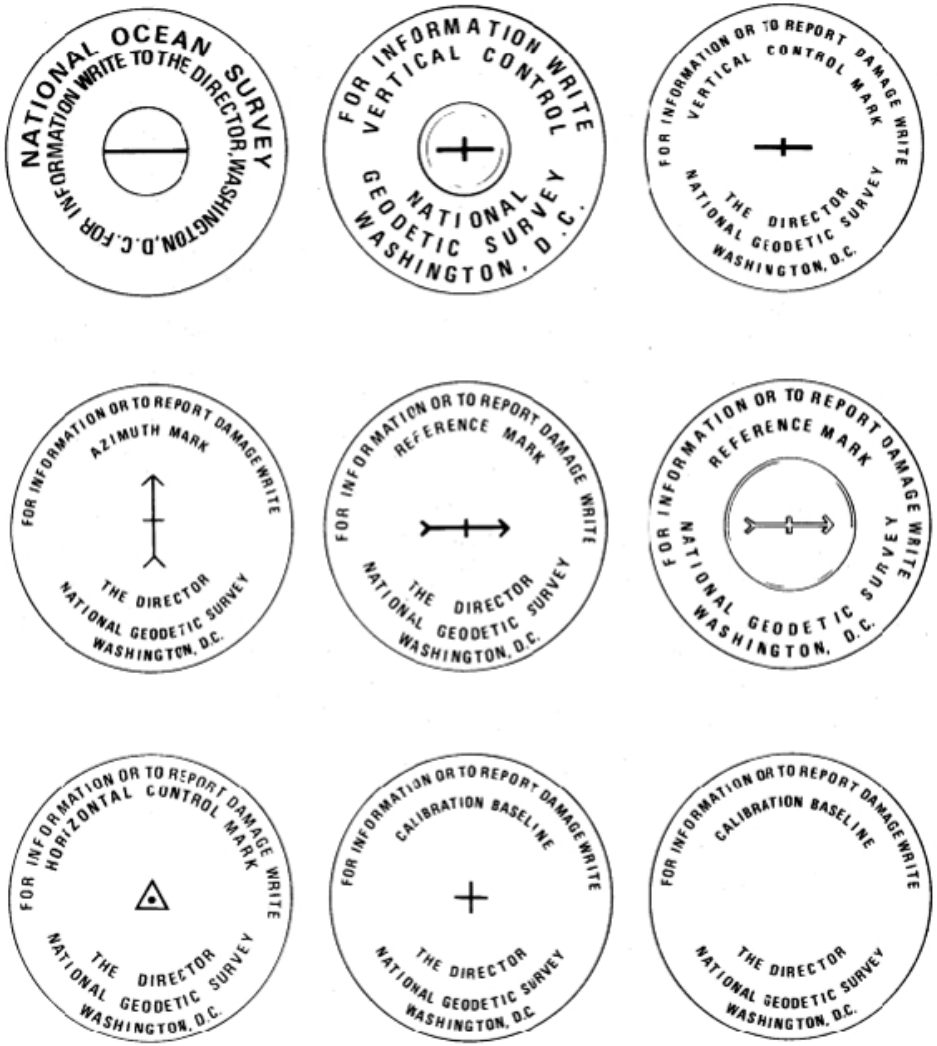


Figure 3b.—Standard marks of the National Ocean Survey/National Geodetic Survey

Disk Type Marks –
a kaleidoscope of colors and definition - and each one is "unique"

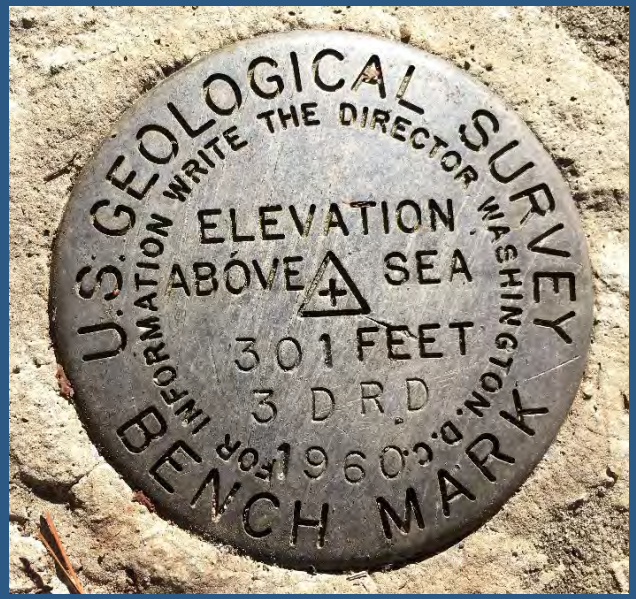
Examples of Disc Type Marks

Examples of Disc Type Marks

Examples of Disc Type Marks

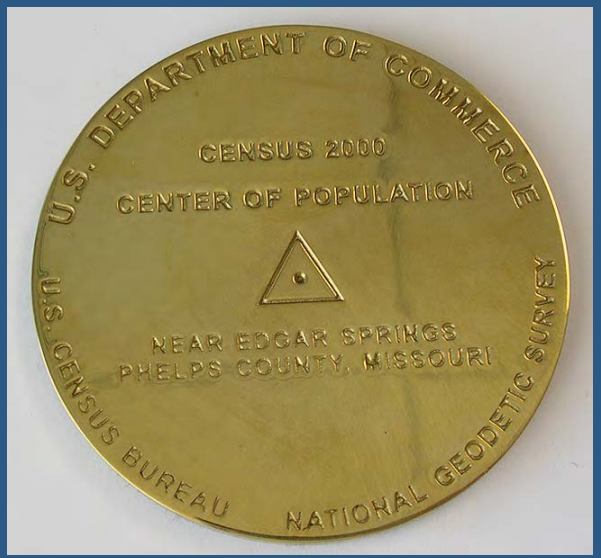
Examples of Disc Type Marks

Examples of Disc Type Marks



Some Disk Type Marks are Commemorative

Examples of Commemorative Discs



Examples of Commemorative Discs

Examples of Commemorative Discs

DE5174 – USPS HQ, Raleigh, NC

N 35° 48’ 07.3730”, W 078° 42’ 24.0728”

GPS Height – 496 ft.

Penalty for willfully destroying, defacing, changing, moving, or removing a Mark

- **1896 Statute** – "$250 * Fine or Imprisonment"
- **1909 & 1948 Statutes** – "fined not more than $250, or imprisonment not more than 6 months, or both"
- **1994 Statute** revision – "fined under this title, or imprisonment not more than 6 months or both"

* Fine in todays dollars more than $6000 !

Where are marks placed?

Marks set in concrete at ground level

By far, these are the most common marks out there!

