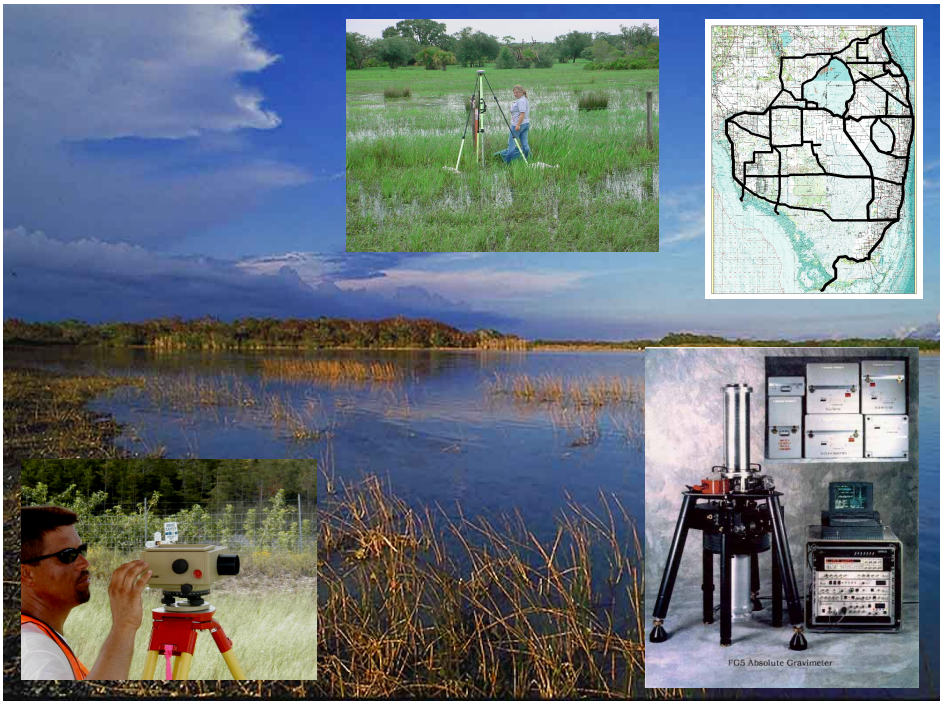
GEODETIC VERTICAL CONTROL NETWORK

FINAL REPORT, OCTOBER 2003

US Army Corps of Engineers®
Jacksonville District



COMPREHENSIVE EVERGLADES RESTORATION PROGRAM

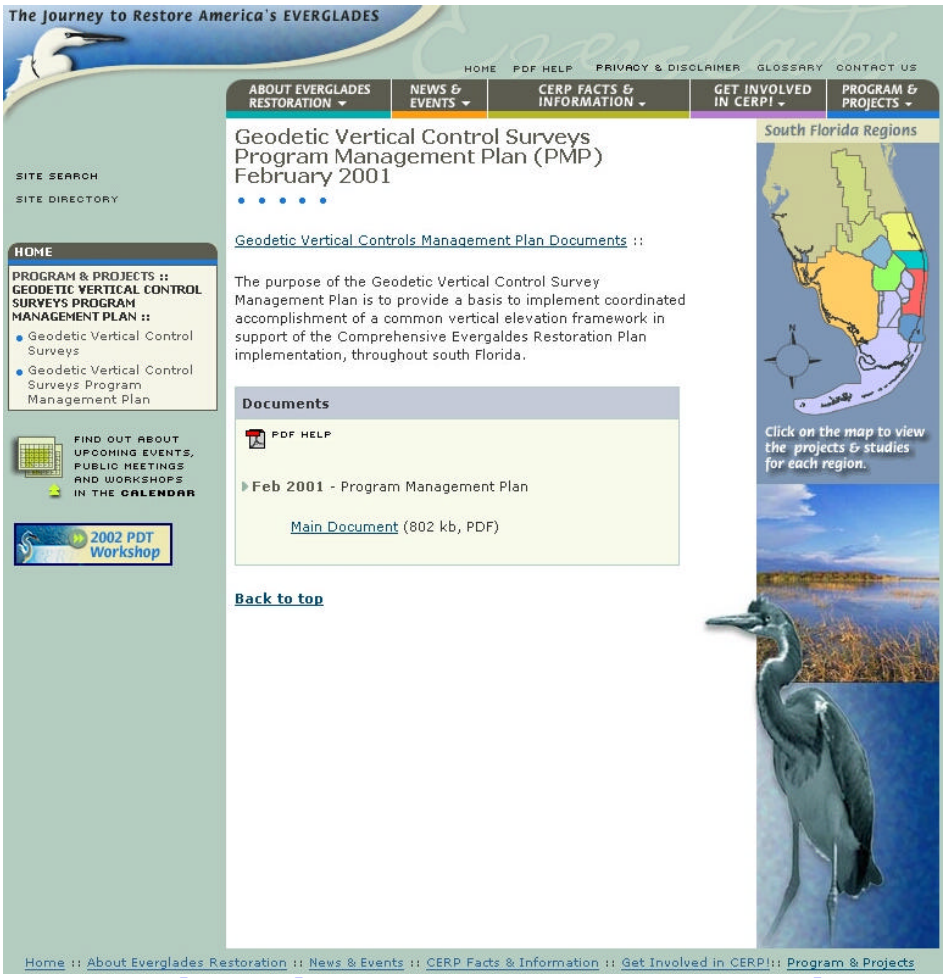
www.evergladesplan.org

PURPOSE

This document identifies the products of the Geodetic Vertical Control Surveys Program, how to implement these products in Comprehensive Everglades Restoration Program (CERP) projects, and how these products will be maintained for the duration of CERP.

AUTHORITY AND COMPLIANCE

The Geodetic Vertical Control Surveys were accomplished under the authority of the Geodetic Vertical Control Surveys Program Management Plan (PMP), which can be downloaded from www.evergladesplan.org shown below.



