Sandia National Laboratories
FGIS Process Overview

Infrastructure Operations

Facilities Geographic Information System (FGIS)

- **Sandia National Laboratories (SNL)/New Mexico (NM) uses a real-time underground utility and Infrastructure Surveying Program to maintain the FGIS.**

- **The FGIS is built on Bentley Map software supported by an Oracle Spatial Database and consists of 89 master FGIS files maintained in our Bentley ProjectWise System.**

- **The process relies on**
  - **Communication and partnering**
  - **Global positioning surveying**
  - **Robust and accurate data collection**
  - **Software tools**
    - *Trimble Geomatics Office (TGO)*
    - *Bentley Map*

Sandia National Laboratories

FGIS (Cont.)

- **FGIS data is used to support the SNL Mission**
  - Site mapping, utility mapping, and site planning
  - Excavation safety
  - Operations and maintenance activities
  - Condition assessment and replacement plant value
  - Pavement management
  - Parking management
  - As-built information

Sandia National Laboratories

GPS and Utility Survey Data

- Our GPS Program and the utility survey data it produces are key components of our Subsurface Program.
- We are committed to collecting, processing, and storing data utilizing the most modern tools available to ensure that our utilities and infrastructure can be accurately mapped and located in the field.
- This data also supports our Infrastructure Operations and Maintenance Program as well as Emergency Management and Security Operations.

GPS Sequence of Events

- **The request is received from Inspector, Contractor, Engineer, or other requestor.**
- **The GPS Technician gathers**
  - **Job location**
  - **Dig permit number/project number**
  - **Description of utilities to be surveyed**
  - **Plot of area to be GPS'd, including all utilities**
- **Then the Technician**
  - **Locates project in ProjectWise and plots construction drawings**
  - **Logs request in VPAT**

Sandia National Laboratories

GPS Sequence of Events (Cont.)

- **GPS Technician Responsibilities**
  - Wear all required PPE.
  - Sign in or check in at project location if necessary.
  - Analyze the site and recognize any hazardous areas.
  - Perform utility survey of all new and existing utilities and infrastructure utilizing the GPS or the total station.
    - *Ask contractor for description or layout if necessary to understand the project.*
    - *Refer to Trimble Data Collector Operations procedure for creating job, starting survey, and measuring points if needed.*
    - *If it is a large project, highlight areas GPS'd and initial/date project plans.*
  - Sign out or check out if necessary.

Sandia National Laboratories

Survey Controller Workflow

- GPS Technician creates a new job in the Trimble Data Collector.
- The calibration file is copied into the new job file.
- GPS Technician verifies connection to GPS Receiver, Base Station, Antenna Height, and Radio Links.
- The GPS Technician selects the RTK Survey Style.
- GPS Technician starts the survey and selects Measure Point and then starts the survey.
- GPS Technician verifies position on a known point.
- GPS Technician enters the survey date and two initials followed by a dash and 001. This ensures the Survey Points are tagged with the appropriate information to process the data for the job.

Sandia
National
Laboratories

Survey Controller Workflow (Cont.)

- **The GPS Technician then starts surveying the underground utilities and infrastructure.**
- **The GPS Technician enters a Point Code for each point surveyed.**
  - This point code includes important information related to the element in the field being surveyed.
- **Examples of Point Codes:**
  - Water 2" Copper
  - Elect DB 6 Way
  - CW 6" PVC
  - GAS 6" HDPE

Sandia
National
Laboratories

Survey Controller Workflow (Cont.)

