Appendix D
Application: Dredge Material Disposal Area RTK Cross-Sections--(Jacksonville District)

D-1. Sample RTK Survey of Maintenance Dredging Confined Disposal Area

The following RTK topographic surveying example is representative of the procedures used for most Corps engineering and construction applications. This example depicts a topographic survey of the levee surrounding the dredge disposal area. These cross-sections were performed on the Quarantine Island disposal area in the St. Johns River, near Jacksonville, Florida. The disposal area is west of Cuts F and G on the navigation project where the material was excavated. The dredging measurement and payment hydrographic surveys in the navigation channel and the RTK surveys in the disposal area placement area were performed for the Jacksonville District by Arc Surveying & Mapping, Inc.

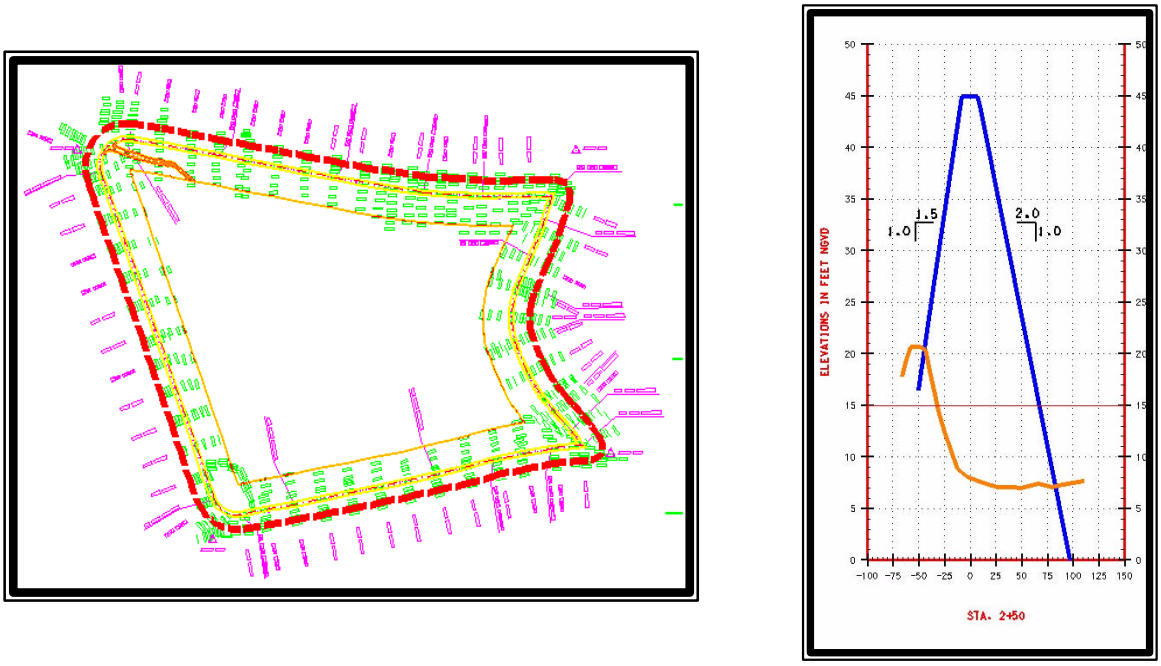


Figure D-1. Plan of confined disposal area and typical section

Figure D-1 above shows a plan of the entire disposal area, over which cross-sections were obtained using RTK techniques. The example data in this appendix covers only a few sections taken on the northerly edge of the disposal area. A typical levee design section at Station 2+00 is shown at the right.

The sketch below (Figure D-2) depicts the layout for the RTK survey. The base receiver was set over ST JO 335 and the 14 representative cross-sections shown were observed relative to that point. Elevations ranged from around 45 feet at the top of the constructed levee down to 15 feet at the toe. Elevations were referenced and adjusted to NGVD 29. ST JO 336 was used as an elevation and position check point for the RTK set up. RTK field data collection procedures followed the methods described in Chapter 9 of this manual.

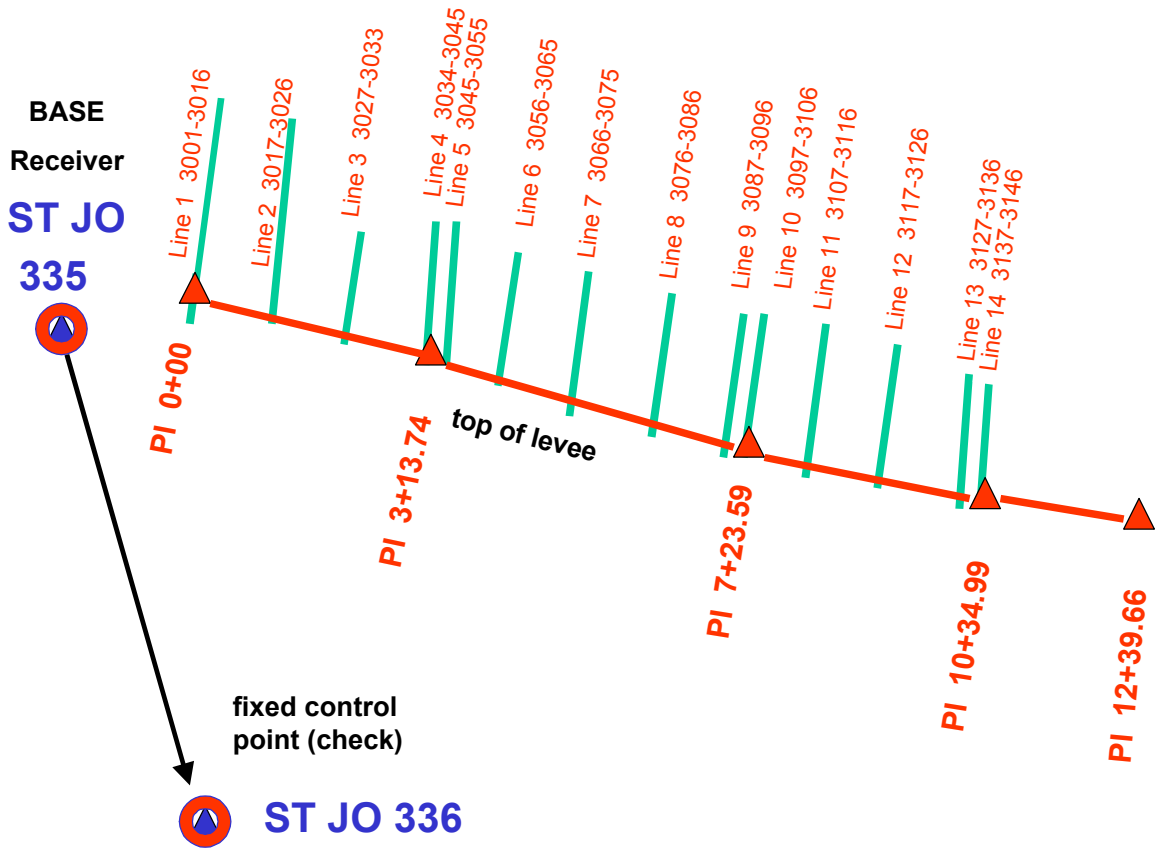


Figure D-2. Disposal area survey fixed control points and baseline layout

The screen capture below (from Trimble Geomatics Office) shows the 14 selected cross-sections, over which a total of 145 topo points were observed on the disposal area embankment. A Trimble RTK system was used to perform the survey and Trimble Geomatics Office software was used to reduce the data. The reference receiver was located at benchmark ST JO 335 (just off the left of the screen), the point whose position and elevation were held fixed for the survey. RTK vector observations to each shot point are shown as rays emanating from ST JO 335. The shot points are numbered from 3001 to 3147, in sequence. Cross-sections were run in alternate directions up and down the embankment.