www.evergladesplan.org/pm/progr_geodetic_plan.cfm

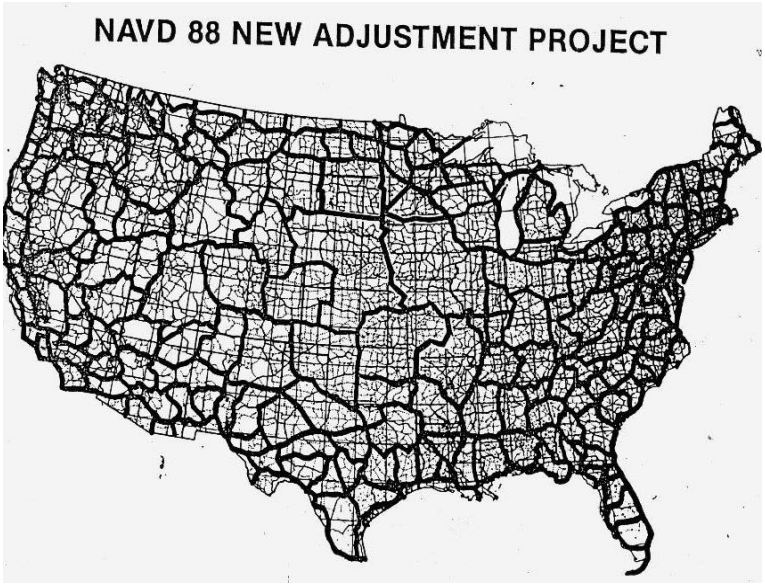
All leveling surveys were conducted in accordance with NGS standards for first and second order vertical control. All Global Position System (GPS) surveys were conducted in accordance with the most current NGS guidelines as directed by the above-mentioned PMP.

BACKGROUND

A more detailed discussion can be found in the PMP. In summary, the National Geodetic Vertical Datum of 1929 (NGVD29) was never fully developed in south Florida. Water did not always flow in the direction of lower datum elevation due to inconsistencies in the vertical network that were never resolved even with continued densification.