EZ1151 – Cary, NC

EZ1054 – Holly Springs, NC

Marks set in concrete at ground level

EX0471 – Nags Head, NC

DF5617 – Near Duck, NC

Marks set in concrete pillars

QW0399 – Billings, MT

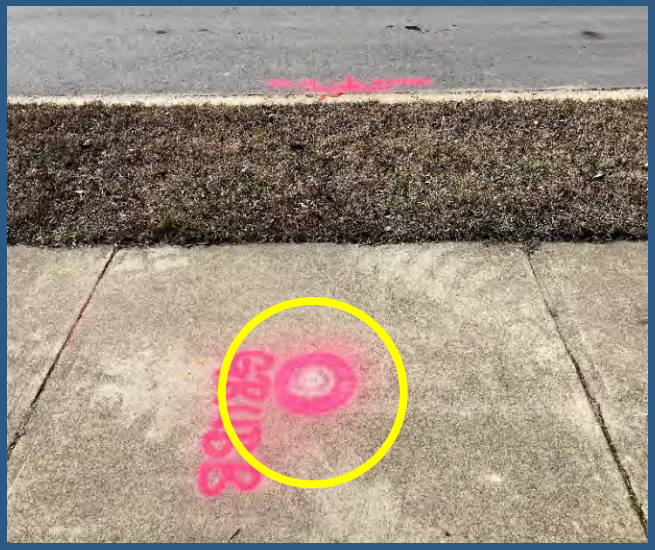
Marks set in concrete pillars

HO0213 – Kanarraville, UT

EZ6086 – Benson, NC

Marks set in sidewalks

EZ5441 – Cary, NC



DF5351 – Holly Springs, NC

Z5324 – Holly Springs, NC

Marks set in a stoops or steps

QW0723 - Yellowstone County Museum, Billings MT

FW0734 – Currituck Beach Light House, Corolla NC

EY2369 – New Bern, NC

CH0605 – Hilton Head, SC

Marks set in a bridge wingwall / abutment

AH9271 – Manteo, NC

JM-0315 – Moab, UT

Marks set in a bridge railings

DL8483 – Near Jordan Lake, NC

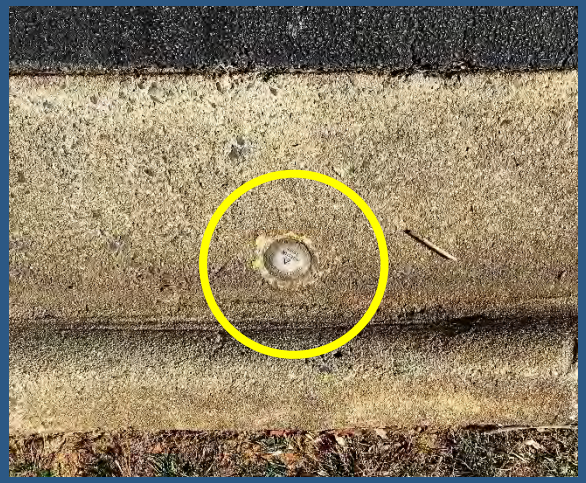
HO0047 – Near Tropic, UT

Marks set in headwalls of culverts

DE6462 – Duck, NC

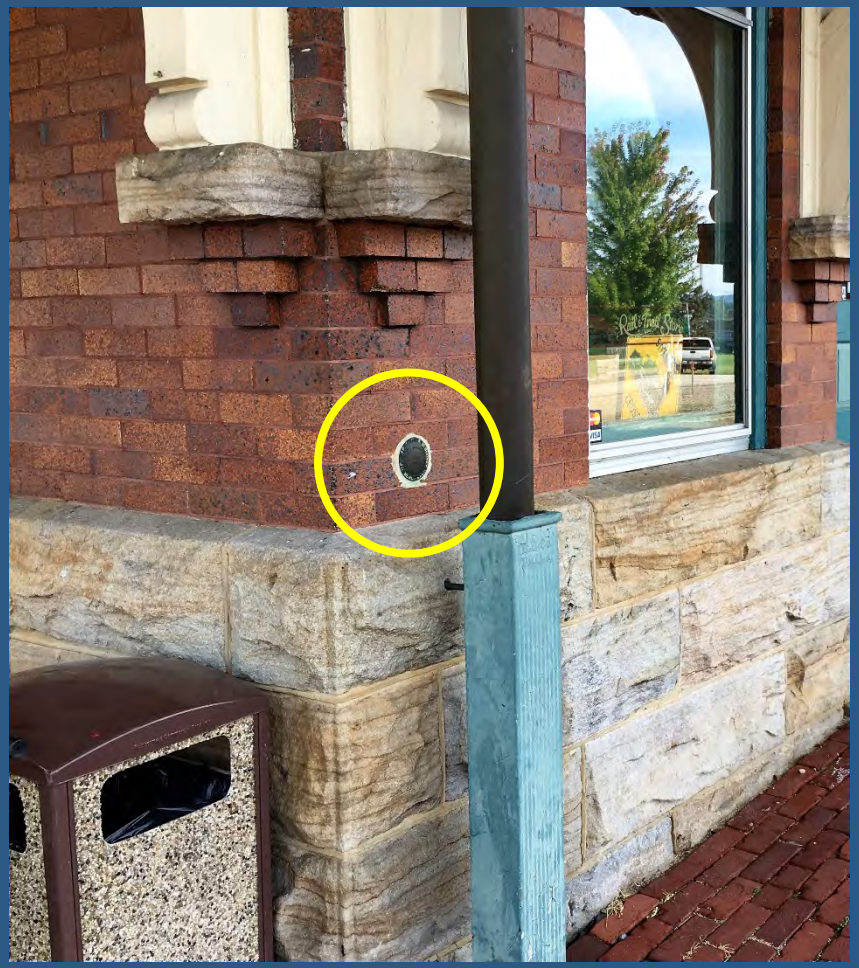
AI7029 - Holly Springs, NC

Marks set in curbs or curb gutters



AI7031 - Holly Springs, NC

EY0619 - New Bern, NC



HW1894 – Elkins, VA

Marks set in a stone or masonry walls

Marks set in a stone or masonry walls

HO0208 – Cedar City, Utah

EZ0385 – Benson, NC

Marks recessed in metal casings

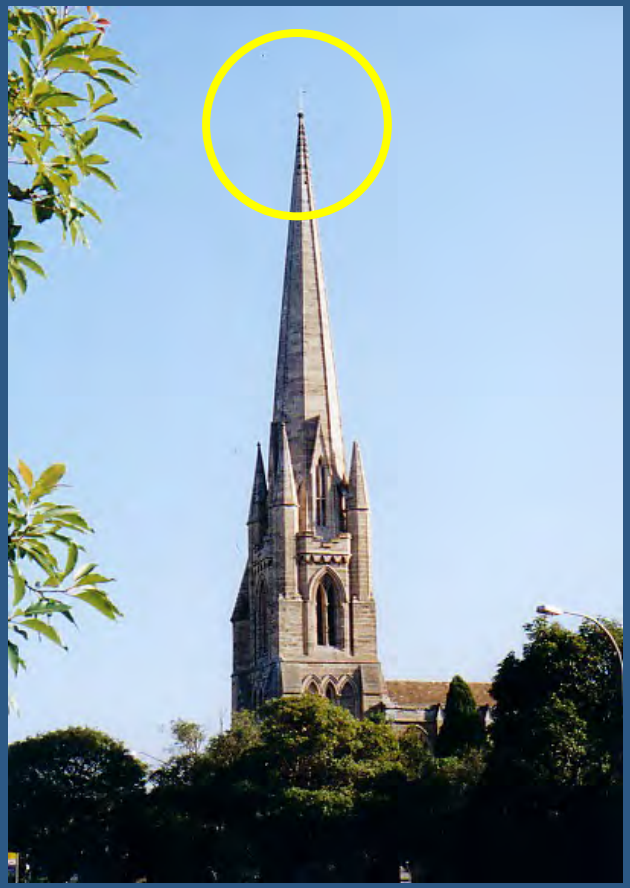
Marks set in natural rock outcrops

JM0225 – MOAB, UT

QW0400 – Billings, MT

PX0413 – Beartooth Wilderness, WY

Marks set on top of Spires, Towers, and Tanks



Note: No USPS Credit Points are awarded for recovering these marks – NGS has low interest in these marks

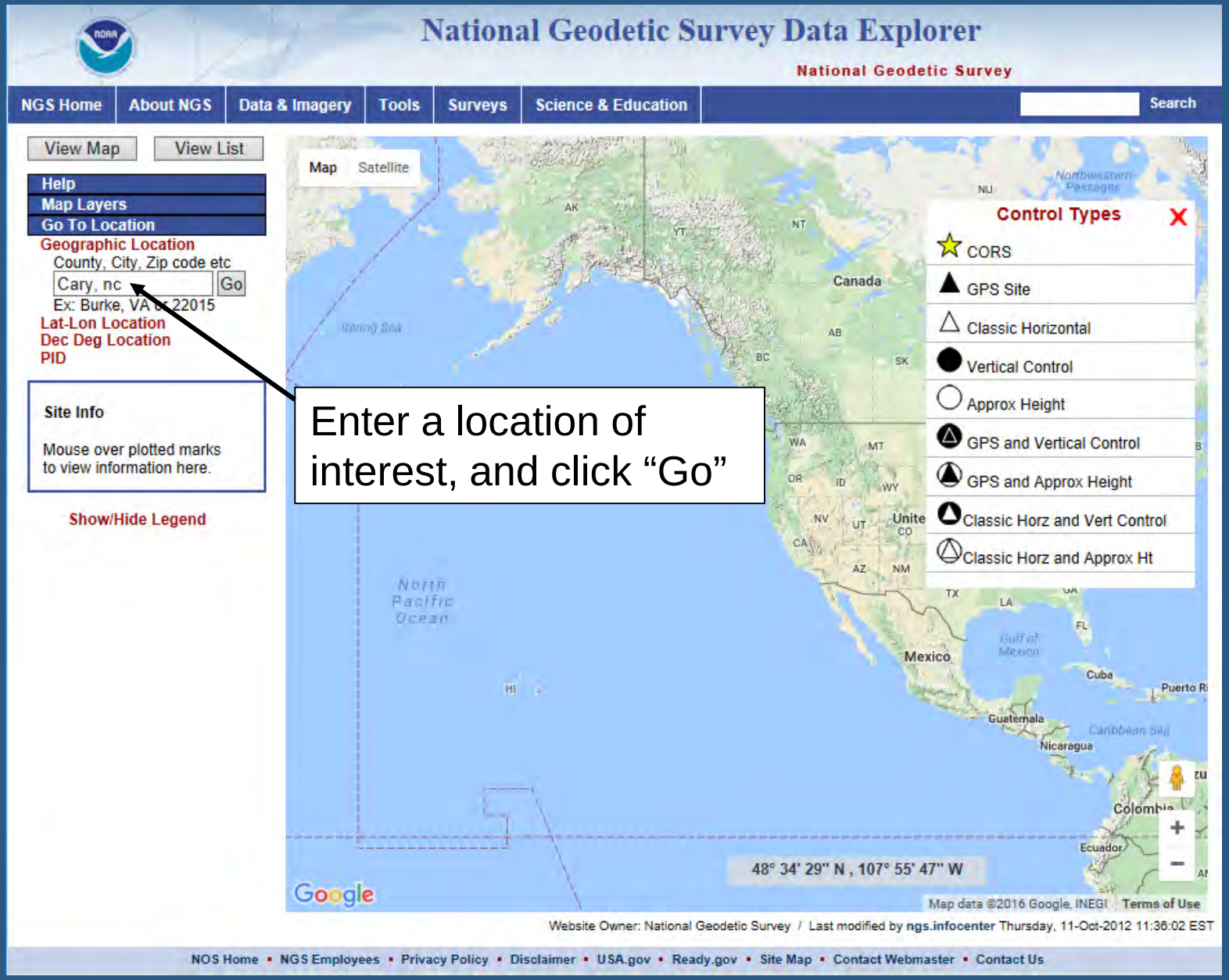
Planning for a Marker Recovery

There are several resources in the NOAA / NGS website to assist in Marker Recoveries

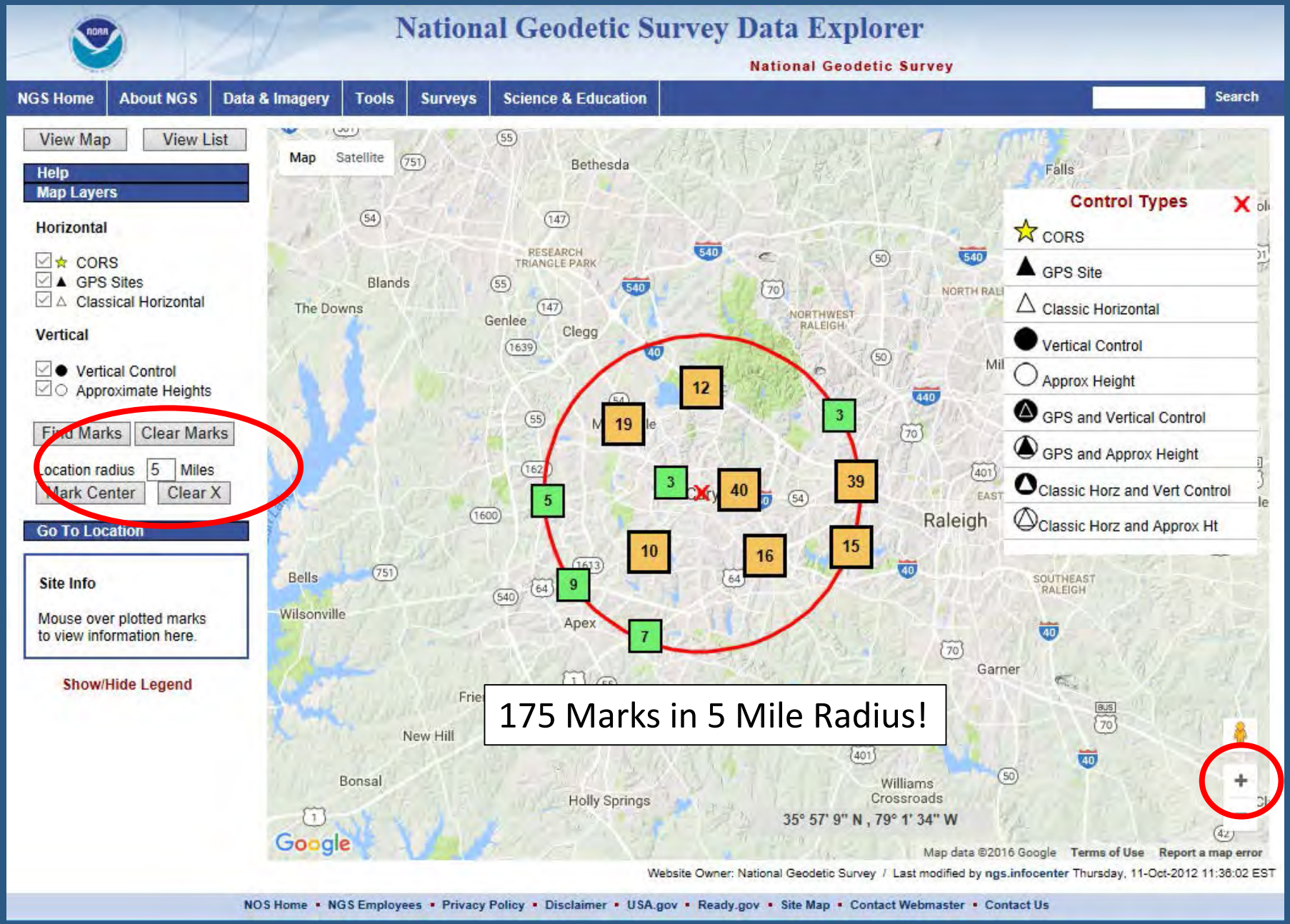
The most useful among these is "**National Geodetic Survey Data Explorer**" which shows the location of all markers in a given area on a zoomable map with search functions.