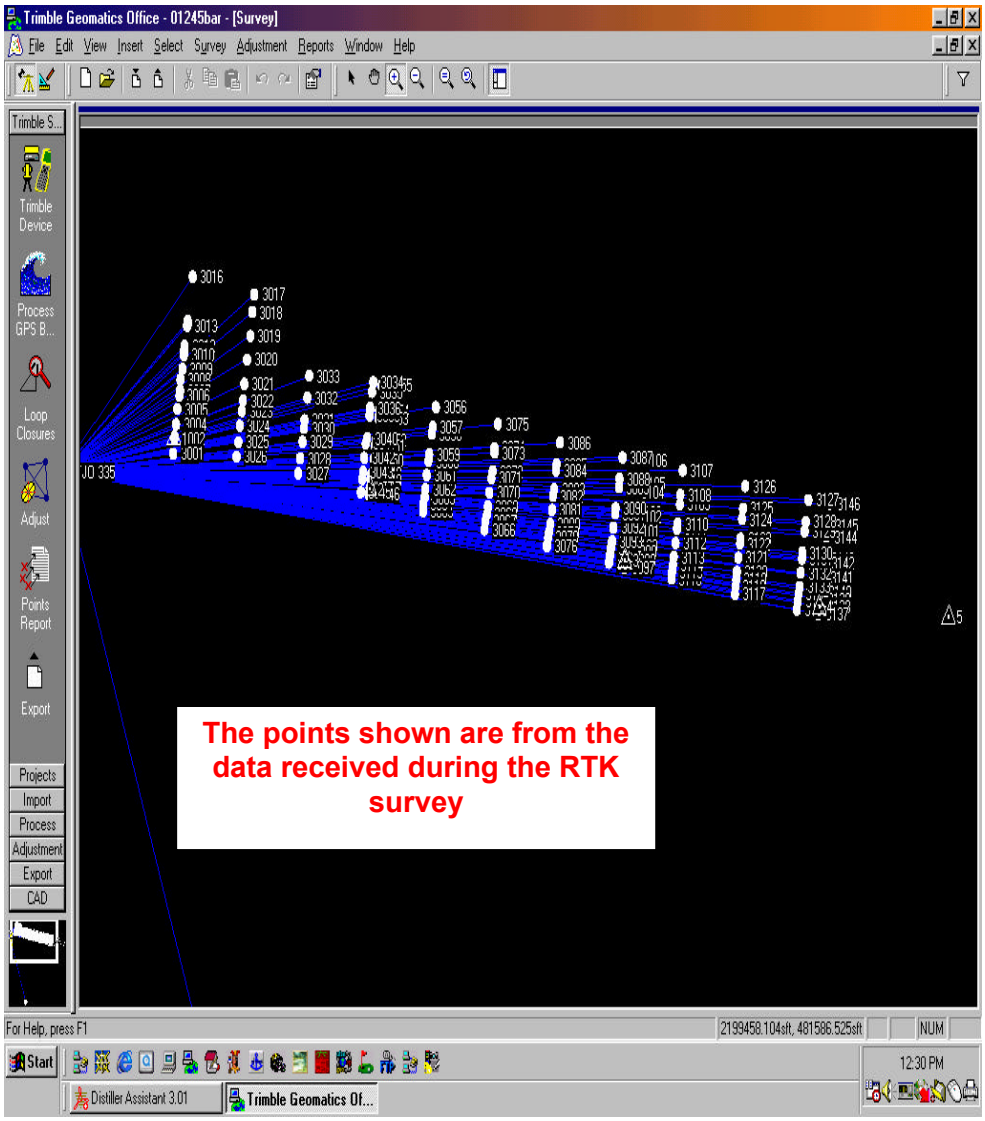


Figure D-3. Trimble Geomatics Office plot of observed RTK vectors and topo points

D-2. Request for Proposal and Scope of Work

The following Request for Proposal, along with the technical scope of work, is an example of a labor-hour (not-to-exceed) task order designed to provide surveying support for a long-term construction project. This task order provides for periodic pre-, during-, and post-construction surveys; including GPS-controlled hydrographic surveys of the channel excavation and GPS/RTK-controlled profile surveys of the placement area. The task order additionally requires the contractor to compute payment volumes for the excavated and placed material.

Engineering Division
Design Branch

Mr. John Sawyer
ARC Surveying and Mapping
5202 San Juan Ave
Jacksonville, Florida 32210

SUBJECT: Contract No. DACW17-01-D-0002

Dear Mr. Sawyer:

Reference contract number DACW17-01-D-0002 for Surveying and Mapping Services. The Government desires to execute a delivery order under subject contract for the following project:

Jacksonville Harbor Construction Dredging Phase I DACW17-01-C-0023
38 Foot Project Cut-F Through Cut-G Construction Survey
Jacksonville, Florida (Survey 01-245)

Please review the enclosed scope of work outlining the Technical Requirements and submit an itemized fee proposal for this work within 10 working days of receipt of this document. Please furnish this fee proposal to the attention of the Chief, Design Branch.

This request does not constitute a notice to proceed for the delivery order. Please do not commence work or incur any costs chargeable to the Government. You are cautioned that preparation of this fee proposal is entirely at your own risk and the Government can assume no obligation for payment of any related expenses incurred by your firm.

Mr. Jerry Burchfield of Survey Section is the point of contact. Please call him at 904-232-1613 if you have questions or need additional information.

Sincerely,

Edward E. Middleton, PhD., P.E.
Chief, Engineering Division

TECHNICAL QUALITY CONTROL REQUIREMENTS
JACKSONVILLE HARBOR CONSTRUCTION DREDGING PHASE I AND PHASE II
DACW17-01-C-0023 38 FOOT PROJECT CUT-F THROUGH CUT-G
DACW17-01-C-0013 40 FOOT PROJECT CUT-3 THROUGH CUT-50
PRE, DURING AND POST CONSTRUCTION SURVEYS
JACKSONVILLE, FLORIDA (SURVEY 01-245)

1. LOCATION OF WORK. The project is located in Duval County at Jacksonville, Florida.

2. SCOPE OF WORK.

2.a. The services to be rendered by the Contractor include obtaining topographic and hydrographic Pre, During, and Post construction surveys, CADD data, and volumes.

2.b. The services to be rendered by the Contractor include all the work described in these technical requirements. Details not specifically described in these instructions are nevertheless a firm requirement if they can be identified as an item, or items, commonly a part of professional grade work of a comparative nature.

2.c. The Contractor shall furnish all necessary materials, labor, supervision, equipment, and transportation necessary to execute and complete all work required by these specifications.

2.d. COMPLIANCE. Surveying and Mapping shall be in strict compliance with EM-1110-1-1000 Photogrammetric Mapping, EM-1110-1-1002 Survey Markers and Monumentation, EM-1110-1-1003 NAVSTAR Global Positioning System Surveying, EM-1110-1-1004 Deformation Monitoring and Control Surveying, EM-1110-2-1003 Hydrographic Surveying, EM-1110-1-2909 Geospatial Data and System, Tri-Services A/E/C CADD Standards, Tri-Services Spatial Data Standards, Related Spatial Data Products and Chapter 177, Chapter 472, and Chapter 61G17 of the Minimum Technical Standards set by the Florida Board of Professional Surveyors and Mappers.

2.d(1) Digital Geospatial Metadata. Metadata are “data about data”. They describes the content, identification, data quality, spatial data organization, spatial reference, entity and attribute information, distribution, metadata reference, and other characteristics of data. Each survey project shall have metadata submitted with the final data submittal. All metadata submitted must be compliant with the Federal Geographic Data Committee Standard “Content Standard for Digital Geospatial Metadata”, FGDC-STD-001-1998. This standard is available for download from www.fgdc.gov. A graphical, annotated workbook explaining the standard is available in PDF format at www.fgdc.gov.

2.d(2) Furnish a digital file using Corpsmet95 Metadata Software. Corpsmet95 is available for download from www.corpsgeo1.usace.army.mil. All sections applicable to this collection effort must be completed. The point of contact in Survey Section for questions about metadata is Mr. Bill Mihalik at 904-232-1462.

2.e. The digital data shall be submitted on Recordable (CD-R) Compact Disk, media. Compact Disk, Rewritable (CD-RW) will not be accepted.

2.f. SUBMITTALS AND POINTS OF CONTACT. The points of contact are, Mr. Son Q. Vu at 904-232-1606, Mr. Dave Robar at 904-232-1458 (Jacksonville District Office), and Mr. Tommy Gaskins at 904-232-2144 (North Florida Area Office) mobile 904-614-9476. The survey Contractor shall furnish data directly to the North Florida Area Office within 24 hours after the survey data is collected in the field.

2.f(1) The survey Contractor shall furnish to the South Florida Area Office, letter size (8 1/2” x 11”) cross sections plots by fax or hand carry. The plots for the pre survey shall depict the plans and specification survey, the design template, and the pre survey. The plots for the after survey shall depict the plans and specification survey, the design template, the pre survey and after survey.

2.f(2) The survey Contractor shall furnish to the South Florida Area Office standard Corps of Engineers size plan view plots, utilizing the sheet layout shown in Enclosure 1, Contract Plans. The Contractor shall also place all cross sections into one or more standard Corps of Engineers size sheet and furnish plots within 48 hours.

TECHNICAL QUALITY CONTROL REQUIREMENTS (Continued)

2.f(3) The Contractor shall perform quantity calculations by the average end area method. The quantities shall be determined by passing the required grade template along both surveys. The quantities shall be furnished to the North Florida Area Office (Hard Copy), Mr. Tommy Gaskins and Survey Section Jacksonville District (DIGITAL COPY).

2.f(4) The survey Contractor shall furnish any and all data requested by the North Florida Area Office, this includes the COPIES OF THE FIELD BOOKS, HARD COPY MAPS, DIGITAL FILES (X, Y, Z, DGN, OR DTM) AND VOLUMES. All data (copies or plots) shall be stamp with a disclaimer such as PRELIMINARY OR ADVANCE COPY, FOR FIELD REVIEW ONLY, SUBJECT TO CORRECTIONS. The digital data shall be uploaded to the FTP site under the Contractor's directory. Survey section shall be furnished only digital data NO PLOTS.