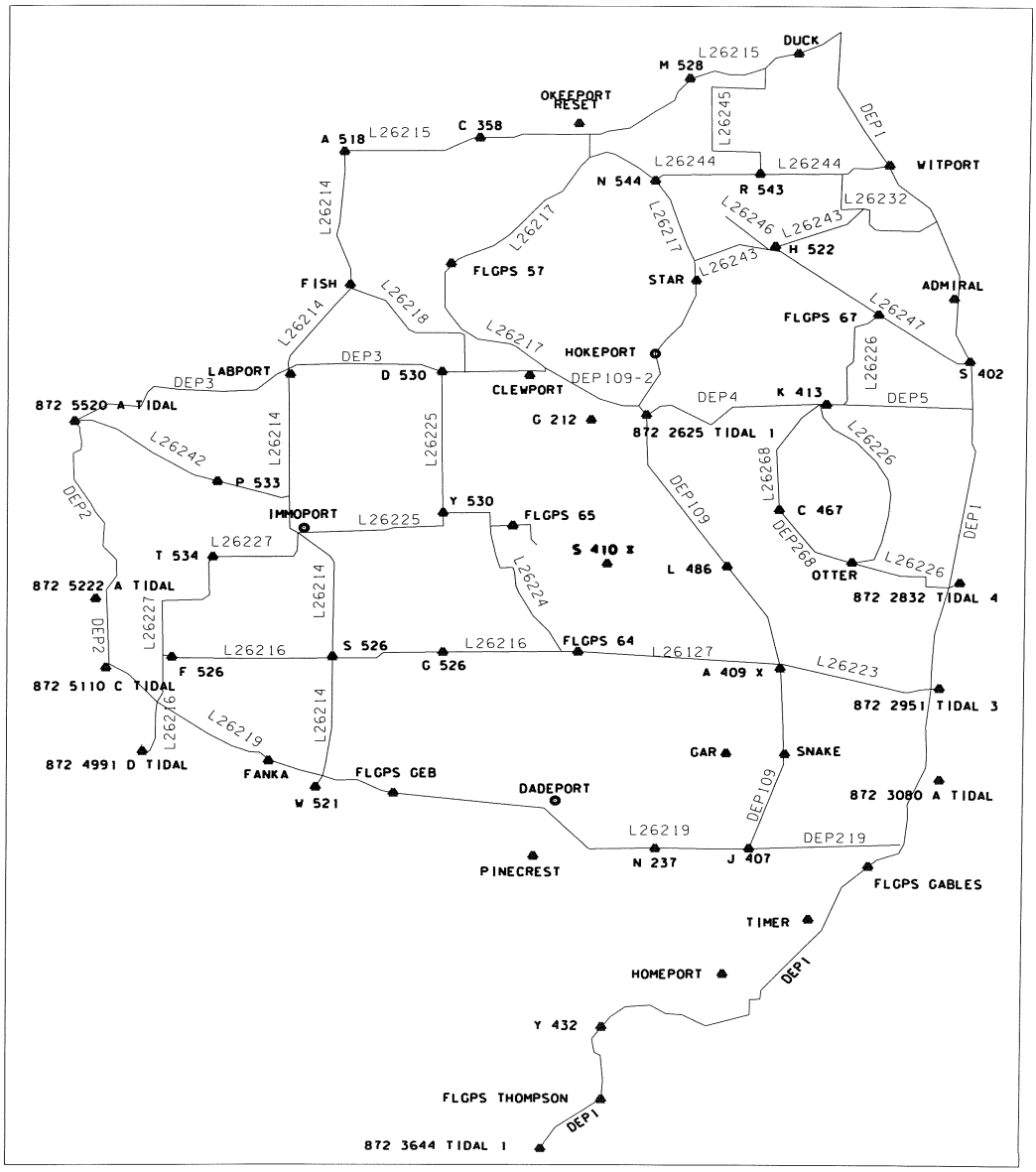
VERTICAL CONTROL USED IN 1929 ADJUSTMENT

The National Geodetic Survey (NGS) eventually abandoned the NGVD 1929 datum in favor of the more robust North American Vertical Datum of 1988 (NAVD88).