https://www.ngs.noaa.gov/NGSDataExplorer/

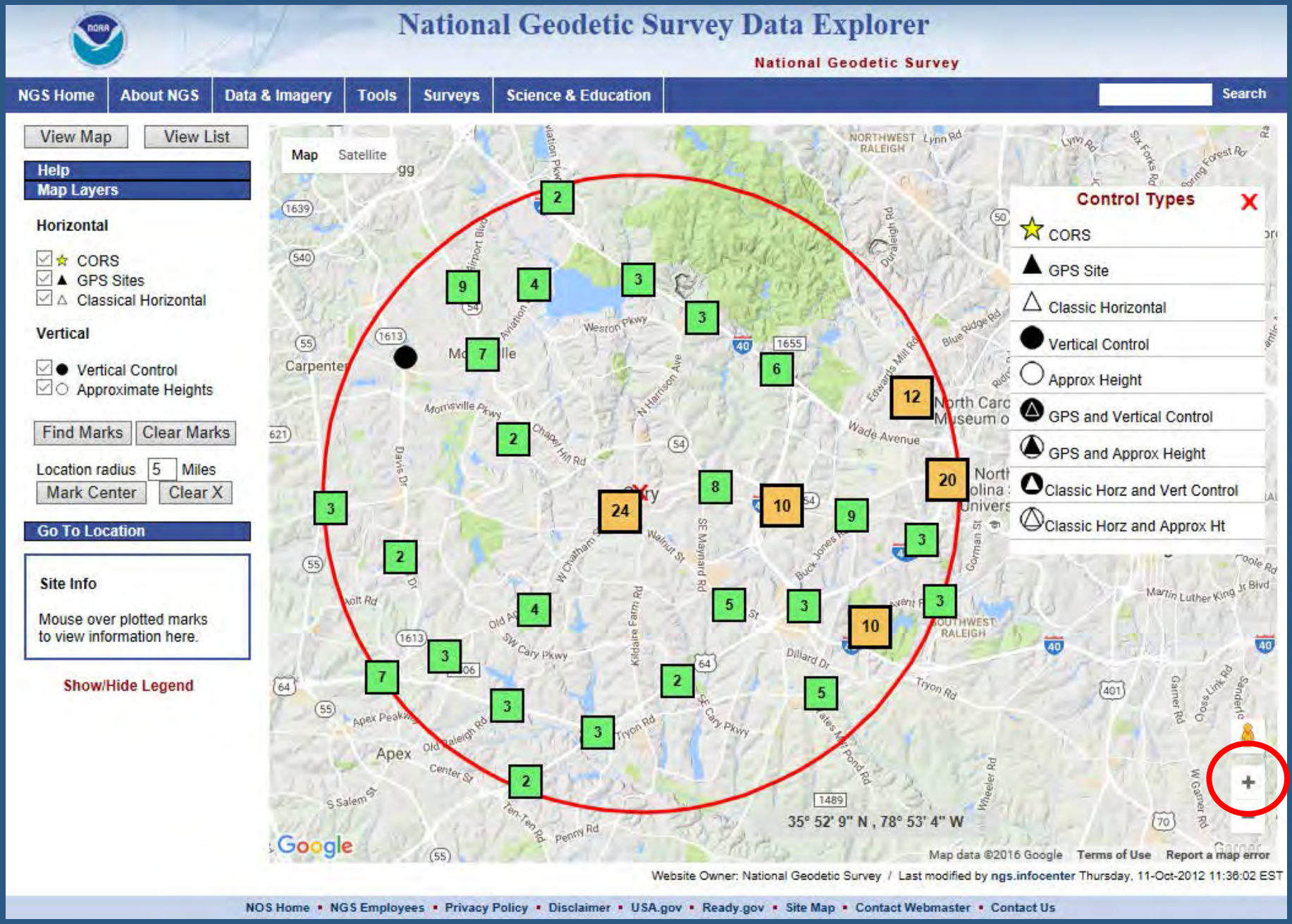
Pull up NGS Data Explorer – Shows map of NA & Marker Types



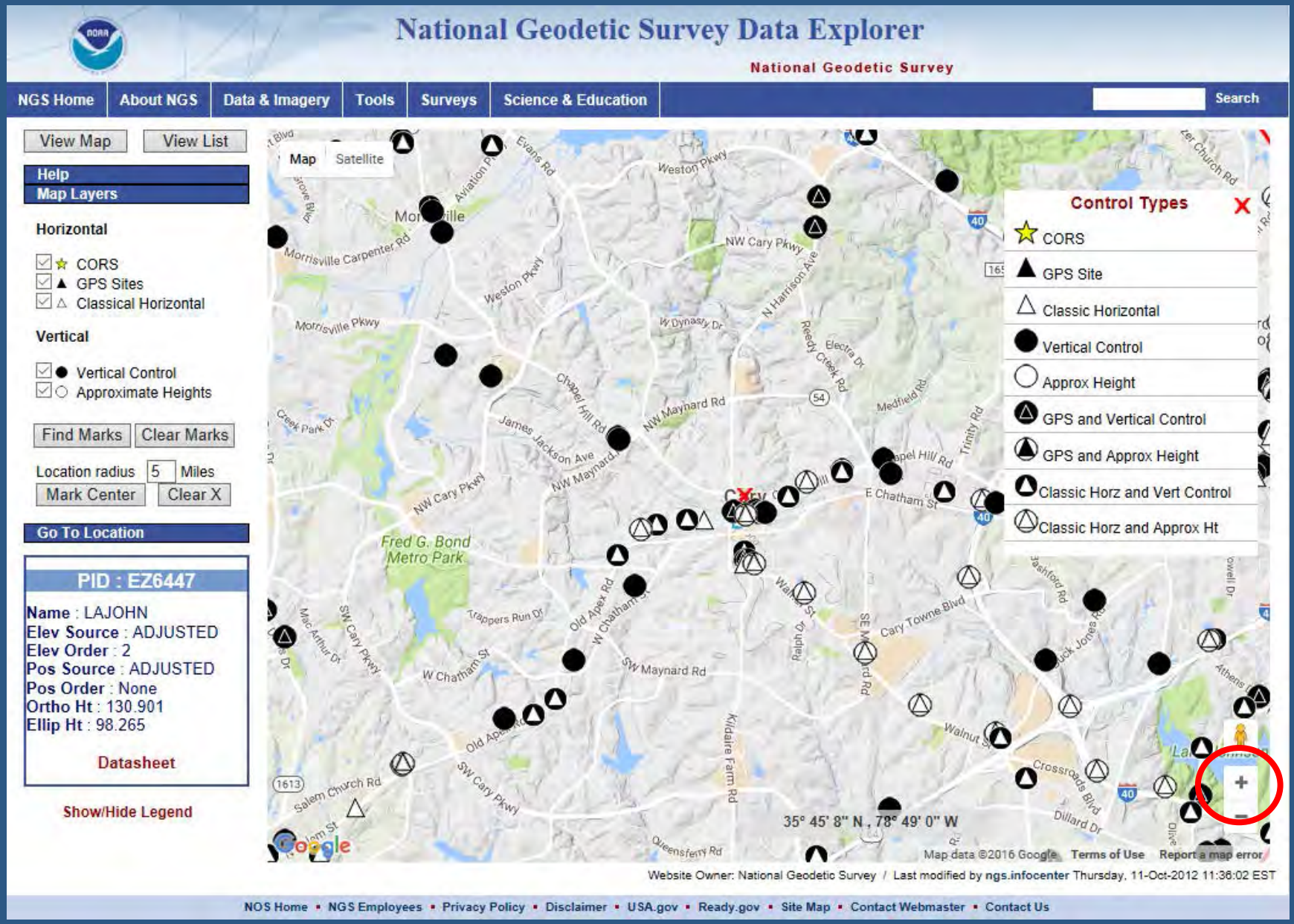
This brings up the location with Marks – 5 mile radius Cary at center



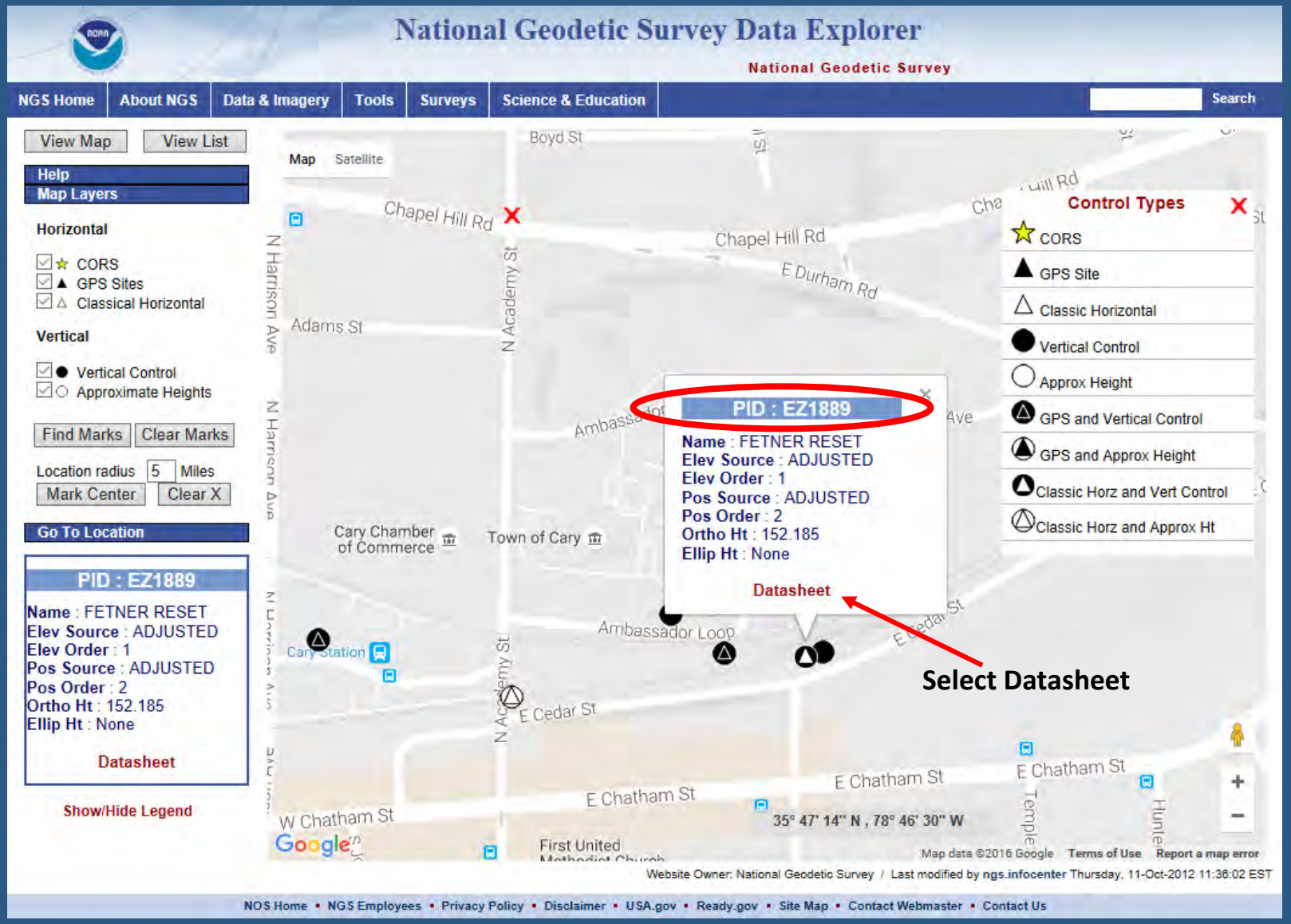
Zoom in to show more detailed distribution of Marks



