



NROS Height Modernization Survey



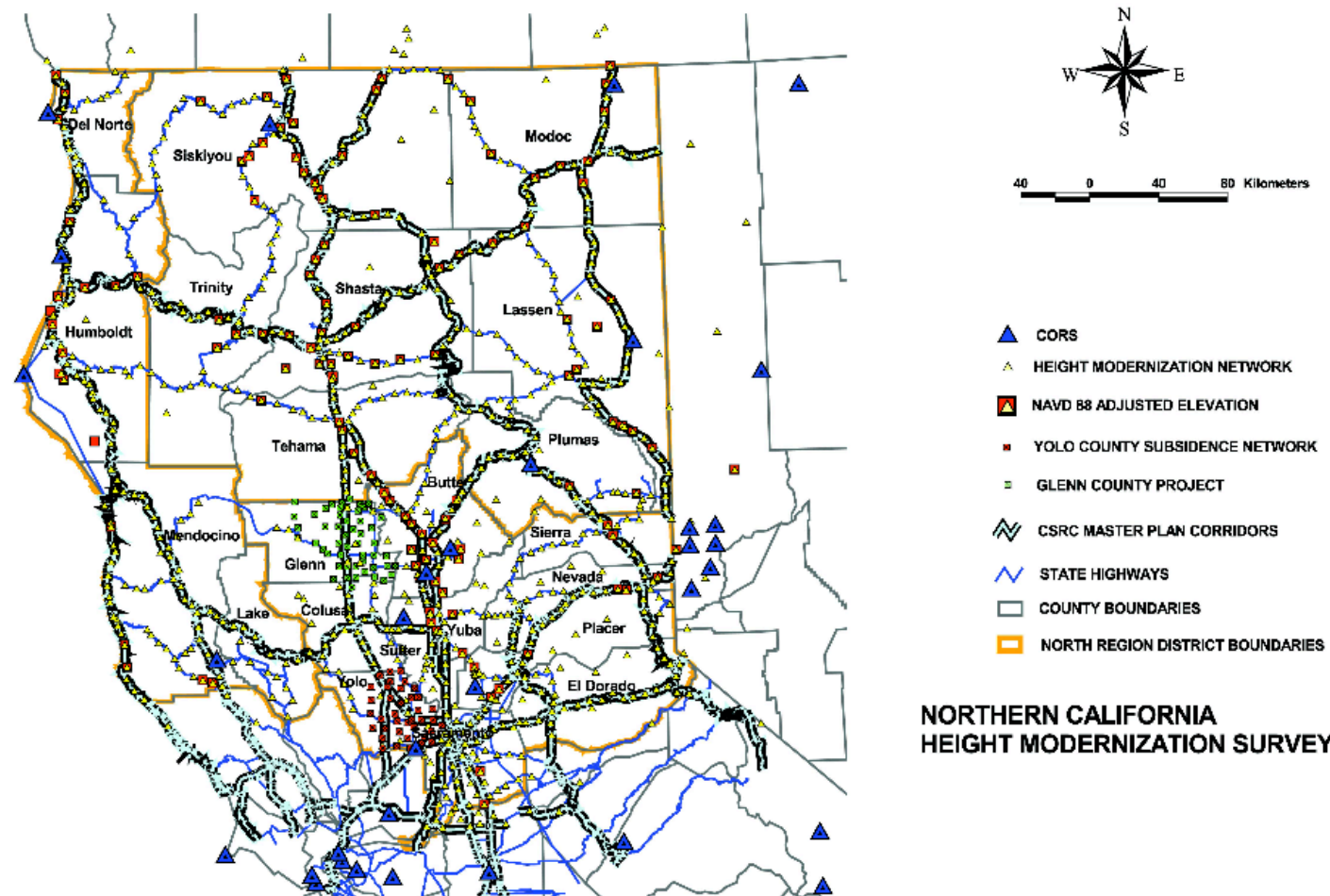
7/1/04

PROJECT DESCRIPTION

- The California Department of Transportation's North Region Office of Surveyors (NROS) in cooperation with the National Geodetic Survey (NGS) and the California Spatial Reference Center (CSRC) is currently working on a 900+/- point Height Modernization Survey Control project.
- The project covers the 22 counties located within Districts 1, 2 and 3 in Northern California.