2.f(5) The survey Contractor shall furnish daily reports, which verifies work effort by line items to EN-DT (Jacksonville District, Survey Section).

2.f(6) For each submittal all of the following files must be submitted if applicable:
Raw data files
XYZ ASCII files (unsorted)
DGN design files
DTM surface files
ALG alignment files
TML template files
RWL roadway files
Volume/Quantity reports
Readme files that explicitly detail the files submitted (including any special circumstances)
Daily Log of survey activities at the project site (this can be part of the Readme file)

The directory structure should be as follows:
Jax FTP
- Company Name
  - Survey Number
    - Pre (pre-construction)
      - YYYYMMDD (date posted)
    - Intermit (intermittent surveys and check surveys)
      - YYYYMMDD
    - Post (post-construction)
      - YYYYMMDD

2.f(7) The final data shall be submitted on CD-ROM after at the conclusion of the project and under the direction of the Jacksonville District Survey Section, a final project CD will be compiled and submitted. The CD will contain all of the partial project data sets posted to the FTP site in addition to a final overall set of files for the project (single overall DGN, etc.). Notify David Robar at the Jacksonville District Office via email or telephone when data has been posted.

2.f(8) NOT TO EXCEED. It was emphasized that the amount that is stated in this delivery order is a "NOT TO EXCEED" amount. The Contractor shall not provide services in excess of 85% of this total amount without first receiving written authorization from the Contracting Officer. Payments will be made on the fixed unit prices of the task order for services performed, as reflected by daily work reports submitted with the payment estimates. Upon completion of all services, if the total amount for services provided is less than the stated amount, the price of the delivery order will be modified to reflect services actually performed and accepted. To certify the hours worked and progress, a daily report shall be furnished directly to the Corps of Engineers, Design Branch, from the field party employed and signed by the Project Office representative. Weekly submittal is acceptable. The Contractor's work hours and work days may have to be adjusted to coincide with the construction Contractor, at no additional cost to the Government.

3. FIELD SURVEY EFFORT. Pre, During, and Post Construction beach surveys shall be collected for Contract DACW17-01-C-0023 as shown in Enclosure 1, Contract Plans And Specifications. Enclosure 2 is the technical requirements for the surveys. Enclosure 3 is CD with the plans and specification surveys.

TECHNICAL QUALITY CONTROL REQUIREMENTS (Continued)

3.a. CONTROL. The Horizontal datum shall be NAD 83 and the vertical datum shall be NGVD 1929 with a MLW datum applied. The MLW datum is shown in Enclosure 1. All control surveys shall be Third Order, Class II accuracy.

3.a(1) The basic control network shall be accomplished using precise differential carrier-phase Global Positioning System (GPS) and Differential GPS baseline vector observations.

3.a(2) Network design, station and baseline occupation requirements, for static and kinematic surveys, satellite observation time per baseline, baseline redundancies, and connection requirements to existing networks, shall follow the criteria given in the above said engineering manual. The field observation log shall be completed at each setup in the field.

3.a(3) GPS derived elevation data shall be supplied in reference to the above said datum. Existing benchmark data and stations shall be used in tandem in a minimally constrained adjustment program to model the geoid. All supporting data used in vertical adjustment shall be submitted to Survey Section. The GPS plan shall be submitted and approved by Mr. Robar prior to commencing work.

3.a(4) Existing Corps of Engineers control data shall be utilized for controlling the surveys. No control monuments shall be utilized that are not included in Enclosure 1. All established or recovered control shall be fully described and entered in a FIELD BOOK, in accordance with the Technical Requirements of this contract. All control surveys shall be Third Order, Class II accuracy.

3.a(5) All horizontal and vertical control (double run forward and back) established shall be a closed traverse or level loop no spur lines, with third order accuracy. All horizontal and vertical control along with baseline layouts, sketches, and pertinent data shall be entered in field books.

3.a(6) All monuments, survey markers, etc., recovered shall be noted in the FIELD BOOK. Control points established or recovered with no description or out-of-date (5 Years old) description shall be described with sketches in the FIELD BOOK for future recovery use.

3.a(7) All original field notes shall be kept in standard pocket size field books and shall become the property of the Government. The first four pages of the field books shall be reserved for indexing and the binding outside edge shall be free of all marking.

3.b. TIDE STAFF. Establish an on-site tide staff referenced to mean low water. Maintain a 0.1' frequency reading log during the water portion of the survey. Tide staff shall be set at the project sites.

3.c. QUANTITY SURVEYS. Topographic and Hydrographic cross sections shall be collected on even 100 foot station intervals for the disposal area and the channels.

3.d. ACOUSTIC MULTIBEAM DATA. Multibeam data shall be collected for final acceptance of the channel (reference COE Hydrographic Manual).

3.e. NAVAIDS. All Navigation's Aids (NAVAIDS) shall be located with coordinate positions (GPS) in or adjacent project area. Fixed NAVAIDS shall be positioned four to five times and floating NAVAIDS shall be positioned one time, with wind and tide direction recorded. Note type and condition of NAVAIDS within the project limits. Waning signs, lights, and any existing regulatory markers, (information signs) within the project limits shall be positioned four to five times. Locate all NAVAIDS in the entrance channel.

3.f. DGPS. The hydrographic positioning system shall be a Differential Global Positioning System utilizing the USCG Nav-beacon system as the reference station. The positioning system shall be checked with two control monuments and recorded along with setup data (input data to the GPS) in the field book. Hydrographic survey log sheets shall be filled out and submitted along with the field book.

3.g. SOUNDING POLE 6" DISK. Utilize a 6 inch diameter disk attached to the bottom of the sounding pole or lead line at all times when collecting conventional soundings.

3.h. BREAKLINE. Breaklines shall be located for all natural or man-make features as needed with X, Y, and Z and identified.

TECHNICAL QUALITY CONTROL REQUIREMENTS (Continued)

3.i. DATA COLLECTION (RTK or TOTAL STATION). Data collection will be allowed for data points only, showing all instrument positions, calibration, backsites and closing readings in the field book. Mr. Robar shall be contacted if you plan to use GPS (RTK) before utilizing. If RTK is utilized Q1 and Q2 files shall be furnished. Before using RTK, one session shall be performed around the expected survey area. After observation of the primary control (four monuments; one on each corner of the work area) the geoid model shall be prepared utilizing the four occupied monument's data. The geoid model shall be furnished to the Corps of Engineers for review and acceptance. CAUTION, unless the one session is observed with the four monuments before modeling the geoid, all data will be rejected and returned to the Contractor.

4. DATA PROCESSING. The Contractor shall make the necessary computations to verify the correctness of all measurements and apply the proper theory of location in accordance with the law or precedent and publish the results of the survey. The Contractor shall submit advance copies of the horizontal control so that USACE can compute the final positions before commencing mapping. Compute and tabulate the horizontal and vertical positions on all work performed. Review and edit all field data for discrepancies before plotting the final drawings.

4.a. Furnish X, Y, Z and descriptor ASCII file for profile line and or each cross section line and one X, Y, Z, and descriptor ASCII file with all data included.

5. CADD. The survey data shall be translated or digital capture into Intergraph IGDS 3D design files according to the specifications furnished. The survey data shall be provided in Intergraph MicroStation Version 5.0 or higher, as shown in the letter dated 30 September 1992.

5.a. GLOBAL ORIGIN. The IGDS 3-D design file shall be prepared with a global origin of 0, 0, 2147483.65, Design file master units: FT., Sub units: 1,000, and positional units: 1. The file name shall be the survey number prefixed to an "c" i.e., c245.DGN.

5.b. DIGITAL TERRAIN MODEL (DTM) DATA. The Contractor shall develop and deliver a surface model of the survey area using Intergraph compatible Digital Terrain Modeling software and the model file shall have the .dtm extension. The digital terrain model shall be developed from the collected data. Breaklines should include ridges, drainage, road edges, surface water boundaries, and other linear features implying a change in slope. The surface model shall be of adequate density and quality to produce a one foot contour interval derived from the original DTM (Digital Terrain Model) file. The contour data shall be incorporated as a reference file into the final data set. All data used to develop the DTM's shall be delivered in Intergraph 3-D design files.

5.b(1) CONTOURS. The contours shall be developed in the digital terrain model (DTM). The contours shall be provided in one or more master DGN files, attached as a reference file to all sheet files utilizing the clip bounds methods. Each contour shall be drawn sharp and clear as a continuous solid line, dashed contours are not acceptable. Every index contour shall be accentuated as a heavier line than the intermediate and shall be annotated according to its actual elevation above NGVD 29 MLW. Whenever index contours are closer than one-quarter (1/4) inch, and the ground slope is uniform, the intermediate shall be omitted. Labeling or numbering of contours shall be placed on top of the contour line, so that the elevation is readily discernible, do not break contours. Labeling of intermediate contours may be required in areas of low relief.