Zoom in again and program starts showing individual Marks



Clicking mark brings a Pop-up with PID# - Click on Datasheet



Mark PID, Designation, Coordinates, Height at Beginning of Data Sheet

The NGS Data Sheet

See file dsdata.txt for more information about the datasheet.

```
PROGRAM = datasheet95, VERSION = 8.10
1         National Geodetic Survey,   Retrieval Date = OCTOBER 31, 2016
 EZ1889 ***********************************************************************
 EZ1889  DESIGNATION -  FETNER RESET
 EZ1889  PID         -  EZ1889
 EZ1889  STATE/COUNTY-  NC/WAKE
 EZ1889  COUNTRY     -  US
 EZ1889  USGS QUAD   -  CARY (1993)
 EZ1889
 EZ1889                            *CURRENT SURVEY CONTROL
 EZ1889 ______________________________________________________________________
 EZ1889* NAD 83(2001) POSITION- 35 47 17.90507(N) 078 46 42.71181(W)    ADJUSTED
 EZ1889* NAVD 88 ORTHO HEIGHT -   152.185 (meters)      499.29   (feet) ADJUSTED
 EZ1889 ______________________________________________________________________
 EZ1889  GEOID HEIGHT    -        -32.303 (meters)                      GEOID12B
 EZ1889  LAPLACE CORR    -         -6.30  (seconds)                     DEFLEC12B
 EZ1889  DYNAMIC HEIGHT  -        152.056 (meters)      498.87   (feet) COMP
 EZ1889  MODELED GRAVITY -    979,779.0   (mgal)                        NAVD 88
 EZ1889
 EZ1889  HORZ ORDER      -  SECOND
 EZ1889  VERT ORDER      -  FIRST     CLASS II
 EZ1889
 EZ1889.The horizontal coordinates were established by classical geodetic methods
 EZ1889.and adjusted by the National Geodetic Survey in August 2005.
 EZ1889.
 EZ1889.The orthometric height was determined by differential leveling and
 EZ1889.adjusted by the NATIONAL GEODETIC SURVEY
 EZ1889.in June 1991.
 EZ1889
 EZ1889.Significant digits in the geoid height do not necessarily reflect accuracy
```

Historical Status near middle of Data Sheet

```
EZ1889
EZ1889_MARKER: DS = TRIANGULATION STATION DISK
EZ1889_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
EZ1889_STAMPING: FETNER 1918 1980
EZ1889_MARK LOGO: NGS
EZ1889_PROJECTION: RECESSED 8 CENTIMETERS
EZ1889_MAGNETIC: O = OTHER; SEE DESCRIPTION
EZ1889_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
EZ1889+STABILITY: SURFACE MOTION
EZ1889_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
EZ1889+SATELLITE: SATELLITE OBSERVATIONS - May 28, 2008
EZ1889
EZ1889  HISTORY     - Date     Condition       Report By
EZ1889  HISTORY     - 1980     MONUMENTED      NGS
EZ1889  HISTORY     - 1980     GOOD            NGS
EZ1889  HISTORY     - 1985     GOOD            USPSQD
EZ1889  HISTORY     - 1988     GOOD            USPSQD
EZ1889  HISTORY     - 1989     GOOD            USPSQD
EZ1889  HISTORY     - 20050609 GOOD            GEOCAC
EZ1889  HISTORY     - 20060919 GOOD            USPSQD
EZ1889  HISTORY     - 20080520 GOOD            NCGS
EZ1889
EZ1889                          STATION DESCRIPTION
EZ1889
EZ1889'DESCRIBED BY NATIONAL GEODETIC SURVEY 1980
EZ1889'IN CARY.
EZ1889'0.05 MILE NORTH ALONG ACADEMY STREET FROM INTERSECTION WITH
EZ1889'CHATHAM STREET IN CARY, TO FIRE STATION, THENCE 0.15 MILE EAST
EZ1889'ALONG CEDAR STREET, AT INTERSECTION WITH NORTH WALKER STREET, 46.7
EZ1889'FEET WEST OF RM 2, 16.1 FEET SOUTHWEST OF TELEGRAPH POLE WITH
EZ1889'REFERENCE TAG, 24.0 FEET SOUTH OF SOUTH RAIL OF SOUTH TRACK, 38.2
EZ1889'FEET NORTH OF FIRE HYDRANT, 88.7 FEET EAST OF SOUTHEAST CORNER OF
EZ1889'BASE OF SEMAPHORE AND 8.9 FEET NORTH OF NORTH CURB OF CEDAR STREET.
EZ1889'THE MARK IS 1.5 FT  W FROM A WITNESS POST.
EZ1889'THE MARK IS 1 FT ABOVE STREET.
EZ1889
```

Location information below History section

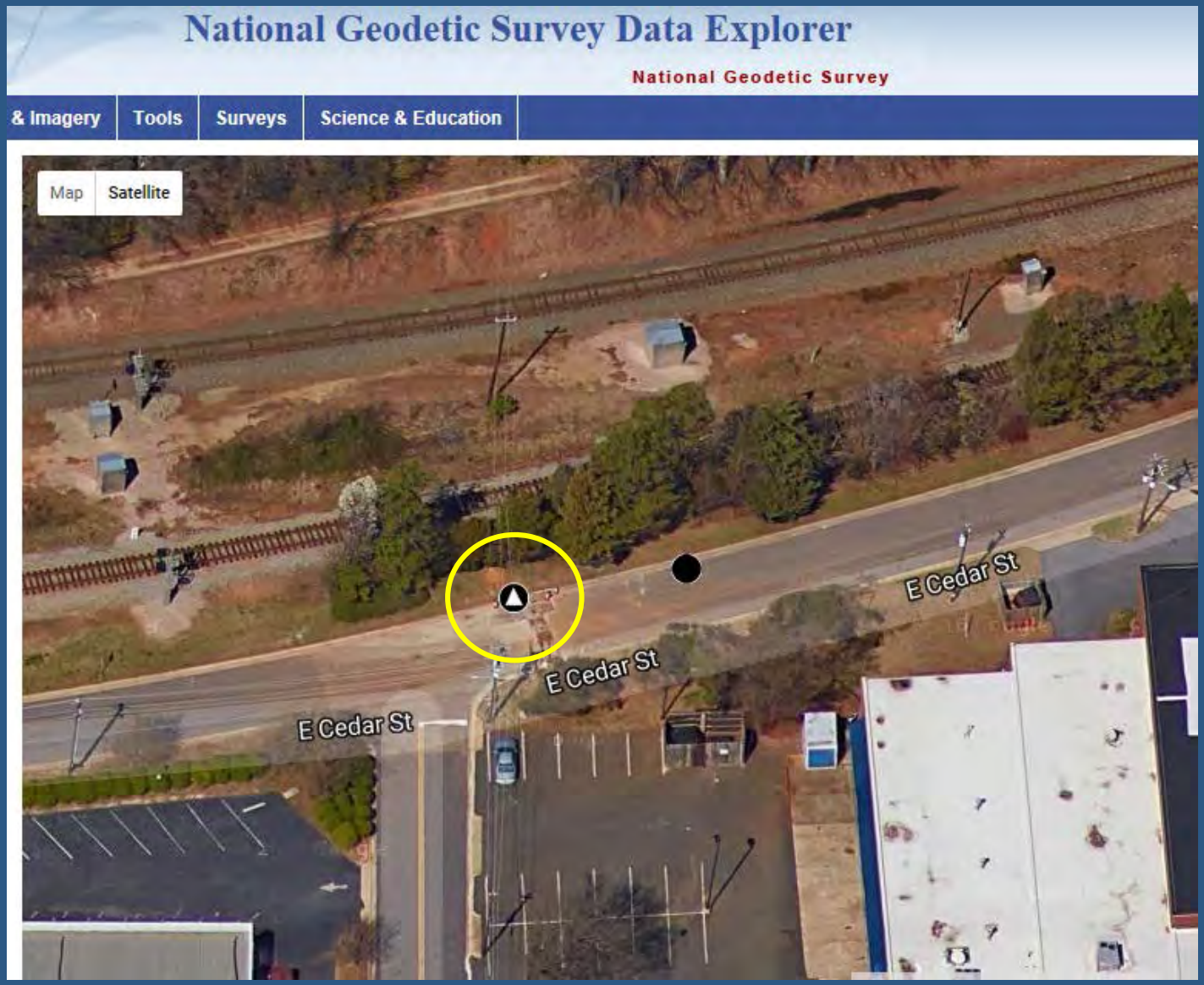
```
EZ1889
EZ1889_MARKER: DS = TRIANGULATION STATION DISK
EZ1889_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
EZ1889_STAMPING: FETNER 1918 1980
EZ1889_MARK LOGO: NGS
EZ1889_PROJECTION: RECESSED 8 CENTIMETERS
EZ1889_MAGNETIC: O = OTHER; SEE DESCRIPTION
EZ1889_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
EZ1889+STABILITY: SURFACE MOTION
EZ1889_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
EZ1889+SATELLITE: SATELLITE OBSERVATIONS - May 20, 2008
EZ1889
EZ1889  HISTORY      - Date     Condition        Report By
EZ1889  HISTORY      - 1980     MONUMENTED       NGS
EZ1889  HISTORY      - 1980     GOOD             NGS
EZ1889  HISTORY      - 1985     GOOD             USPSQD
EZ1889  HISTORY      - 1988     GOOD             USPSQD
EZ1889  HISTORY      - 1989     GOOD             USPSQD
EZ1889  HISTORY      - 20050609 GOOD             GEOCAC
EZ1889  HISTORY      - 20060919 GOOD             USPSQD
EZ1889  HISTORY      - 20080520 GOOD             NCGS
EZ1889
EZ1889                          STATION DESCRIPTION
EZ1889
EZ1889'DESCRIBED BY NATIONAL GEODETIC SURVEY 1980
EZ1889'IN CARY.
EZ1889'0.05 MILE NORTH ALONG ACADEMY STREET FROM INTERSECTION WITH
EZ1889'CHATHAM STREET IN CARY, TO FIRE STATION, THENCE 0.15 MILE EAST
EZ1889'ALONG CEDAR STREET, AT INTERSECTION WITH NORTH WALKER STREET, 46.7
EZ1889'FEET WEST OF RM 2, 16.1 FEET SOUTHWEST OF TELEGRAPH POLE WITH
EZ1889'REFERENCE TAG, 24.0 FEET SOUTH OF SOUTH RAIL OF SOUTH TRACK, 38.2
EZ1889'FEET NORTH OF FIRE HYDRANT, 88.7 FEET EAST OF SOUTHEAST CORNER OF
EZ1889'BASE OF SEMAPHORE AND 8.9 FEET NORTH OF NORTH CURB OF CEDAR STREET.
EZ1889'THE MARK IS 1.5 FT  W FROM A WITNESS POST.
EZ1889'THE MARK IS 1 FT ABOVE STREET.
EZ1889
```

```
EZ1889'
EZ1889'REFERENCE MARK 2 RECOVERED IN GOOD CONDITION. PUBLISHED DESCRIPTION
EZ1889'ADEQUATE, WITH ADDITION THAT MARK IS 46.7 FEET EAST OF STATION,
EZ1889'RECESSED 2 CENTIMETERS.
EZ1889'
EZ1889'BENCHMARK F 189 1967 RECOVERED IN GOOD CONDITION SOUTHEAST OF THE
EZ1889'PAIGE-WALKER HOTEL, 8.7 FEET SOUTH OF A TELEPHONE POLE, AND 1.2 FEET
EZ1889'WEST OF A WITNESS POST. PUBLISHED DESCRIPTION ADEQUATE.
EZ1889'
EZ1889'BENCHMARK G 189 WAS RECOVERED BY GEOCAC IN JUNE 2002. THE MARK WAS
EZ1889'REPORTED TO BE IN GOOD CONDITION, ALTHOUGH IT WAS NOTED THAT THERE
EZ1889'WERE SCRATCHES ACROSS THE SURFACE. THE PUBLISHED DESCRIPTION IS
EZ1889'ADEQUATE.
EZ1889'
EZ1889
EZ1889                          STATION RECOVERY (2006)
EZ1889
EZ1889'RECOVERY NOTE BY US POWER SQUADRON 2006
EZ1889'RECOVERED IN GOOD CONDITION.
EZ1889
EZ1889                          STATION RECOVERY (2008)
EZ1889
EZ1889'RECOVERY NOTE BY NORTH CAROLINA GEODETIC SURVEY 2008 (WMK)
EZ1889'RECOVERED IN GOOD CONDITION WITH CHANGES.
EZ1889'
EZ1889'MARK IS 4 INCHES (10 CM) BELOW GROUND.  LOCATED 1.5 FT (0.5 M)
EZ1889'SOUTHWEST OF METAL WITNESS POST.  THE TELEPHONE POLE IS GONE.

*** retrieval complete.
Elapsed Time = 00:00:05
```