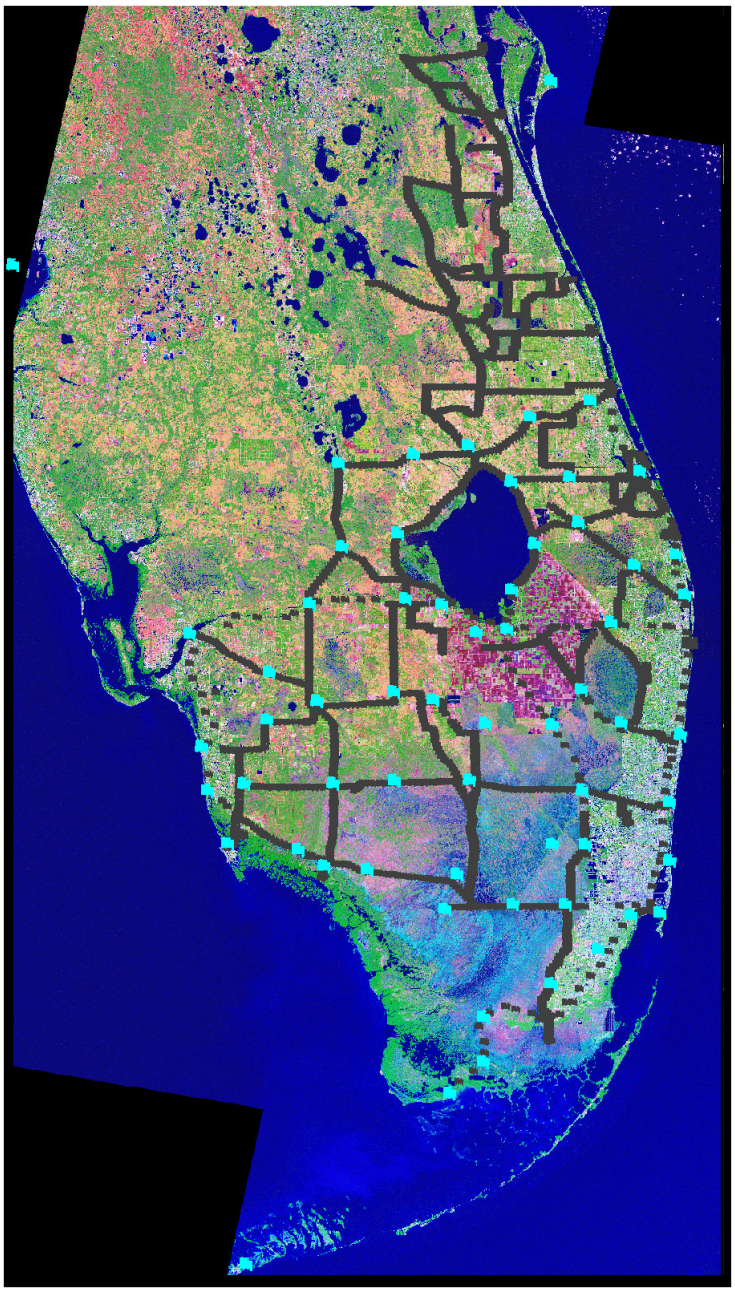
NARRATIVE

The Geodetic Vertical Control Surveys served to verify and densify the existing NAVD88 network in south Florida as well as establish important ties to the historic NGVD29 datum throughout this region of the state where so much time and money has been invested in studies now tied to the abandoned datum whose control network is steadily disappearing. These ties will serve to facilitate a transition to the more robust NAVD88 datum. All survey requests for CERP projects are inherently tied to both datums to make it possible for modeling to be conducted in NGVD29 for comparison to historical studies and in NAVD88 for verification of past modeling results using a more robust datum and subsequent project design. An updated VERTCON program grid will be provided by NGS to USACE and SFWMD based on the results of the Geodetic Vertical Control Surveys.