5.c. MODEL DGN FILES (SCALE 1:1).

5.c(1) The topographic data points shall be provided in one or more DGN file.

5.c(2) The hydrographic data points shall be provided in one or more DGN file.

5.c(3) The control and baseline data points shall be provided in one or more master DGN file attached as a reference file to all sheet files utilizing the clip bounds methods.

5.c(4) The contours shall be provided in one or more DGN file attached as a reference file to all sheet files utilizing the clip bounds methods.

5.c(5) The breaklines shall be provided in one or more master DGN file attached as a reference file to all sheet files utilizing the clip bounds methods DO NOT PLOT THE BREAKLINES.

TECHNICAL QUALITY CONTROL REQUIREMENTS (Concluded)

5.d. SECTION VIEWS. The sections shall be extracted and displayed from the digital terrain model (DTM OR TTN) utilizing INROADS OR INXPRESS. The sections shall be generated or extracted along the same azimuth as the section was collected in the field. The sections shall be displayed at a 10 to 1 vertical exaggeration. The planimetric lines (alignment of extraction), alignment, stations, and cross sections shall be displayed in one DGN file (NO PLOTS) with the district border file attached.

6. SURVEY/QUALITY CONTROL REPORT. The Contractor shall furnish a digital (*.doc) file on the final CD. The report shall include Right-of-Entry information, Control monuments Designation recovered, destroyed, fixed, included in control network, tide gauge location and monument used, dates of field survey collection, types of equipment used, quality control checks, and digital files. Unique circumstances and/or issues related to this survey, general approach/methodology to this survey. Along with any other data required in accordance with the law or precedent and for the Corps of Engineers to publish the results of the survey.

7. DELIVERIES. On completion, all data required shall be delivered or mailed to Design Branch, Survey Section at the address shown in contract, and shall be accompanied by a properly numbered, dated and signed letter or shipping form, in duplicate, listing the materials being transmitted. All costs of deliveries shall be borne by the Contractor. Items to be delivered include, but are not limited to the following:

7.a. GPS network plan, (before GPS work commences).

7.b. GPS raw data along with field observation log sheets filled out in field with all information and sketches.

7.c. Computation files with Horizontal and Vertical abstracts.

7.d. Horizontal and Vertical Field Books.

7.e. Furnish X, Y, Z, and descriptor ASCII file for each cross section and one merged with all data collected for all cross section.

7.f. DTM File.

7.g. DGN files.

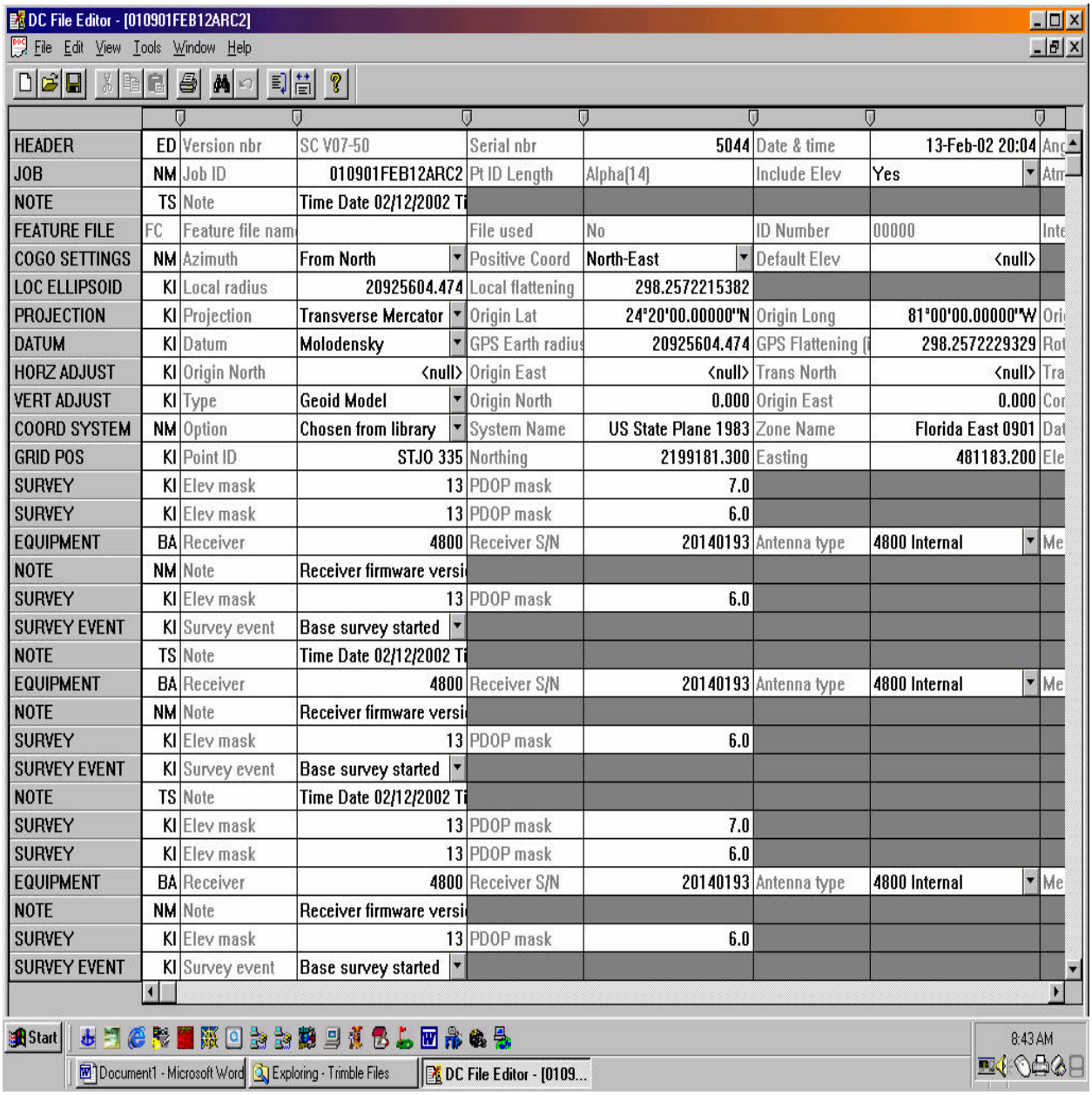
7.h. Volumes.

7.i. Furnish a digital file using CORPSMET 95 (Metadata Software) with the appropriate data included.

7.j. Survey Report *.doc file.

D-3. Trimble Geomatics Office Data Processing

The following three screen captures (Figures D-4 a-c) from the Geomatics Office file editor show the initial calibration and control parameters set for this RTK project. Fixed positional data for ST JO 335 are also shown, along with mask angle settings, PDOP limits, instrument serial numbers, and antenna data. The site was calibrated relative to NAD 1983 (WGS 84 ellipsoid), with coordinates transformed to the Florida SPCS (East Zone). The geoid model used was GEOID 99. The elevation reference datum for this disposal area is NGVD 29.



HEADER	ED	Version nbr	SC V07-50	Serial nbr	5044	Date & time	13-Feb-02 20:04	Anc
JOB	NM	Job ID	010901FEB12ARC2	Pt ID Length	Alpha(14)	Include Elev	Yes	Atm
NOTE	TS	Note	Time Date 02/12/2002 Ti					
FEATURE FILE	FC	Feature file nam		File used	No	ID Number	00000	Inte
COGO SETTINGS	NM	Azimuth	From North	Positive Coord	North-East	Default Elev	<null>	
LOC ELLIPSOID	KI	Local radius	20925604.474	Local flattening	298.2572215382			
PROJECTION	KI	Projection	Transverse Mercator	Origin Lat	24°20'00.00000"N	Origin Long	81°00'00.00000"W	Ori
DATUM	KI	Datum	Molodensky	GPS Earth radius	20925604.474	GPS Flattening (i	298.2572229329	Rot
HORZ ADJUST	KI	Origin North	<null>	Origin East	<null>	Trans North	<null>	Tra
VERT ADJUST	KI	Type	Geoid Model	Origin North	0.000	Origin East	0.000	Cor
COORD SYSTEM	NM	Option	Chosen from library	System Name	US State Plane 1983	Zone Name	Florida East 0901	Dat
GRID POS	KI	Point ID	STJO 335	Northing	2199181.300	Easting	481183.200	Ele
SURVEY	KI	Elev mask	13	PDOP mask	7.0			
SURVEY	KI	Elev mask	13	PDOP mask	6.0			
EQUIPMENT	BA	Receiver	4800	Receiver S/N	20140193	Antenna type	4800 Internal	Me
NOTE	NM	Note	Receiver firmware versi					
SURVEY	KI	Elev mask	13	PDOP mask	6.0			
SURVEY EVENT	KI	Survey event	Base survey started					
NOTE	TS	Note	Time Date 02/12/2002 Ti					
EQUIPMENT	BA	Receiver	4800	Receiver S/N	20140193	Antenna type	4800 Internal	Me
NOTE	NM	Note	Receiver firmware versi					
SURVEY	KI	Elev mask	13	PDOP mask	6.0			
SURVEY EVENT	KI	Survey event	Base survey started					
NOTE	TS	Note	Time Date 02/12/2002 Ti					
SURVEY	KI	Elev mask	13	PDOP mask	7.0			
SURVEY	KI	Elev mask	13	PDOP mask	6.0			
EQUIPMENT	BA	Receiver	4800	Receiver S/N	20140193	Antenna type	4800 Internal	Me
NOTE	NM	Note	Receiver firmware versi					
SURVEY	KI	Elev mask	13	PDOP mask	6.0			
SURVEY EVENT	KI	Survey event	Base survey started					