Usually good current information on Mark location is at end of data sheet location section

Satellite Map View Good for Locating the Mark



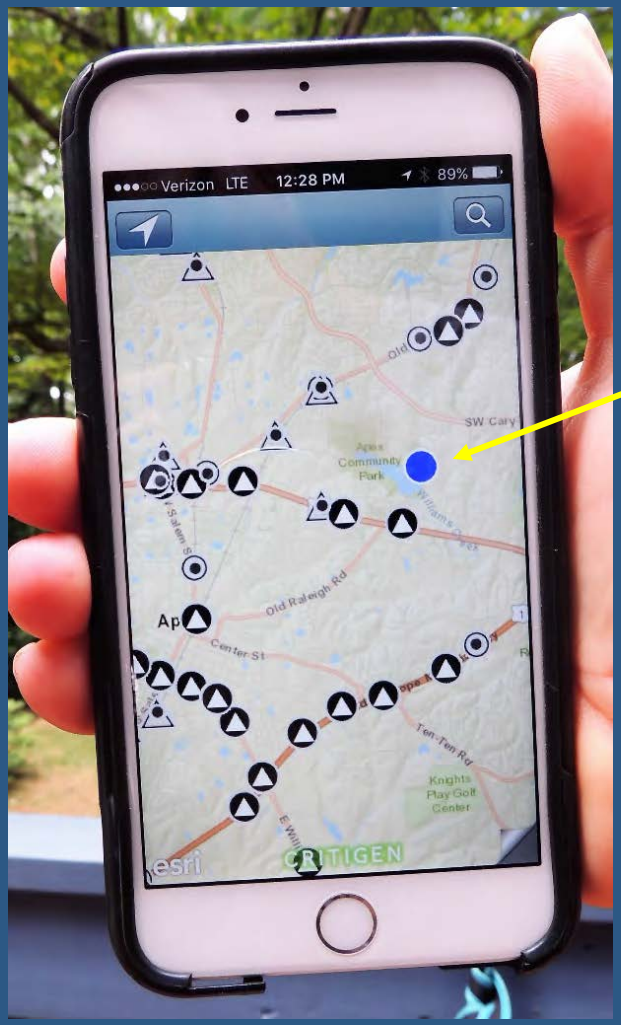
There are Smart Phone "Apps" for Geodetics

- Can use these apps in the field anywhere
- No or little preplanning required
- One App is for locating markers and viewing the datasheets
- Another App is for taking a picture of a mark found that shows the GPS coordinates and the date of recovery in the picture

Apps simplify the recovery process!

"FindAContol" - Example App for Locating and Navigating to Marks

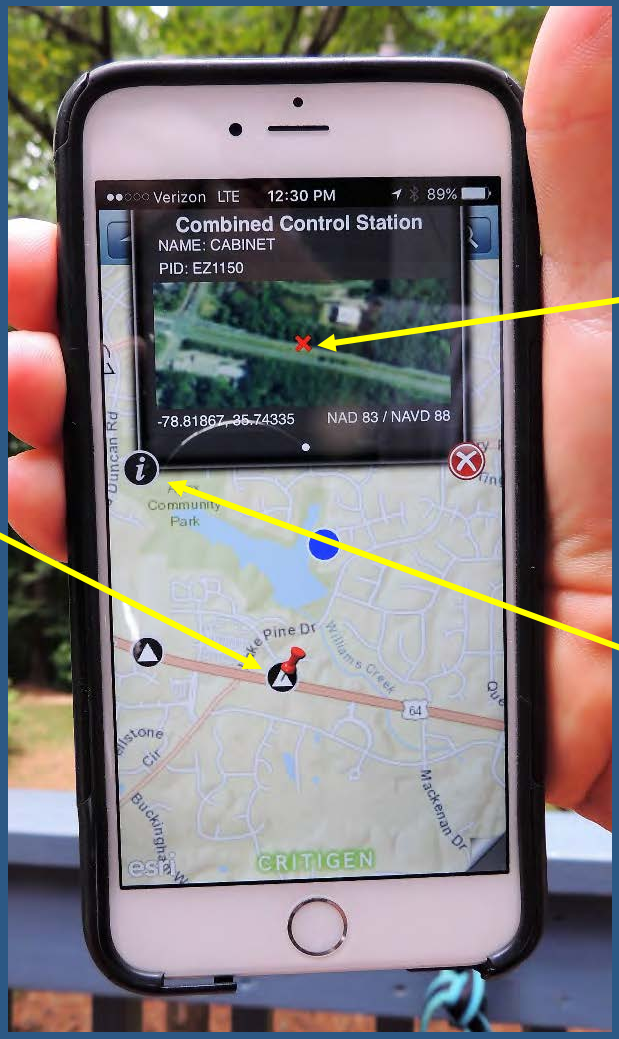
1) Open App and it shows Marks nearby



Also Shows Your Position

"FindAContol" - Example App for Locating and Navigating to Marks

2) Select a Mark of interest

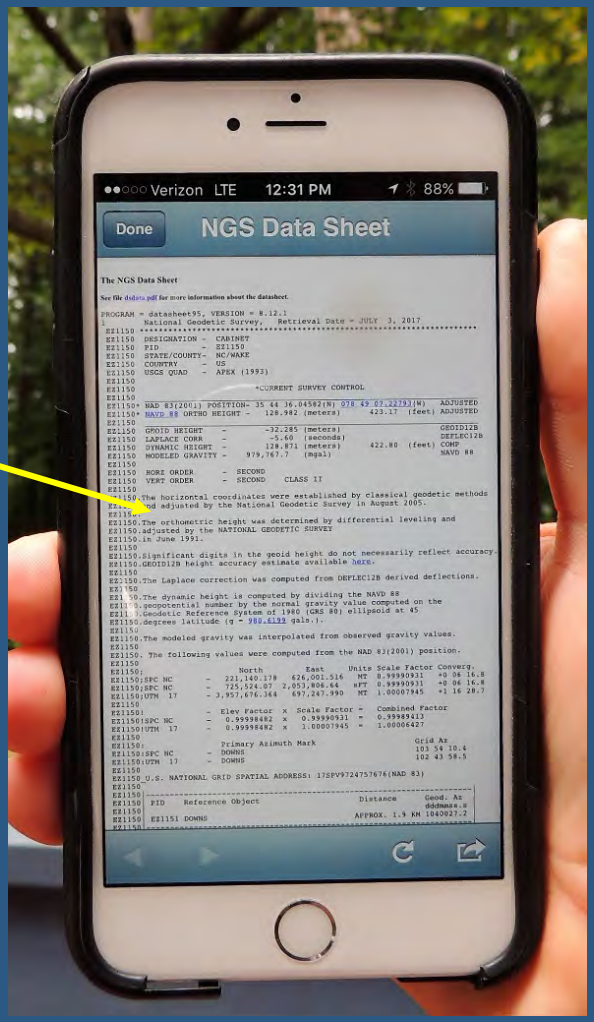


Window pops up showing satellite view, the Mark Name and the Mark PID

3) Select *"i" (information)*

“FindAContol” - Example App for Locating and Navigating to Marks

NGS Datasheet is displayed



Conducting a Mark Recovery

For Recovery Report must get a picture showing:

1. The Mark
2. The GPS Coordinates
3. The Date of Recovery

Solocator™ - Example App for Taking Pictures

Take picture of mark with this phone camera app, and picture shows:

- Mark
- Coordinates
- Date
- Elevation
- Compass Bearing

Some Marks have “visual aids” nearby to assist in locating them and to warn construction workers etc. of their presence

“Witness Posts” – near the mark

“Witness Tags” – referenece location

“Vinyl cloth X or T” - over mark

"Witness Posts"

- Signs usually placed close to a mark (often 1-2 ft)
- Lets public know a survey marker is nearby
- Datasheets often give distance and direction from mark