CURRENT NETWORK



PROJECT DESCRIPTION

- The goal of the survey is to establish a network of First Order or better horizontal accuracy monuments with ellipsoid height local accuracies of 2 cm at the 95 percent confidence level at a 7 km spacing along all highway corridors in the North Region.
- The Readjustment of the National Spatial Reference System- The National Readjustment is scheduled to commence in June 2005. Adjustment of the national layers will proceed sequentially and are scheduled for completion in October 2006. The regional layers will be adjusted from November 2006 through September 2007.



Feature:

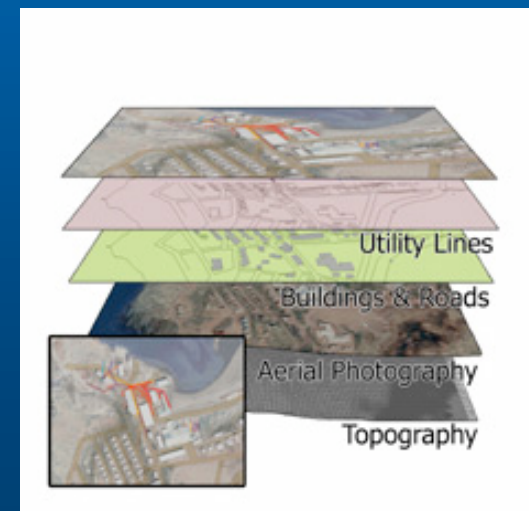
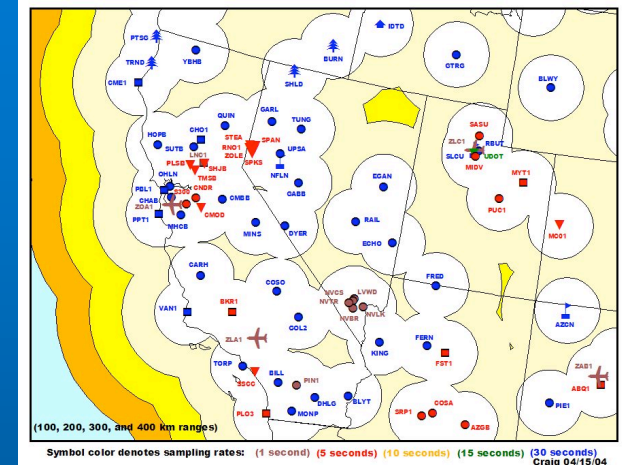
Height Modernization Provides Safer Transportation.
Geodesy is the branch of mathematics that deals with the shape and area of the Earth.

Without a good foundation, a building will collapse. Our transportation infrastructure is the same way. The location and placement of roads and airports must be predetermined so that traffic runs smoothly. When building a road or bridge over water, construction teams have to make sure that the two sections of the bridge will meet at the same point. If they don't, the bridge will be unusable.



PROJECT DESCRIPTION

- The project's timetable is less than a year with the intent of being included into the nationwide Horizontal Readjustment to be done by NGS within a few years.
- Need base GIS platform for all mapping and database information.



PROJECT DATUM

- The horizontal coordinates will be referenced to the North American Datum of 1983 (NAD83)
- The vertical datum will be the North American Vertical Datum of 1988 (NAVD88)