Figure D-4a. Trimble Geomatics File Editor (Continued)

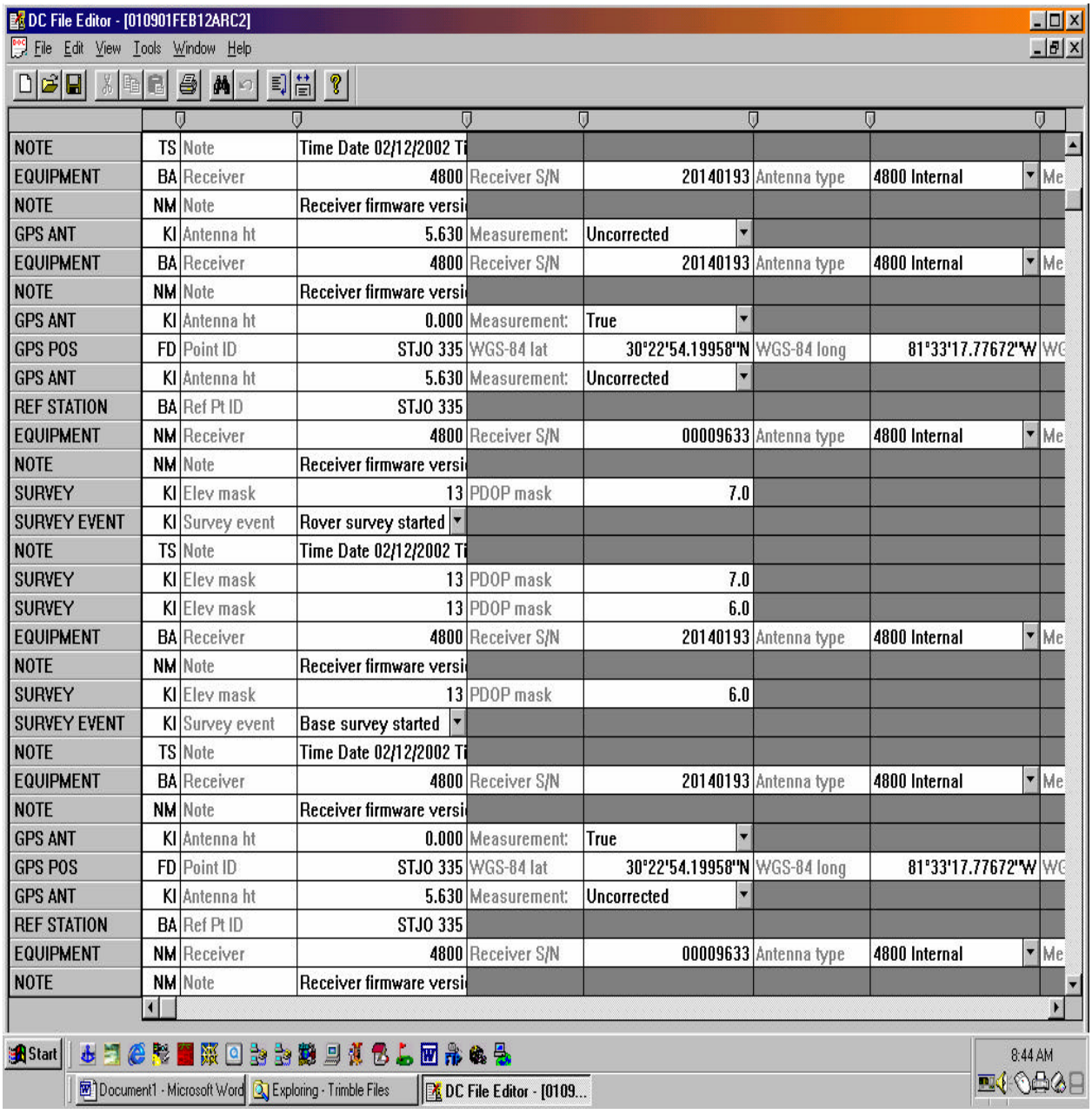


Figure D-4b. Trimble Geomatics File Editor (Continued)

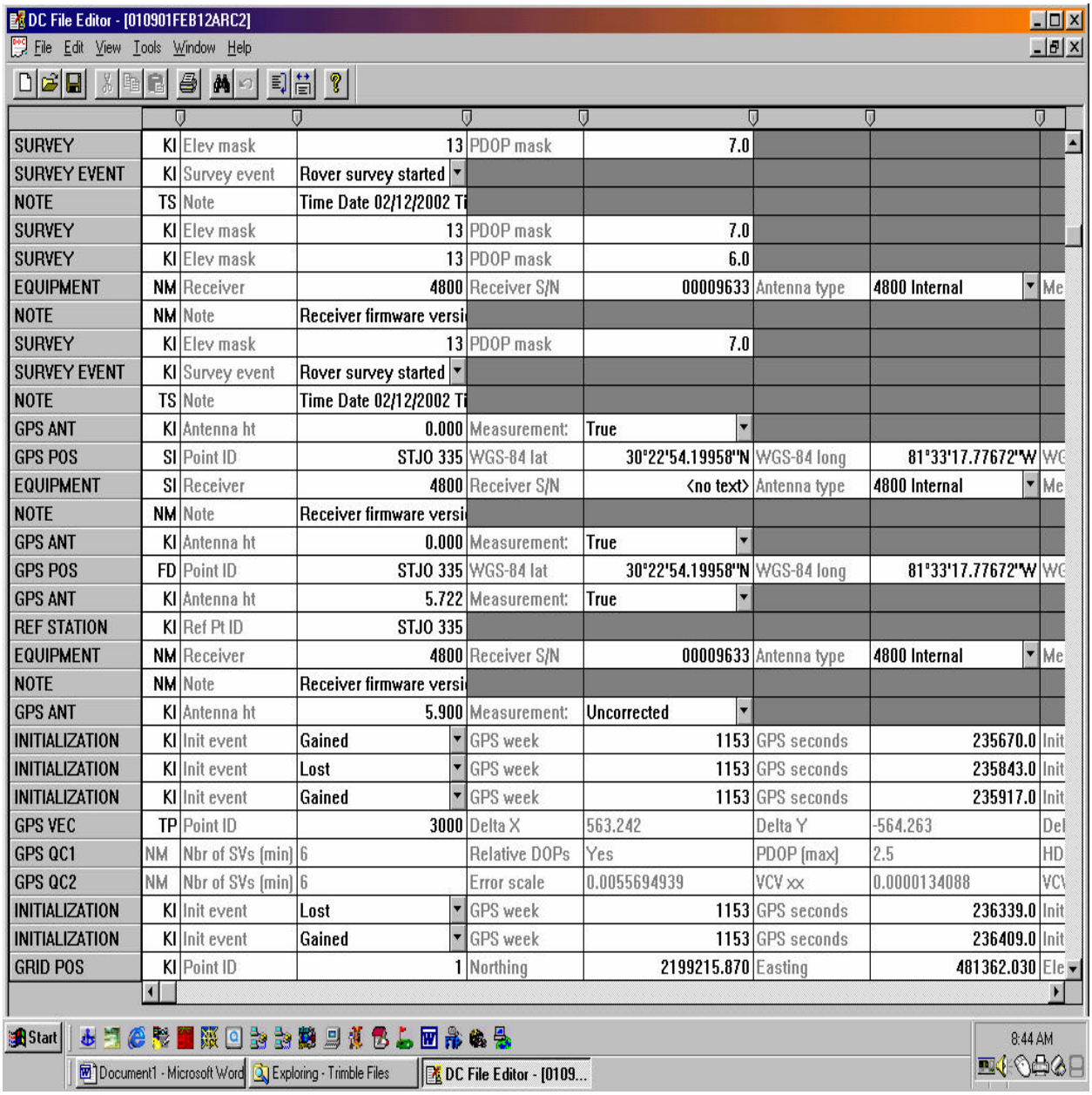


Figure D-4c. Trimble Geomatics File Editor (Concluded)

Figure D-5 below shows the coordinates for six baseline PI points (1 through 6) along the top of the embankment.