Examples of “Sign” Witness Posts near Marks

FY0211 – Youngsville, NC

FW0683 – Duck, NC

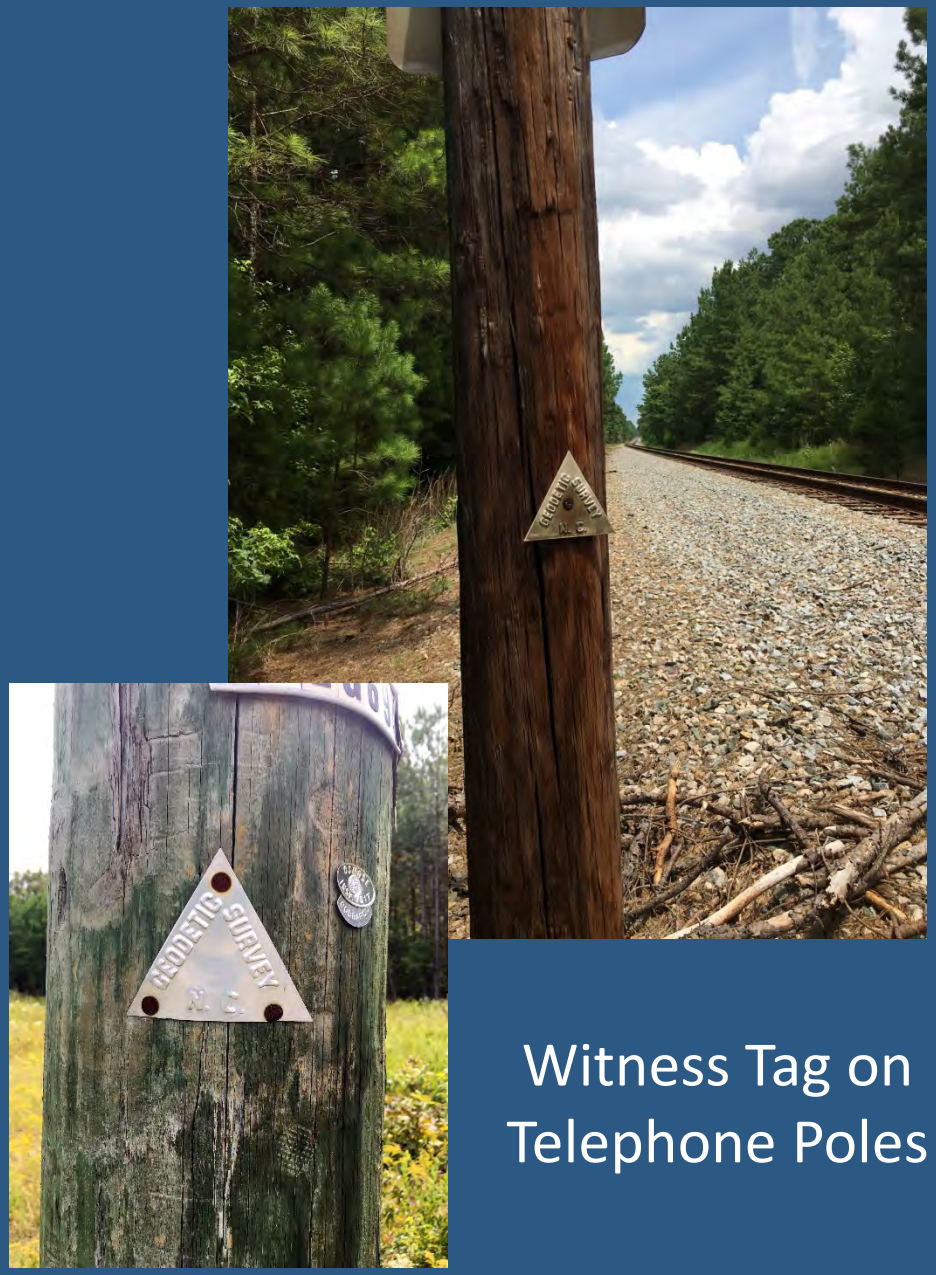
Examples of “Orange” Witness Posts near Marks

AE2728 – Switzerland, SC

AB6821 – Apex, NC

"Witness Tags"

- Placed on telephone poles, trees, fence posts etc.
- Lets public know a survey marker is nearby to
- Can be close to or farther away from a mark
- Distance and Direction from mark usually provided in Datasheet



Witness Tag on Telephone Poles

“Witness Tags”

Witness Tags on Fence Posts

“Witness Tags”

Witness Tags on Trees

Witness Tag “eaten by the tree”

FW0050 – Kitty Hawk, NC

"Vinyl Cloth" - showing location of Mark "T-Type"

Placed over the Mark

“Vinyl Cloth” - showing location of Mark “X-Type”

Placed around the Mark

Recommended Equipment for Marker Recovery

- Datasheet – or, Smartphone Datasheet App
- Handheld GPS - (WAAS best) and/or GPS Smartphone App
- Camera - for combined pic of mark, coordinates, and date – or, Smartphone camera App with coordinates & date stamp
- Tape Measure - 100 ft or longer – fast retrieve best
- Compass - handheld or Smartphone compass
- Probe – e.g. screwdriver for locating shallow buried marks and for opening lid covers
- Metal Detector – for locating buried marks
- Digging Tools – e.g. spade and small shovel
- Gloves / Machete – to clear area around mark
- Water / Towels - to clean marks
- Vehicle – optional AWD / 4WD nice to have
- Reflective Vest – for visibility in traffic areas
- First Aid Kit

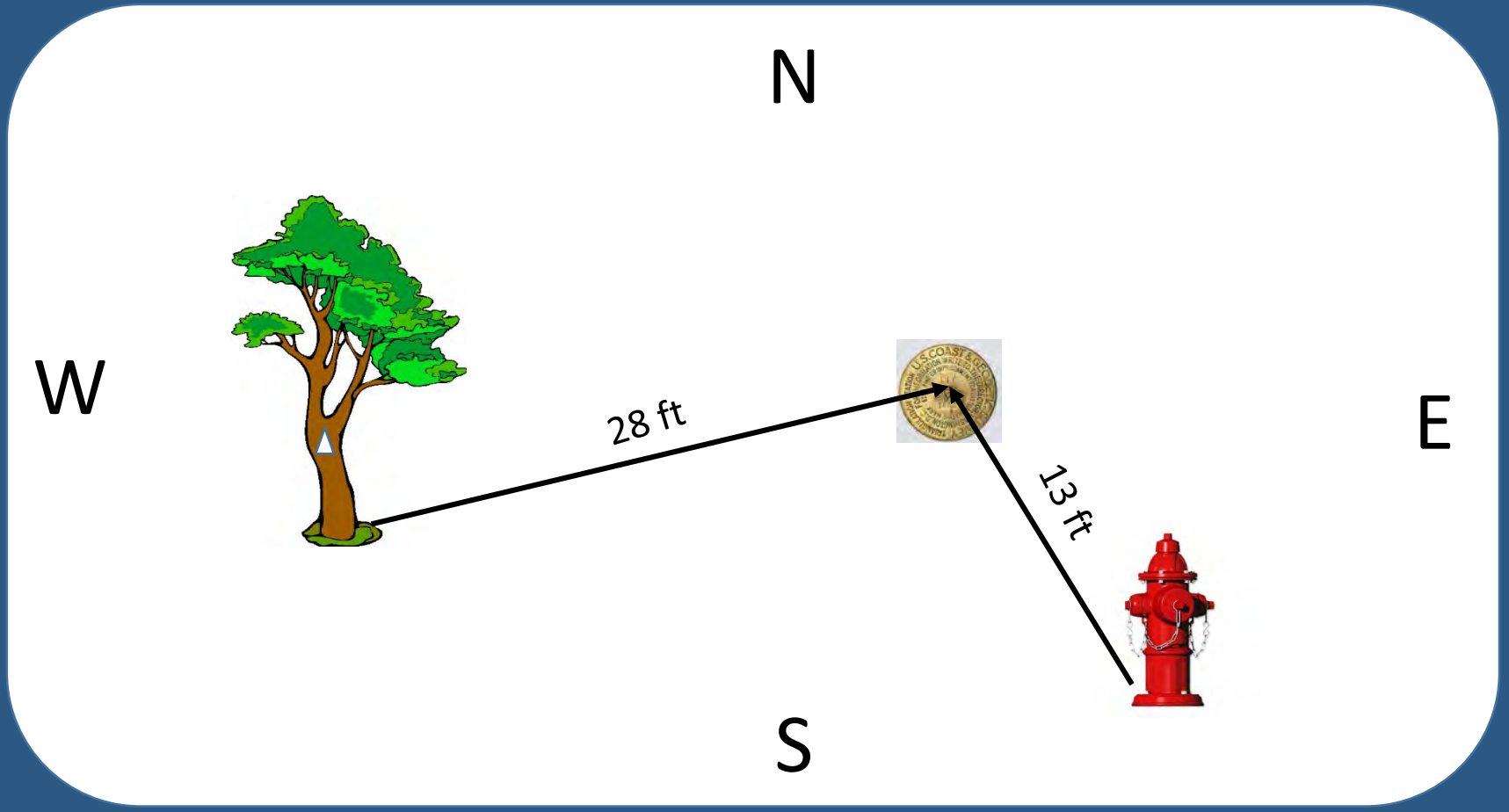
Useful tools for locating marks

Compass

Tape Measure

Example of Mark recovery with Tape Measure and Compass

mark location description in Datasheet: ….mark is located 28’ ENE of a tree with metal witness tag, and 13’ NNW of a fire hydrant



Where is that Mark? – if it is not showing on the surface, it should be under there somewhere!

Finding Marks that are Not Visible

Often Marks will be buried by dirt or sand or are covered with grass or debris

- They can be located with the aid of a metal prod or metal detector – and a small spade for shovel digging down to it
- Sometimes there is a small depression that can be seen or felt by foot - the marker is often under that depression

Bring along a bottle of water and a rag to clean the Mark once it has been recovered!

Useful tool if mark is not visible in ground

Metal Detector

Recovery Classifications

GOOD – mark found in good condition, not moved, not damaged, legible, no serious corrosion/erosion

POOR – mark found disturbed, or moved, or damaged, or scuffed, or seriously eroded/corroded, or not legible – needs maintenance

NOT FOUND – mark not found or missing from monument base

DESTROYED – mark found but physically removed from site – or not found but evidence of site destruction

Damaged or Destroyed Marks – out of service

EZ0856 – Wake Forest, NC

FW0072 – Nags Head, NC

Damaged or Destroyed Marks – out of service

Mark that is broken from metal shaft and concrete encasement

AH4783 – Benson, NC

General Recovery & Reporting Requirements

- A mark recovery may not be submitted within 24 months of the last recovery unless there is a change of status from “Not Found” to “Found”
- A mark may not be reported as “Not Found” if the previous report was “Not Found” or “Destroyed”
- All required fields must be completed on the submittal form.
- Reports must be submitted within 30 days of the investigation.

Mark Recovery Credits

- Geographical Mark (tower, cupola, etc.) – 0 credits
- Horizontal Mark - 5 credits
- Vertical or Vertical/Horizontal Mark – 10 credits
- "Not recovered, not found" for a Horizontal or Vertical Mark, 2 credit
- Bonus for Vertical or Horizontal Mark not recovered in the past 5 years. – 4 credits
- Bonus for mark recovered where last recovery was "Not recovered, not found" – 25 credits
- Bonus for Vertical or Horizontal Mark not recovered in the last 25 years. – 25 credits

Steps for Reporting a Mark Recovery

Preparing Your Pictures for a Mark Recovery Report

Note: Each picture used in a recovery report must have the PID in the filename!