Survey Controller Workflow (Cont.)
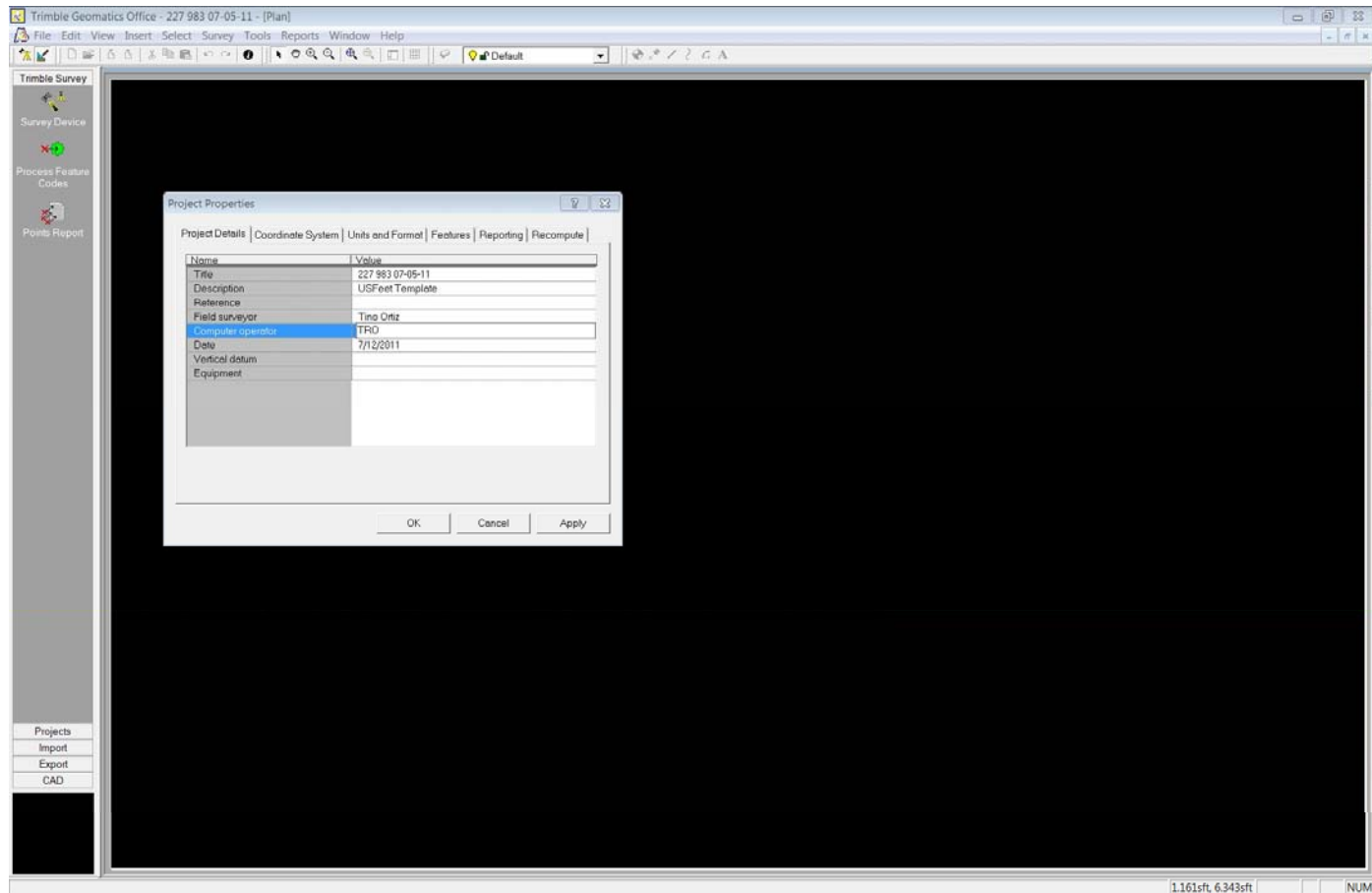

Point Code

GPS and Utility Survey Data Processing

- **Processing survey data in Office**
  - **Log GPS activities performed in the field into VPAT.**