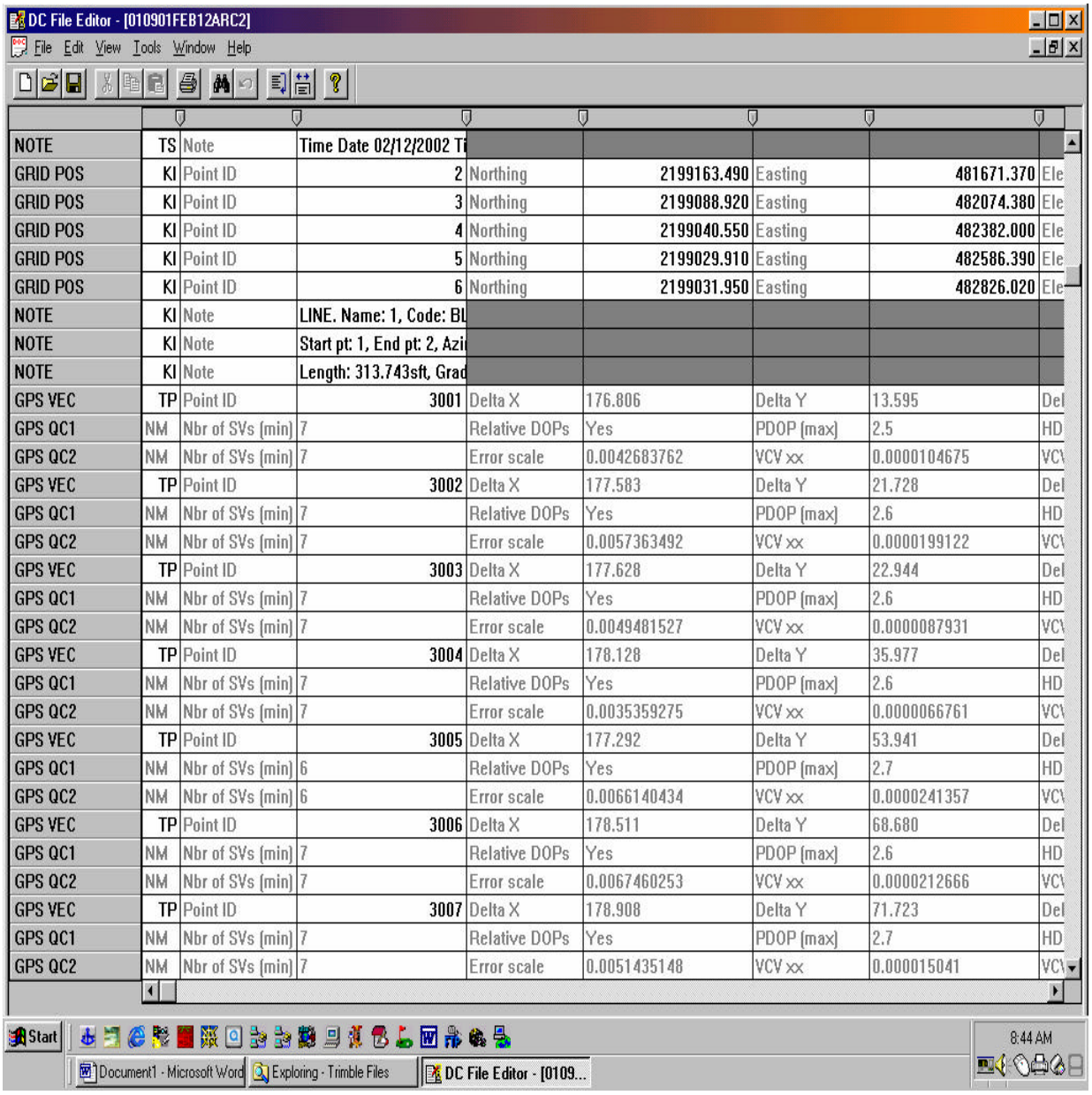


Figure D-5. Baseline PI coordinates

The following screen captures are from Trimble Geomatics "Observations" and show the first few topo observations made relative to the fixed elevation at benchmark ST JO 335. The "Geoid" window (bottom figure) depicts the (-) 93.296 ft geoid separation input for this area.

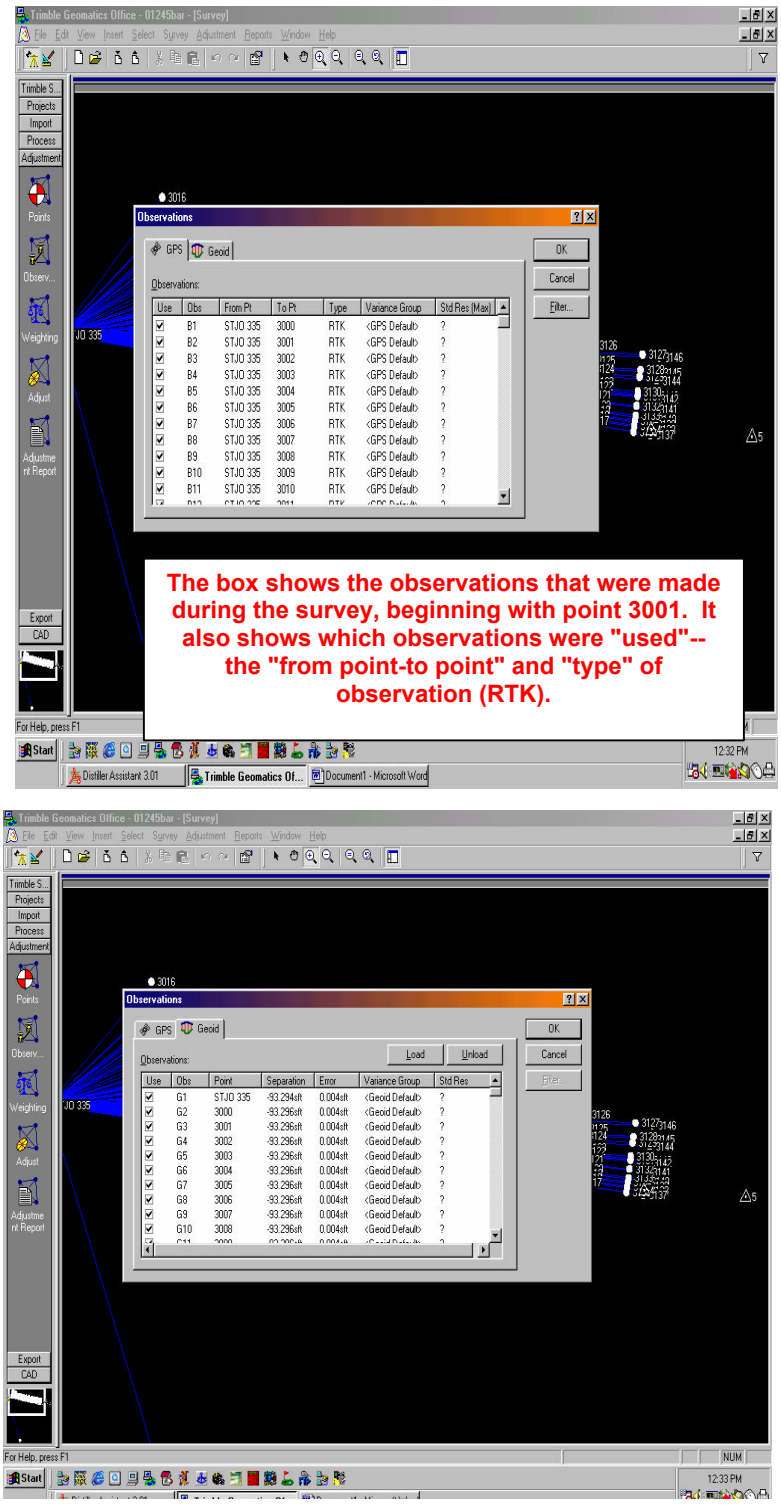
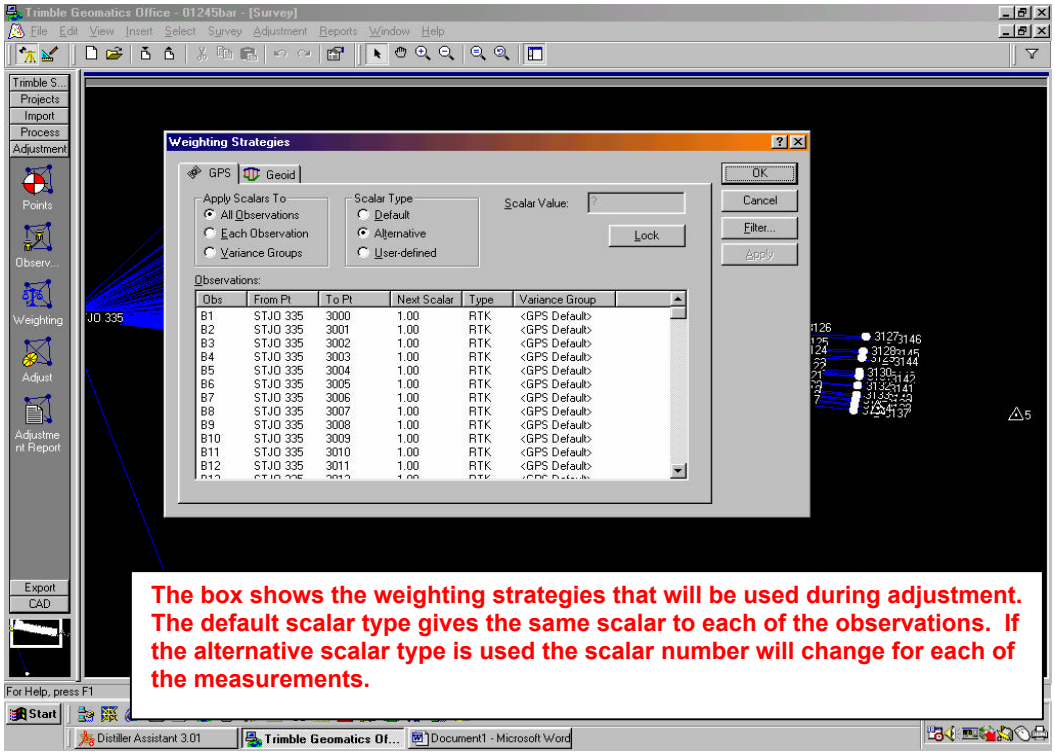