Steps if you use a Smart Phone Camera with recommended Solocator* App to take pictures of the marks found:

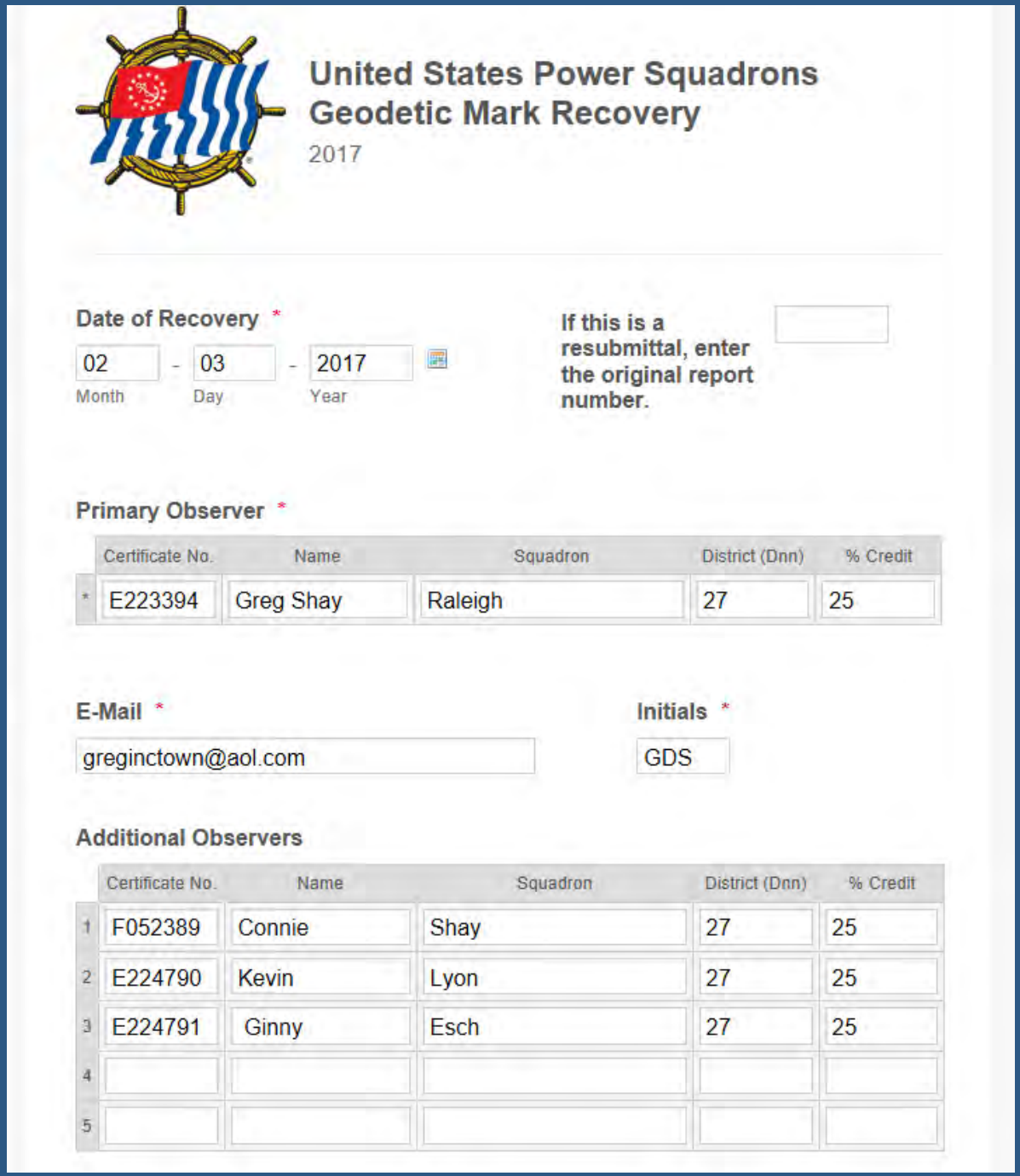
1. Make a new folder on your computer with the date of your geo mark recovery outing - example: Geo 06-12-17
2. Connect your Smartphone to the computer, and move or copy your mark pictures to that folder
3. Within that folder, add a new folder for each different mark found and name folder with the marks PID number - example EZ 2951
4. Move all pictures of a given mark into it's correct folder
5. In each folder, pick out the best picture of the mark and rename it so that it has the mark's PID in the filename, e.g. EZ 2951 Pic

Where do I go to submit a Marker Recovery Report?

1. go to the USPS Homepage at www.usps.org
2. at top of page select Members Log In
3. Log in with Certificate No. and Pin
4. at top of page select Departments
5. from dropdown list select Executive Department
6. from next dropdown list select Cooperative Charting Committee
7. on left of CCC page select Geodetic Program
8. near bottom next page select Reporting – Geodetic Reporting
9. at bottom of next page select Geodetic Report Form 2017

Marker Submittal Report

Start Page



United States Power Squadrons
Geodetic Mark Recovery
2017

Date of Recovery *

02 - 03 - 2017

Month Day Year

If this is a resubmittal, enter the original report number.

Primary Observer *

	Certificate No.	Name	Squadron	District (Dnn)	% Credit
*	E223394	Greg Shay	Raleigh	27	25

E-Mail *

greginctown@aol.com

Initials *

GDS

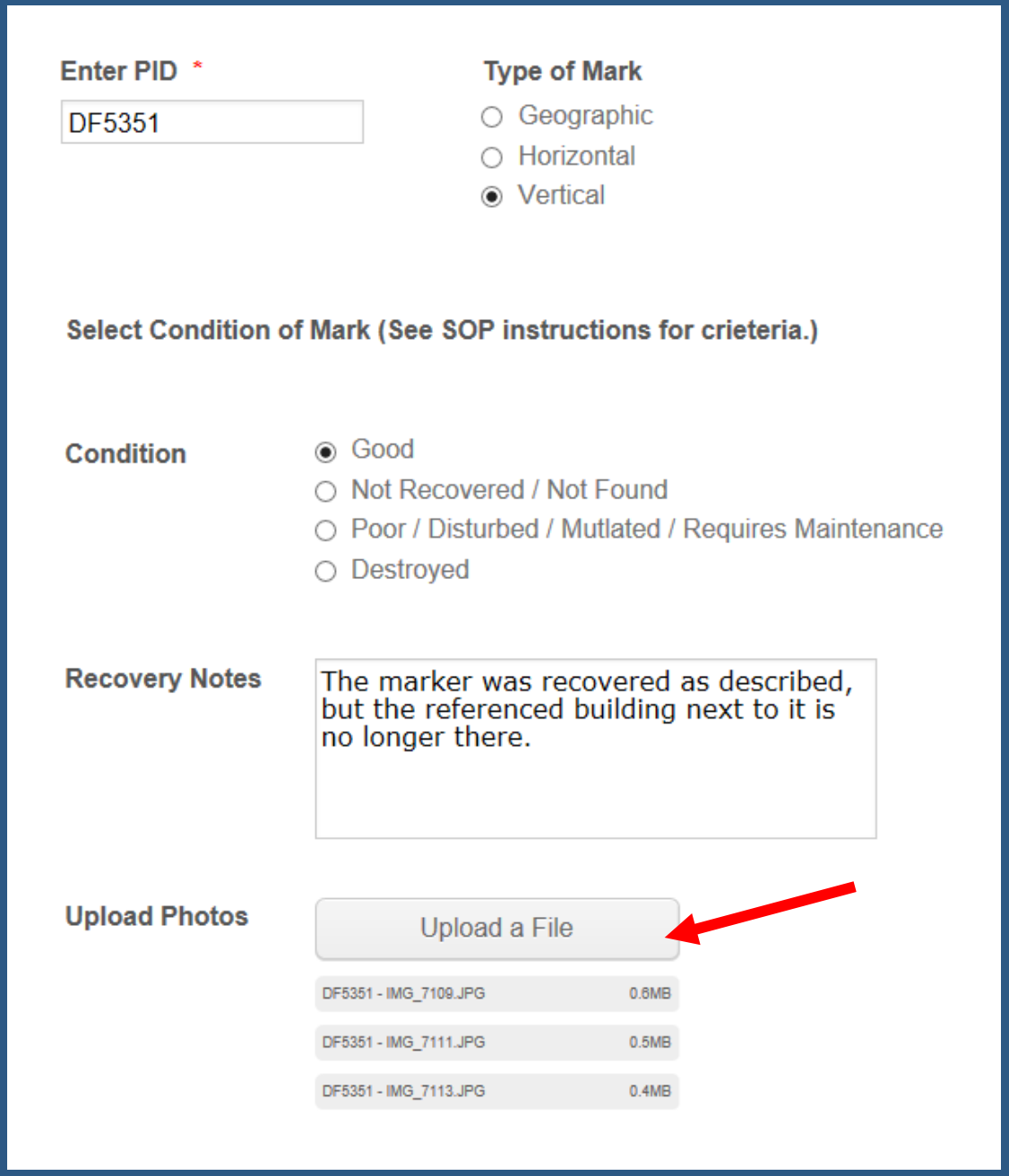
Additional Observers

	Certificate No.	Name	Squadron	District (Dnn)	% Credit
1	F052389	Connie	Shay	27	25
2	E224790	Kevin	Lyon	27	25
3	E224791	Ginny	Esch	27	25
4					
5					