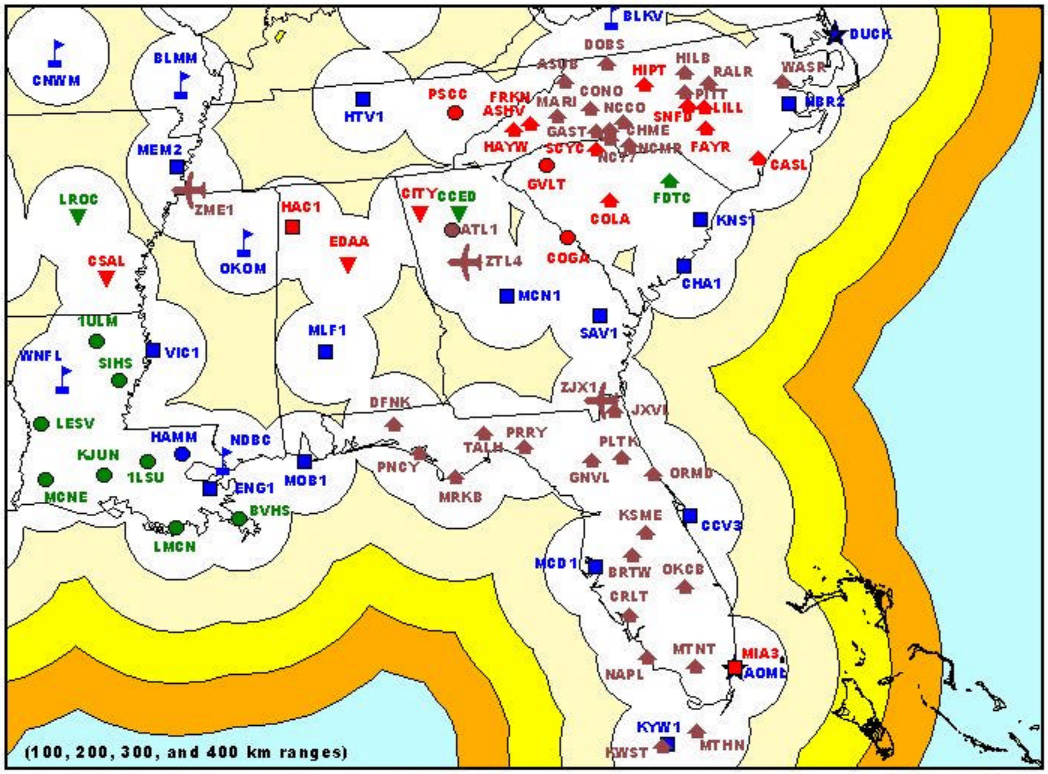
As with anything built on inconsistent data, errors propagate and further compound the issue. This is clearly evident in the NGVD29 datum as well as all of the USACE control that owes its origin to the abandoned datum. The Geodetic Vertical Control Network serves to provide a better foundation for CERP. The previous image shows level lines preformed by USACE A/E contractors (designated with “L”) and by Florida DEP (designated with “DEP”). Stations shown in bold were included in the leveling network, the GPS network, or both. Quality control was provided by NGS.

With supplemental data from NGS, the CERP Geodetic Vertical Control Network takes on the extents delineated by the following image.



Primary control stations are shown in cyan. Secondary and supplemental control stations are shown in black.