Figure D-6. Trimble Geomatics Observations windows



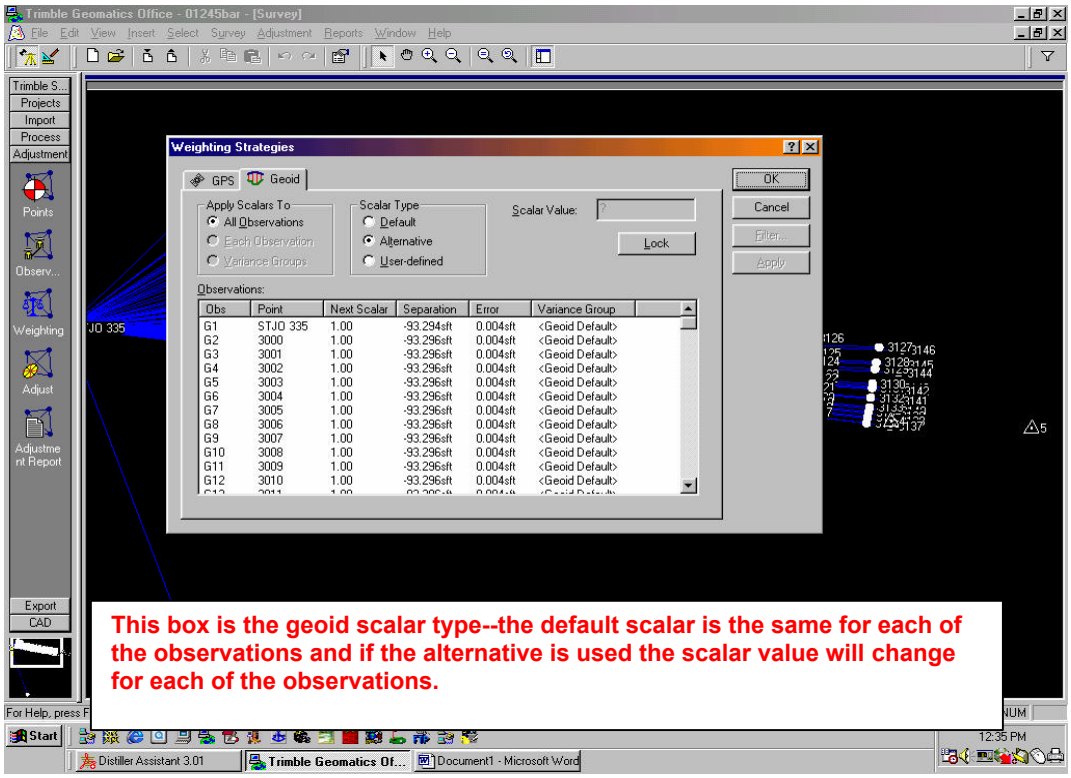


Figure D-7. GPS and Geoid Weighting Strategies

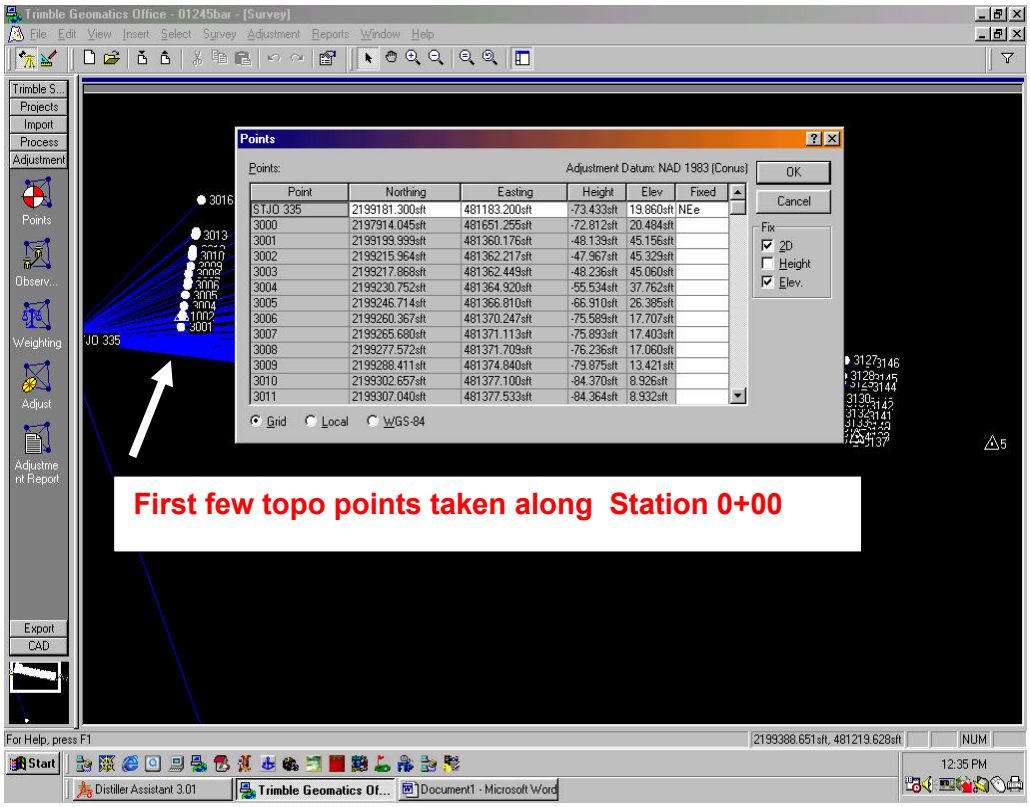


Figure D-8. Listing of first 11 topographic points in file

D-4. Final Coordinates of Points on Cross-Sections

The following Trimble tabulation lists the computed RTK coordinates and elevations for each observed point, along with information about the reference datums, geoids, grids, etc. Coordinates and elevations for the check point, ST JO 336, are also indicated. A comparison at the end of the list shows the differences between two checks on ST JO 336. This check indicated repeatability was well within 0.2 ft horizontal and 0.1 ft vertical.