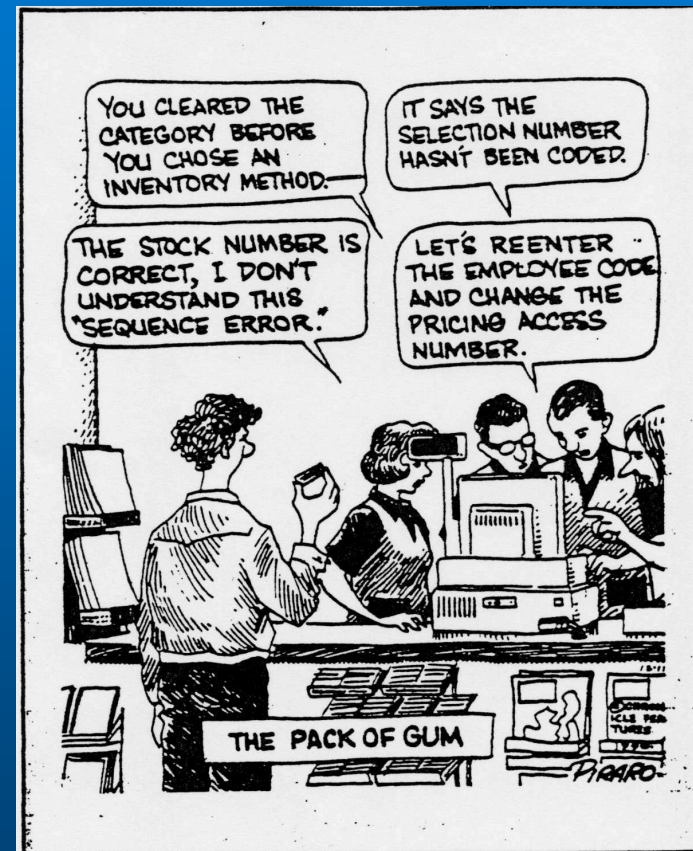
PROJECT DESCRIPTION

- Network design and observation schedule will be in accordance with NOAA Technical Memorandum NOS NGS-58 GUIDELINES FOR ESTABLISHING GPS-DERIVED ELLIPSOID HEIGHTS (STANDARDS: 2 CM AND 5 CM) VERSION 4.3.

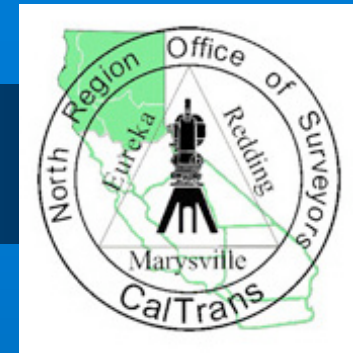


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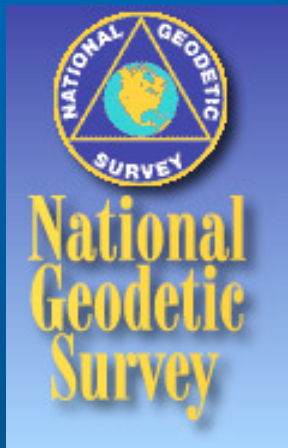
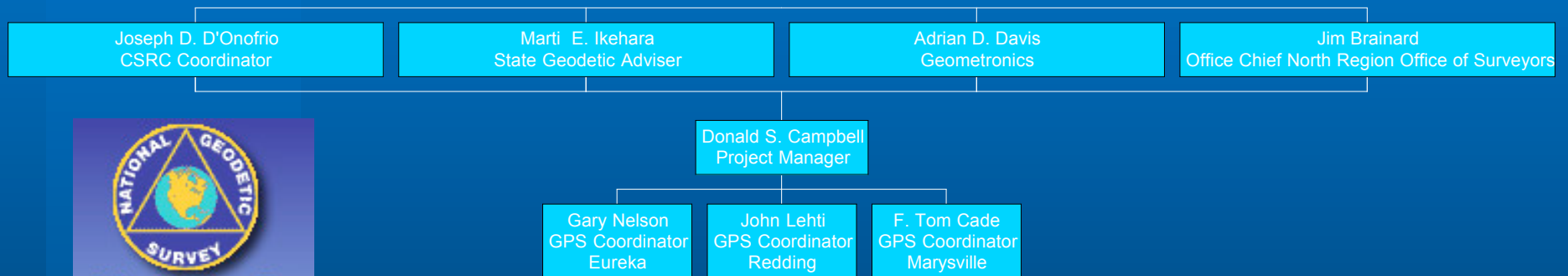
- All project information will be coordinated and established through a cooperative effort with NROS, NGS and CSRC.
- Although it is no pack of gum, this network will take a coordinated effort from all entities.



Project Team



PROJECT TEAM



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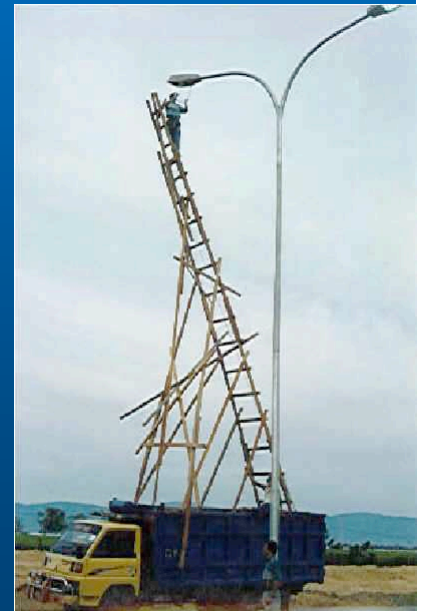