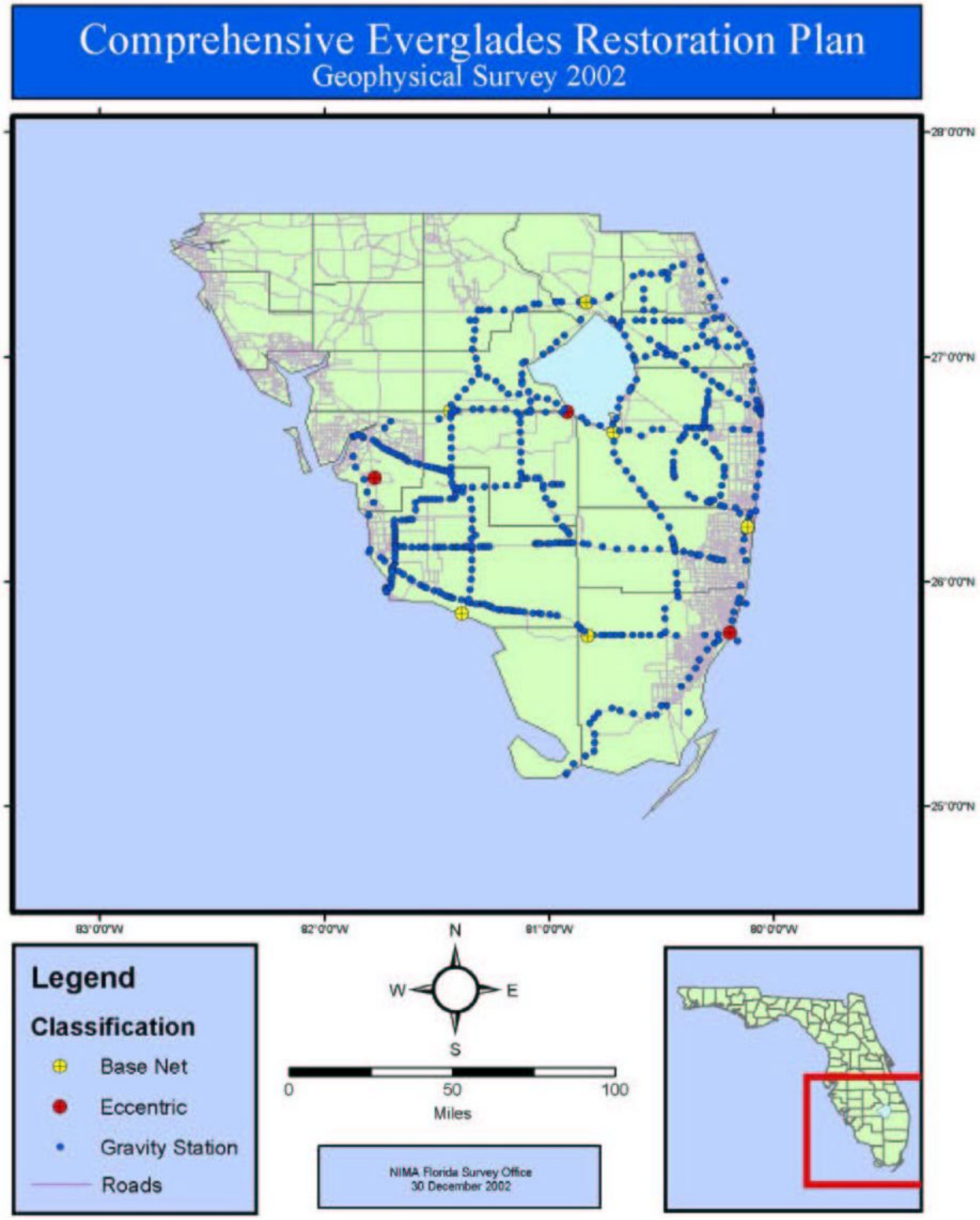
With implementation of CERP expected to take 30 plus years, the Geodetic Vertical Control Surveys were conducted in such a way to avoid having to repeat the expensive and time consuming process of performing first and second order levels across the state. In addition to the conventional levels, and at a fraction of the cost, GPS and gravity measurements were performed on all of the vertical benchmarks in the vertical control network. The network was also tied into the Continuously Operating Reference Station (CORS) network.



Symbol color denotes sampling rates: (1 second) (5 seconds) (10 seconds) (15 seconds) (30 seconds)

Craig 8/27/03

The CORS network is part of a global network and the basis for the most current horizontal datum adjustments and anticipated future horizontal and vertical datums (NAD83/05, ITRF). At the start of the Geodetic Vertical Control Surveys, Florida only had four CORS sites. Since then, the Florida Department of Transportation (FDOT) has established 17 new CORS sites and intends to establish approximately 25 more. These sites, shown in brown on the above map, are essentially a part of the Geodetic Vertical Control Network primary control. This densification on the part of FDOT has relieved USACE and SFWMD from the burden of maintaining our own primary control that can now be re-established from the CORS as needed under specific projects.