Marker Submittal Report

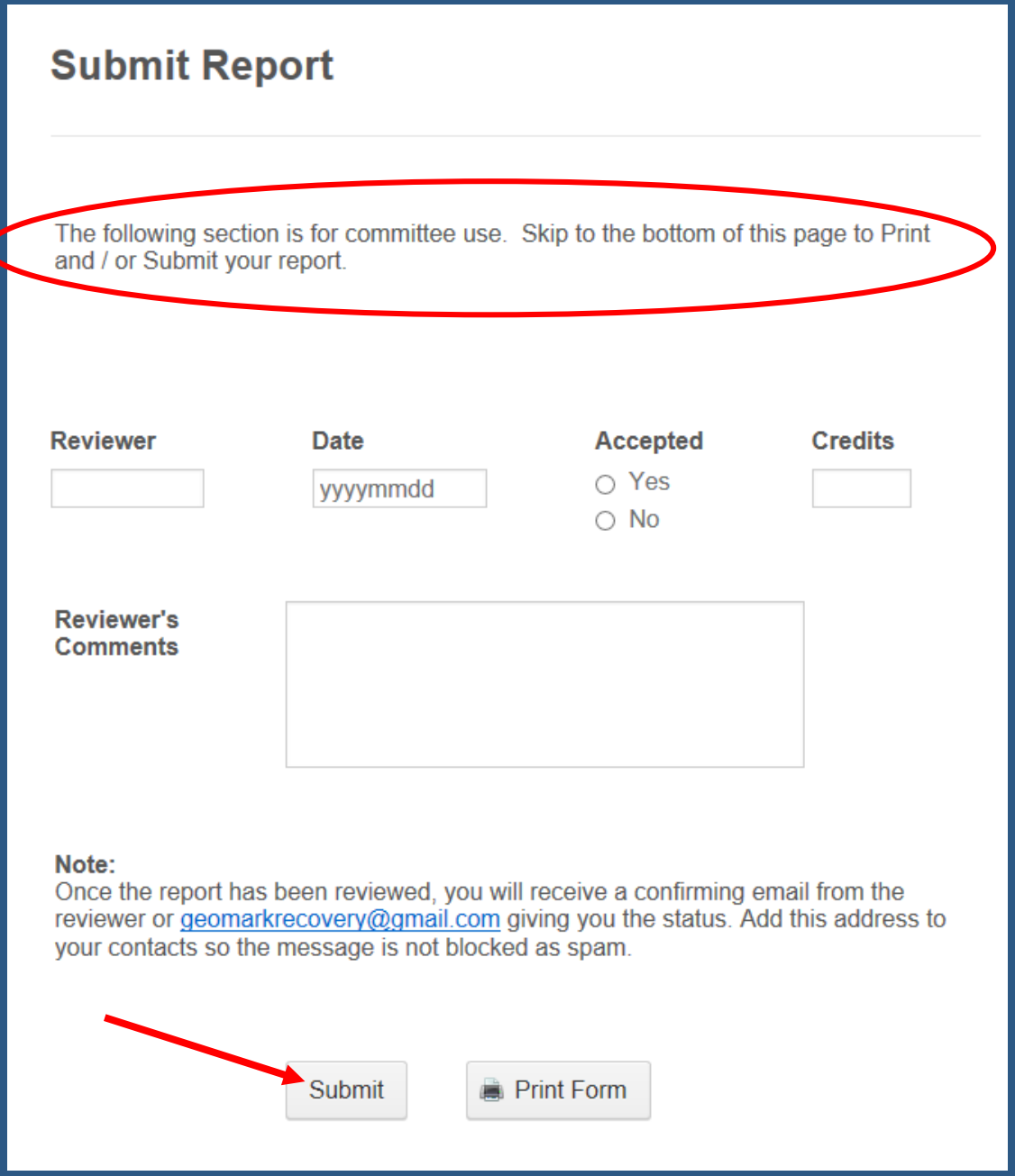
First Marker Report Page

Can do 5 PID's per Report

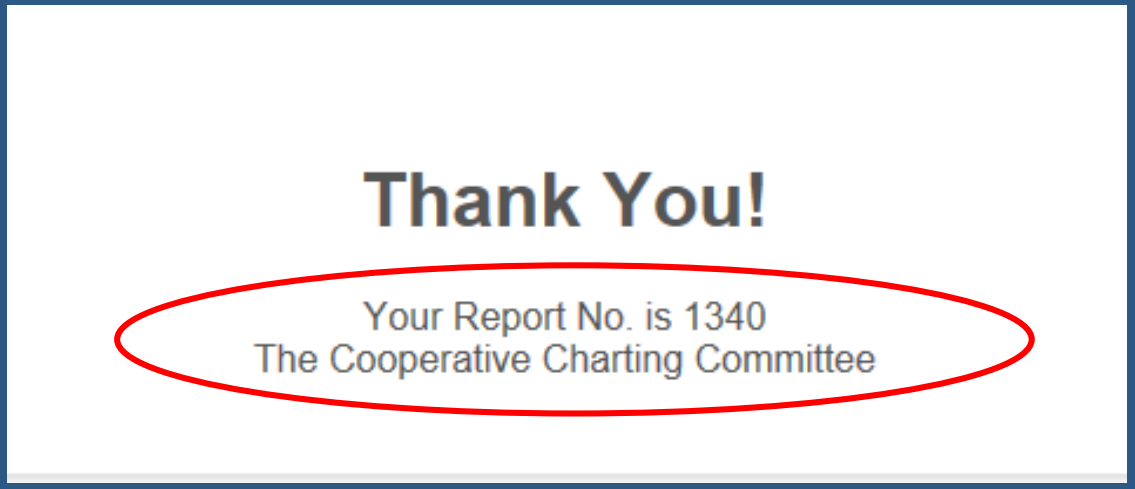


Marker Submittal Report

Submission Page



Marker Submittal Report

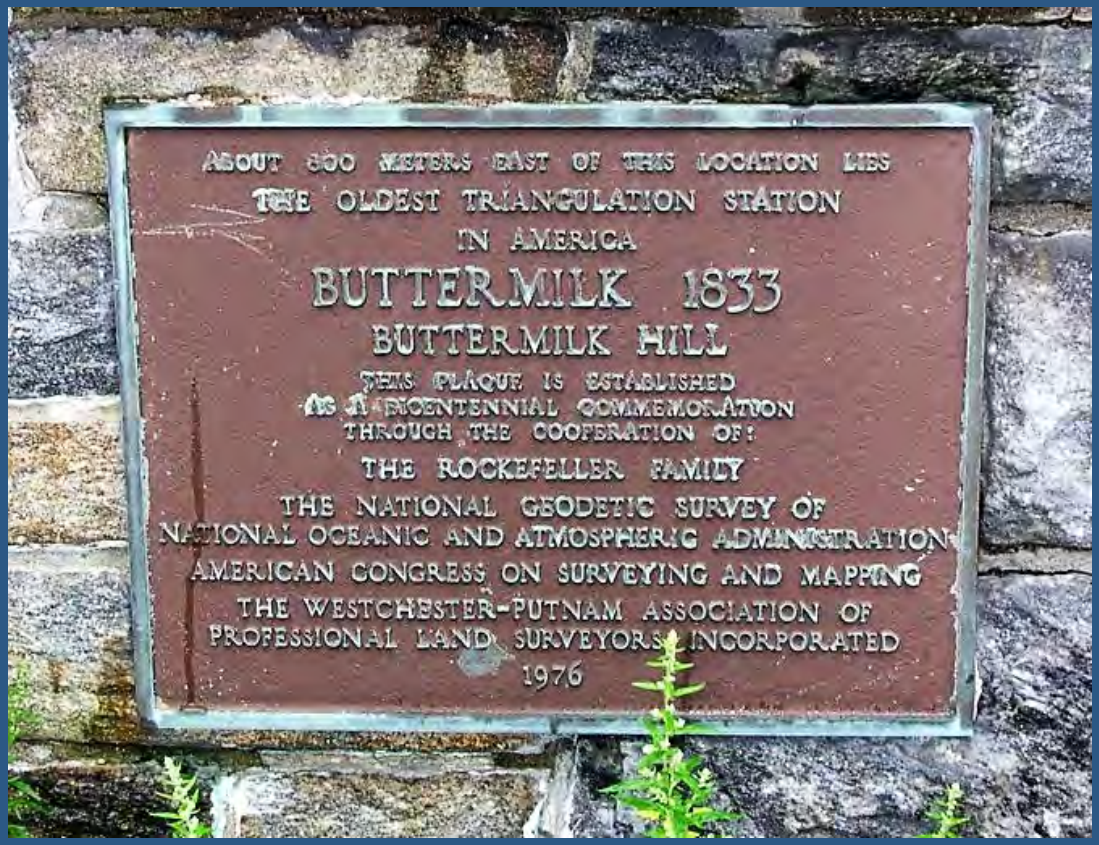


Keep a record of your submission and Report No.

Submission was Successful with Repot No.

BUTTERMILK – The Oldest Surviving Survey Mark

This bronze plaque commemorates BUTTERMILK, the oldest surviving first-order (high accuracy) triangulation station survey point (mark) in the United States. It was dedicated in 1776 as part of the U.S. Bicentennial Celebration. Located just north of NY City.



Original mark set in 1833 by Ferdinand Hassler -
a drill hole 2.5” in diameter and 10” deep

Bronze disc mark later set by
National Geodetic Survey in 1932

Some Memorable Mark Recoveries

100th Anniversary of First Flight – PID DK3532 (Designation: POND)

Location: Town of Kitty Hawk

PID GW2116 (Designation: GW 1750)
at Natural Bridge Virginia

Line of sight

Standing at the Mark's location, looking across the creek you can see George Washington's initials carved in stone

Highest Mark Personally Found – in Wyoming

Beartooth Highway switchbacks to Summit in Wyoming

Beartooth–Absaroka Wilderness (Montana/Wyoming)

Beartooth Highway Summit
Elev. 10,947 ft

PX0413 Mark
Elev. 11062 ft

Photographing the “Stockaid” Marker

PID PX0413

Designation: STOCKAID

WY – 11,000+ ft Elevation

Oldest Mark Personally Found – 1918, near former Seaboard Airline Railroad, Youngsville

FY0211 and FY0212 – Youngsville, NC

Youngville?

Reference Mark Found – 1918, at Old Apex Rail Station – Now Apex Chamber of Commerce

EZ0599 – Apex, NC

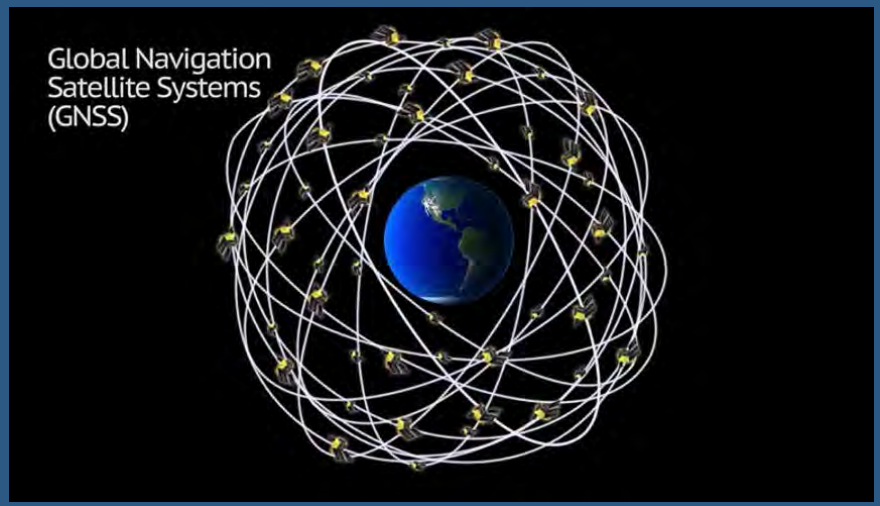
Train Caboose at the Apex Chamber of Commerce

Mark Modernization: GPS "Continuously Operating Reference Stations" (CORS) also part of the National Spatial Reference System

DL3891 GPS CORS, Jordan Lake, Forest Service Headquarters

Approx. 2000 CORS Stations established in 2015 and growing

Modernization: GPS is used to improve location accuracy of marks



Mark GPS Augmentation

Pictures from NOAA Video Library

Datums NAHD 83 and NAVD 88 will be replaced (target date 2022) with a new datum based primarily on Global Navigation Satellite Systems e.g. GPS

Will Passive Monuments (Disk and Rod Marks) still be important?

Importance of geodetic markers and the Marker Recovery Program going forward

- NC - reference to a horizontal control mark is required for boundary surveys
- NC - reference to a vertical benchmark is required for elevation surveys
- Marks will be used with CORS (GPS) as part of the 2022 horizontal / vertical datums
- Marks will be used for quality control of CORS data
- Marks will be used to perform geodetic leveling
- Marks will be used for gravity observations
- Marks will play a “critical role” in support of the development of the 2022 datum and to support users of the 2022 datum

The above information is per communication with Gary Thompson, Chief Surveyor, North Carolina, on 07-12-17

The End!


U.S. COAST & GEODETIC SURVEY
TRIANGULATION STATION
FOR INFORMATION WRITE TO THE DIRECTOR, WASHINGTON, D.C.
FINE OR IMPRISONMENT FOR DISTURBING THIS MARK
TOOTH OF TIME
9,003 FT.
1949