Team/Resources

- **NROS has spent approximately 3000 person hours to date.**
- **We are in the process of spending \$10k on leveling equipment upgrades to meet vertical leveling specifications.**
- **We have budgeted an additional \$20k for next fiscal year for other equipment or monument needs.**
- **We currently need an additional \$33k for monument supplies as identified in the reconnaissance portion of work completed to date.**

Team/Resources

- The NROS is estimating a 6-8 week GPS field effort with additional leveling project of approximately 12 weeks.
- This totals an estimated 9600 person hours until project completion.
- Additional project funding is being requested in the amount of \$33k as stated in the above paragraph through the CSRC.



Schedule



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Current Status

- Initial reconnaissance complete for Region
- Disk for drill-hole monuments being set.
- Waiting for monument supplies.
- Identify leveling needs and resources.

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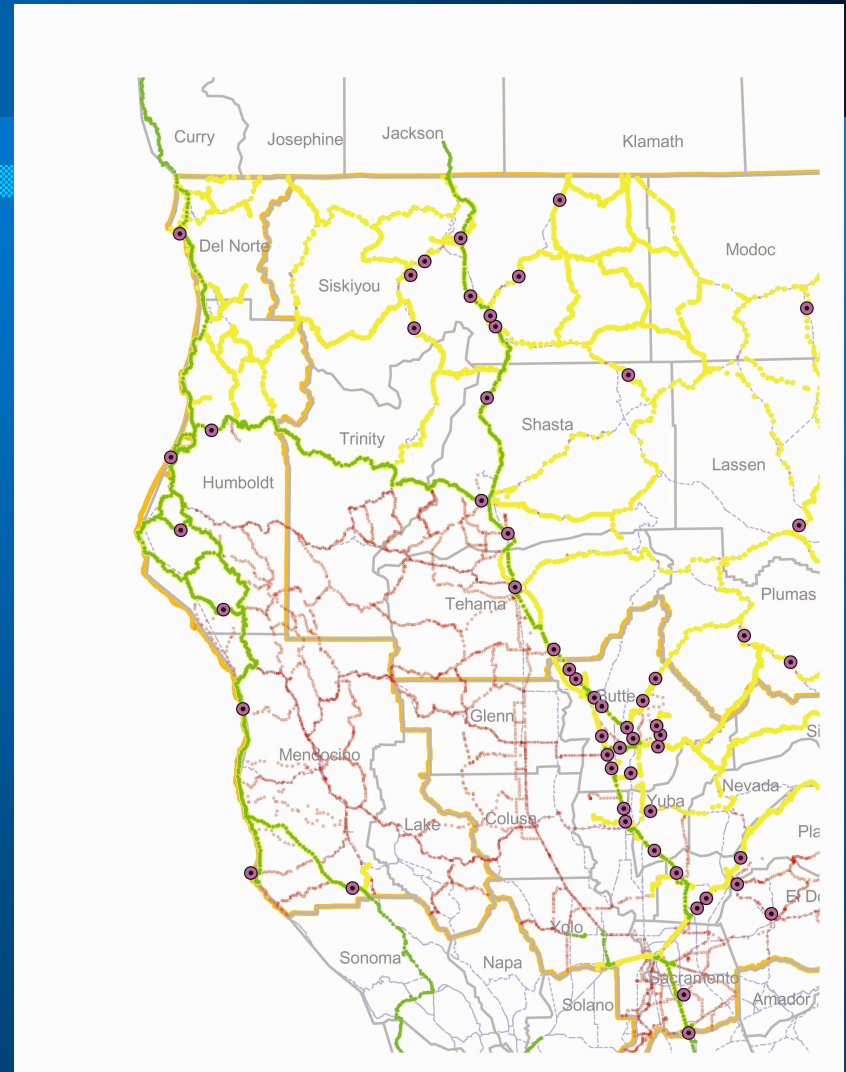