Final Listing of Observed Points

Fixed width point coordinate listing

Project name 01245bar
Coordinate Units US survey feet
Distance Units US survey feet
Height Units US survey feet
Date printed 8/20/02 12:37:02 PM
Coordinate System US State Plane 1983 Zone Florida East 0901
Datum NAD 1983 (Conus)
Geoid model GEOID99 (Conus)
Coordinate units: US survey feet
Elevation units: US survey feet

Reference Datum Parameters

Elevations referenced to NGVD 29

Point listing

Name	Northing	Easting	Elevation	Feature Code
STJO 335	2199181.300	481183.200	19.860	ACOE MON
3000	2197914.045	481651.255	20.484	CHK IN ST JO 336
1	2199215.870	481362.030	13.000	0+00
2	2199163.490	481671.370	13.000	PI 3+13.74
3	2199088.920	482074.380	13.000	PI 7+23.59
4	2199040.550	482382.000	13.000	PI 10+34.99
5	2199029.910	482586.390	13.000	PI 12+39.66
6	2199031.950	482826.020	13.000	PI 14+79.30
3001	2199199.999	481360.176	45.156	TOP LEVEE
3002	2199215.964	481362.217	45.329	GND
3003	2199217.868	481362.449	45.060	TOP LEVEE
3004	2199230.752	481364.920	37.762	SLP
3005	2199246.714	481366.810	26.385	SLP
3006	2199260.367	481370.247	17.707	TOE LEVEE
3007	2199265.680	481371.113	17.403	GND
3008	2199277.572	481371.709	17.060	BRK
3009	2199288.411	481374.840	13.421	SLP
3010	2199302.657	481377.100	8.926	BRK
3011	2199307.040	481377.533	8.932	BRK
3012	2199312.396	481378.231	10.353	BRK
3013	2199333.392	481381.984	9.018	GND
3014	2199334.741	481383.238	9.432	BRK
3015	2199338.309	481383.368	6.865	BRK SOUTH END OF PIPE PILE
3016	2199384.650	481391.055	7.821	GND NORTH SIDE OF PIPE PILE
3017	2199366.127	481488.416	7.624	GND
3018	2199347.730	481485.338	8.001	GND
3019	2199322.648	481482.309	8.471	GND
3020	2199298.067	481477.092	9.085	BRK
3021	2199272.929	481472.688	16.434	BRK
3022	2199255.697	481470.546	17.949	TOE LEVEE
3023	2199244.566	481469.000	24.264	SLP
3024	2199229.231	481465.548	35.291	SLP
3025	2199212.151	481463.286	45.550	TOP LEVEE
3026	2199197.201	481460.477	45.546	TOP LEVEE
3027	2199179.463	481558.052	45.666	TOP LEVEE
3028	2199195.180	481560.957	45.681	TOP LEVEE
3029	2199212.564	481564.767	33.632	SLP
3030	2199226.977	481567.093	23.017	SLP
3031	2199235.011	481567.707	17.555	TOE LEVEE
3032	2199258.442	481572.385	15.941	BRK
3033	2199281.314	481575.366	10.959	GND
3034	2199274.564	481676.546	9.443	TREE LINE
3035	2199264.474	481674.632	9.502	GND
3036	2199248.182	481671.606	10.271	BRK
3037	2199245.983	481671.930	12.527	BRK

LINE 1

PI Station 0+00

Points 3001 thru 3016

Final Listing of Observed Points (Continued)

Name	Northing	Easting	Elevation	Feature Code
3038	2199240.352	481670.583	16.606	BRK
3039	2199239.973	481670.826	16.597	BRK
3040	2199216.180	481666.760	17.168	TOE LEVEE
3041	2199210.533	481664.537	20.202	SLP
3042	2199195.746	481662.326	30.564	SLP
3043	2199180.980	481660.209	41.257	SLP
3044	2199173.701	481659.481	45.693	TOP LEVEE
3045	2199159.847	481656.740	45.862	TOP LEVEE
3046	2199157.651	481669.736	45.861	TOP LEVEE
3047	2199164.029	481671.527	45.971	GND
3048	2199172.385	481673.051	45.648	TOP LEVEE
3049	2199178.972	481673.282	40.667	SLP
3050	2199193.732	481676.922	30.838	SLP
3051	2199208.133	481679.138	20.259	SLP
3052	2199213.831	481680.182	17.037	TOE LEVEE
3053	2199237.524	481684.628	16.738	BRK
3054	2199244.599	481685.769	10.463	BRK
3055	2199271.059	481689.628	9.106	TREE LINE
3056	2199248.677	481775.660	8.129	TREE LINE
3057	2199227.998	481770.512	9.607	BRK
3058	2199220.781	481769.121	15.875	BRK
3059	2199199.758	481765.024	16.842	TOE LEVEE
3060	2199192.327	481763.747	19.992	SLP
3061	2199177.703	481761.018	29.702	SLP
3062	2199163.207	481758.872	39.776	SLP
3063	2199154.511	481757.891	45.578	TOP LEVEE
3064	2199147.475	481755.512	45.729	GND
3065	2199140.021	481755.480	45.570	TOP LEVEE
3066	2199120.937	481852.586	45.105	TOP LEVEE
3067	2199130.060	481854.090	45.132	GND
3068	2199136.808	481856.432	44.989	TOP LEVEE
3069	2199144.995	481857.716	39.716	SLP
3070	2199159.413	481859.993	29.485	SLP
3071	2199174.480	481863.265	20.065	SLP
3072	2199181.776	481865.501	16.948	TOE LEVEE
3073	2199201.096	481868.135	15.688	BRK
3074	2199206.059	481868.126	8.690	BRK
3075	2199231.069	481873.669	7.121	TREE LINE
3076	2199103.740	481950.915	45.295	TREE LINE
3077	2199103.646	481951.690	45.260	TOP LEVEE
3078	2199112.366	481952.925	45.417	GND
3079	2199117.876	481954.391	45.049	TOP LEVEE
3080	2199126.659	481956.372	40.023	SLP
3081	2199141.430	481959.148	29.481	SLP
3082	2199156.118	481960.785	20.228	SLP
3083	2199162.793	481962.528	16.679	TOE LEVEE
3084	2199182.459	481965.633	15.532	BRK
3085	2199188.883	481966.505	8.357	BRK
3086	2199211.685	481971.859	5.488	TREE LINE
3087	2199196.029	482070.755	6.406	TREE LINE
3088	2199173.846	482065.692	7.875	BRK
3089	2199165.071	482065.076	16.162	BRK
3090	2199143.318	482059.769	17.537	TOE LEVEE
3091	2199137.896	482058.831	20.323	SLP
3092	2199123.031	482056.113	29.447	SLP
3093	2199108.614	482053.986	39.740	SLP
3094	2199100.852	482051.997	45.151	TOP LEVEE
3095	2199093.674	482050.679	45.279	GND
3096	2199086.315	482049.134	45.579	TOP LEVEE
3097	2199081.124	482073.545	45.330	TOP LEVEE
3098	2199089.674	482075.034	45.414	GND

Final Listing of Observed Points (Concluded)

Name	Northing	Easting	Elevation	Feature Code
3099	2199097.527	482076.386	44.784	TOP LEVEE
3100	2199104.299	482077.444	40.172	SLP
3101	2199118.692	482080.383	29.698	SLP
3102	2199133.761	482083.402	20.255	SLP
3103	2199138.783	482084.389	17.650	TOE LEVEE
3104	2199160.505	482088.277	16.597	BRK
3105	2199168.850	482089.607	8.810	BRK
3106	2199192.889	482092.993	5.844	TREE LINE
3107	2199182.573	482165.848	6.137	TREE LINE
3108	2199156.945	482162.124	8.130	BRK
3109	2199147.118	482161.417	16.249	BRK
3110	2199127.248	482157.412	17.403	TOE LEVEE
3111	2199121.910	482156.701	19.962	SLP
3112	2199106.873	482154.575	29.773	SLP
3113	2199092.500	482151.611	40.207	SLP
3114	2199084.389	482150.513	45.505	TOP LEVEE
3115	2199077.070	482148.916	45.605	GND
3116	2199069.835	482147.937	45.346	TOP LEVEE
3117	2199053.593	482248.233	45.445	TOP LEVEE
3118	2199061.015	482249.129	45.489	GND
3119	2199068.622	482250.452	45.438	TOP LEVEE
3120	2199076.630	482251.368	39.882	SLP
3121	2199091.695	482253.717	29.251	SLP
3122	2199106.298	482256.417	20.293	SLP
3123	2199111.368	482257.035	17.799	TOE LEVEE
3124	2199131.742	482259.561	16.689	BRK
3125	2199142.707	482261.077	7.581	BRK
3126	2199166.334	482264.746	4.956	GND
3127	2199151.877	482364.498	5.293	GND
3128	2199129.007	482360.224	7.096	BRK
3129	2199119.051	482358.557	16.268	BRK
3130	2199097.092	482354.914	17.644	TOE LEVEE
3131	2199090.754	482354.390	19.786	SLP
3132	2199075.847	482352.131	29.372	SLP
3133	2199061.315	482350.750	39.630	SLP
3134	2199053.703	482348.875	45.246	TOP LEVEE
3135	2199046.268	482347.542	45.743	GND
3136	2199037.454	482346.208	45.410	TOP LEVEE
3137	2199032.359	482380.200	45.147	TOP LEVEE
3138	2199041.159	482382.638	45.704	GND
3139	2199048.788	482383.667	45.587	TOP LEVEE
3140	2199055.931	482385.236	40.246	SLP
3141	2199070.519	482387.084	30.297	SLP
3142	2199085.384	482388.779	20.138	SLP
3143	2199090.871	482389.763	17.801	TOE LEVEE
3144	2199113.683	482393.186	16.724	BRK
3145	2199125.318	482394.590	7.227	BRK
3146	2199147.958	482398.202	5.426	GND
3147	2197914.192	481651.189	20.539	CHK IN ST JO 336

ST JO 336 checks: Points 3000 & 3147
dx = +0.147 ft
dy = -0.066 ft
dz = +0.055 ft