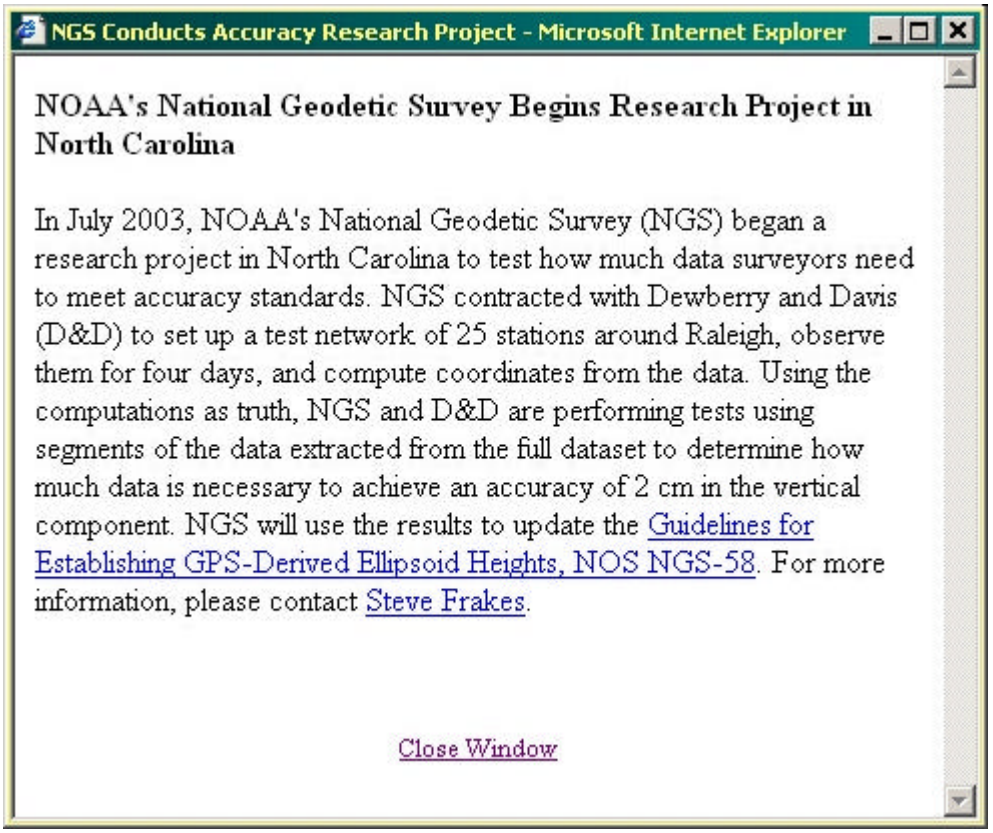


The official CERP datums are NAVD88 for vertical and NAD83/99 (North American Datum of 1983, 1999 adjustment) for horizontal. NAD83/99 is a three dimensional datum, compatible with NAVD88 through the use of the most current geoid model. This model is a joint effort of NGS and the National Image and Mapping Agency (NIMA), revised and published periodically as warranted. The current geoid model, GEOID99, will be updated with information

collected under the Geodetic Vertical Control Surveys. Publication of the anticipated GEOID03 is expected during the later part of calendar year 2003. It should be noted that although a knowledgeable person can make use of GPS in conjunction with the NGVD29 datum, the results are not without discrepancy and not truly compatible with NGVD29.

With the work that has been done to establish this network and its historic ties to the NGVD29 datum, these expensive conventional techniques should not have to be repeated over such a large area for the duration of CERP. Less expensive GPS techniques combined with conventional methods, where economical and appropriate, will be used to maintain and densify the network as needed for project work. Project surveys can make full use of the less expensive GPS survey techniques as well.

Further advances in GPS technology such as the increasing speed of the equipment, the improving accuracy, and the emerging Virtual Reference Stations, will provide additional enhancement of the GPS compatible CERP Geodetic Vertical Control Network. Even the procedures used to conduct GPS surveys are being studied and revised to reflect the improved equipment as indicated by the message below taken from www.ngs.noaa.gov.



Studies such as this will reduce the cost to obtain surveys with a given level of confidence in accuracy.

CONCLUSION

The CERP Geodetic Vertical Control Surveys were accomplished under budget and ahead of schedule through good organization, technical expertise, and strategic partnering with other Federal agencies, State agencies, and the private sector.

All CERP control points are published at www.ngs.noaa.gov and can be downloaded as “datasheets” by following the links and using identifying information from the CERP control table that follows. All horizontal and vertical values shown in the table are second order or above with most of the second order values coming from the “supplemental” stations.

This information is also available from CESAJ-EN-DT in a MicroStation DGN file, Microsoft Excel spreadsheet, and will eventually be available over the web through the Geospatial Program Management eGIS initiative. Additional formats can be made available upon request (e.g., ESRI ArcGIS, ASCII, AutoCAD, etc.).