HEIGHT MODERNIZATION SURVEYS SUMMARY OF SCOPE OF WORK FOR THE NATIONAL GEODETIC SURVEY

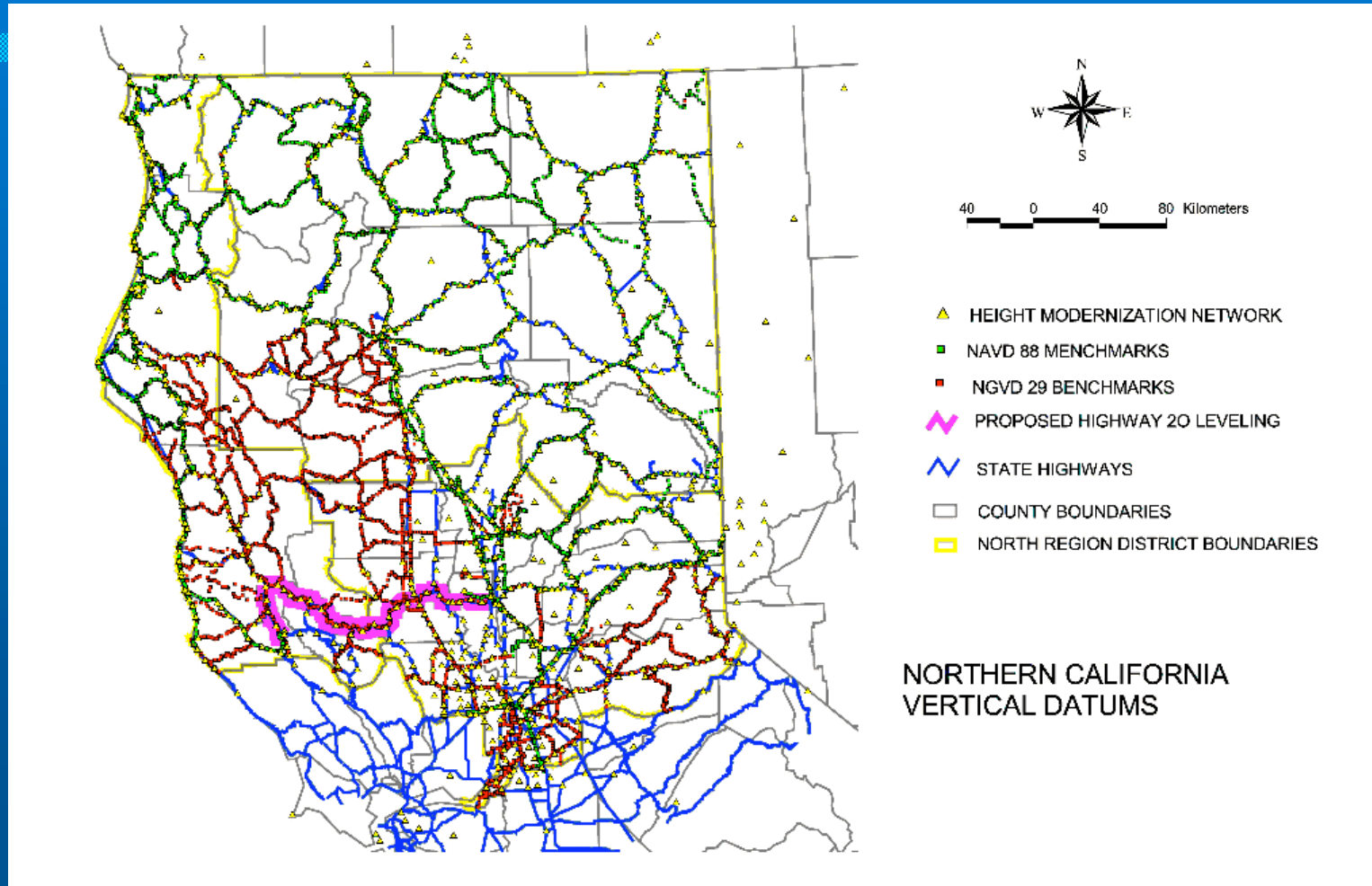
1. **DELIVERABLES** - Requirements include: reconnaissance reports with survey plans for project areas across the U.S., survey mark recovery notes and descriptions, digital photography of marks, GPS observations, vector processing records, GPS adjustment records, sketches, visibility diagrams, and reports.
2. **RECONNAISSANCE REQUIREMENTS** - The North Region will coordinate with local officials, recover existing survey marks, select type and location for new marks, and set marks to National Geodetic Survey (NGS) specifications, write survey mark recovery notes and mark descriptions to NGS specifications, plan a survey network including ties to Continuously Operating Reference Stations (CORS) (GPS), the High Accuracy Reference Network (HARN) and bench marks, obtain digital photography of marks, provide mark maintenance (if required), and produce a project sketch and project report.
3. **MARK SETTING** - The North Region will set stainless-steel rod marks, concrete marks 4 feet deep, and/or disks in drill holes in bedrock. Marks will be set to NGS specifications for type, length, material, stability, and stamping.
4. **GPS POSITIONING PROCEDURES** - GPS data will be collected using GPS equipment meeting the following criteria: the receiver model must have been evaluated against the Federal Geodetic Control Subcommittee (FGCS) test network, must be a state-of-the-art dual frequency with high quality C/A code or P code pseudo-ranges, must be capable of measuring full wavelength L2 carrier phase, must function acceptably in an Anti-Spoofing environment, and must consist of a geodetic quality antenna with ground plane and an antenna model that has been calibrated by NGS. The North Region must follow guidelines for establishing GPS derived heights (2 to 5 cm) documented in NOAA Technical Memorandum NOS NGS 58 (http://www.ngs.noaa.gov/PUBS_LIB/NGS-58.html). Fixed height tripods will be used.
5. **VECTOR PROCESSING** - Vector processing will be performed using the latest version of the NGS software package PAGE-NT or equivalent. The 'equivalent' of PAGE-NT is subjective, based on the software's ability to correct for the same systematic errors that PAGE-NT corrects, apply the NGS required antenna offsets, and its ability to reproduce the same results as PAGE-NT. This determination will be made by NGS. NGS precise orbit data and NGS CORS data will be used.
6. **ADJUSTMENT PROCESSING** - All stations in a project area should be adjusted together. Six adjustments are required: (1) free, (2) constrained with only CORS or CTCORS held, (3) constrained with CORS or CTCORS and HARN stations held, (4) a final free with accuracies, (5) a free vertical holding one bench mark in the center of the project, and (6) a fully constrained vertical (with all approved bench marks held and only one horizontal point). All data must be submitted in NGS approved formats, and NGS program ADJUST will be used for all adjustments. Additional guidelines for GPS derived orthometric height determination will be provided.
8. **REPORTING REQUIREMENTS** - The North Region will submit a reconnaissance report prior to setting marks and making GPS observations. Regular status reports may be made via email. The final report will include a project sketch, raw and processed data files, digital recovery notes and description files, observation logs, files from all six adjustments plus other requirements as listed in the Scope of Work.

Distribution of Valid NAVD 88 Benchmarks

- There are 62 NAVD 88 Benchmarks incorporated into the planned network
- Leveling issues are ongoing and we should have decisions made within 2 weeks.



Vertical Leveling & Network



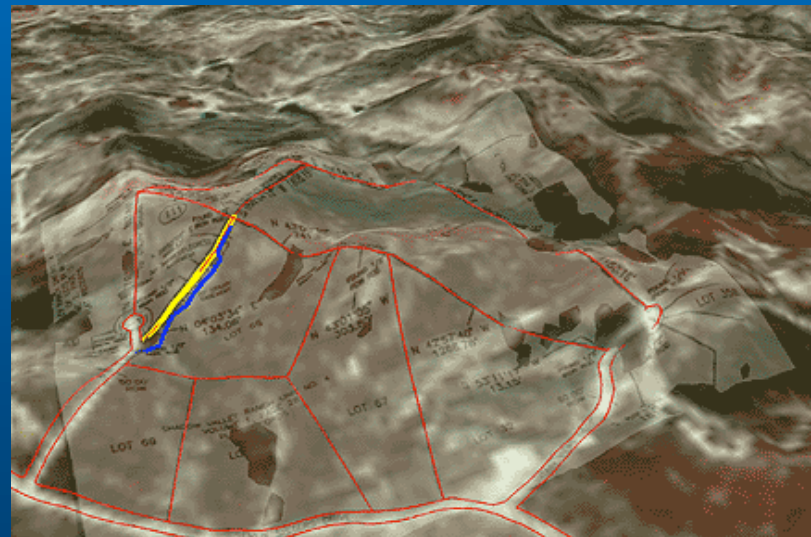
This network will provide many uses for Public and Private Sector Organizations



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Records of Survey

The 22 counties within the network will receive a county specific Record of Survey to increase awareness and accessibility of the network for public and private sector use.





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Questions???

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