    - *The GPS number is the last three digits of permit, the building number, and the date.*
  - **Download data from Data Collector to PC and process in TGO.**
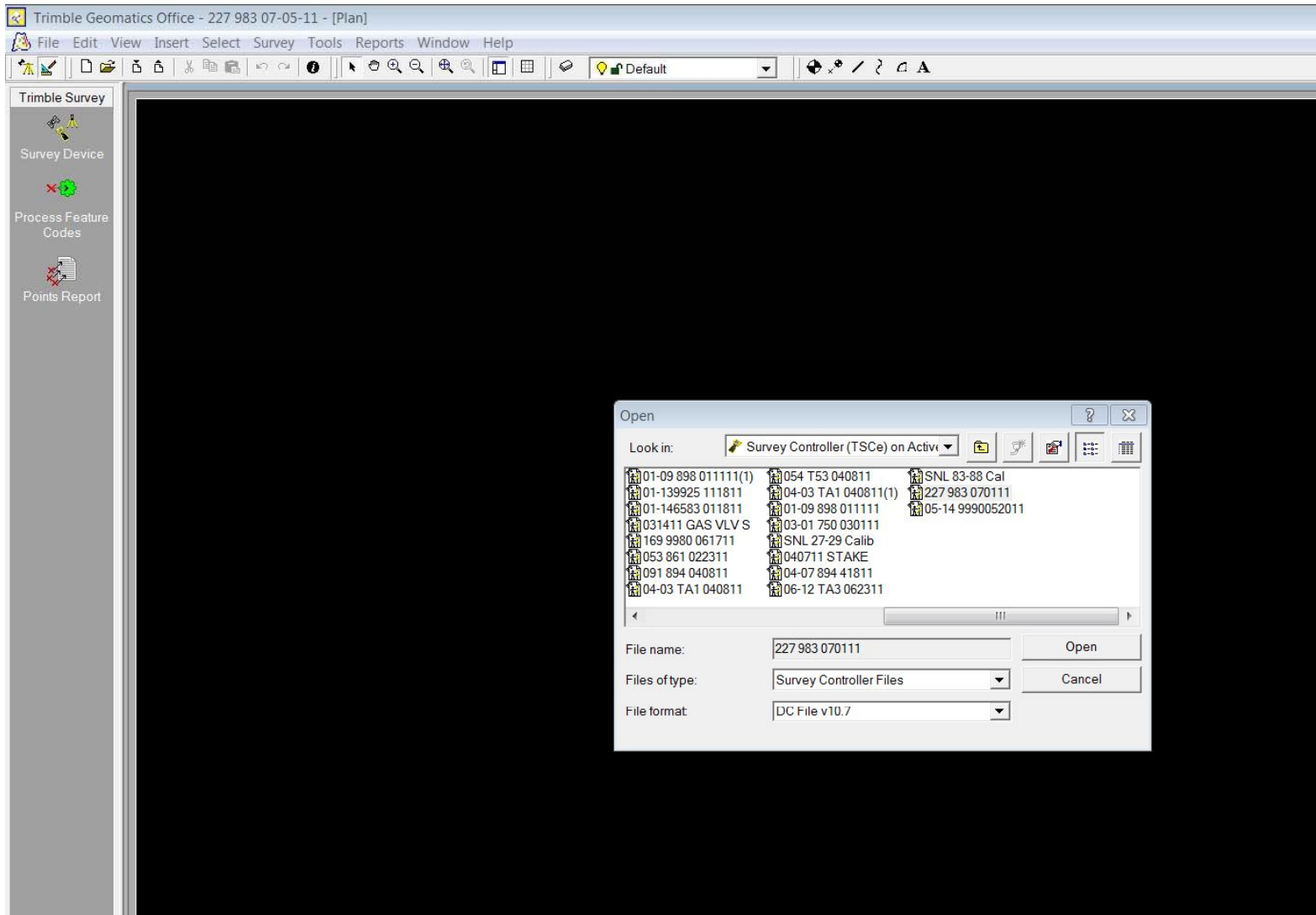   - *Refer to procedure for downloading data to PC if needed.*

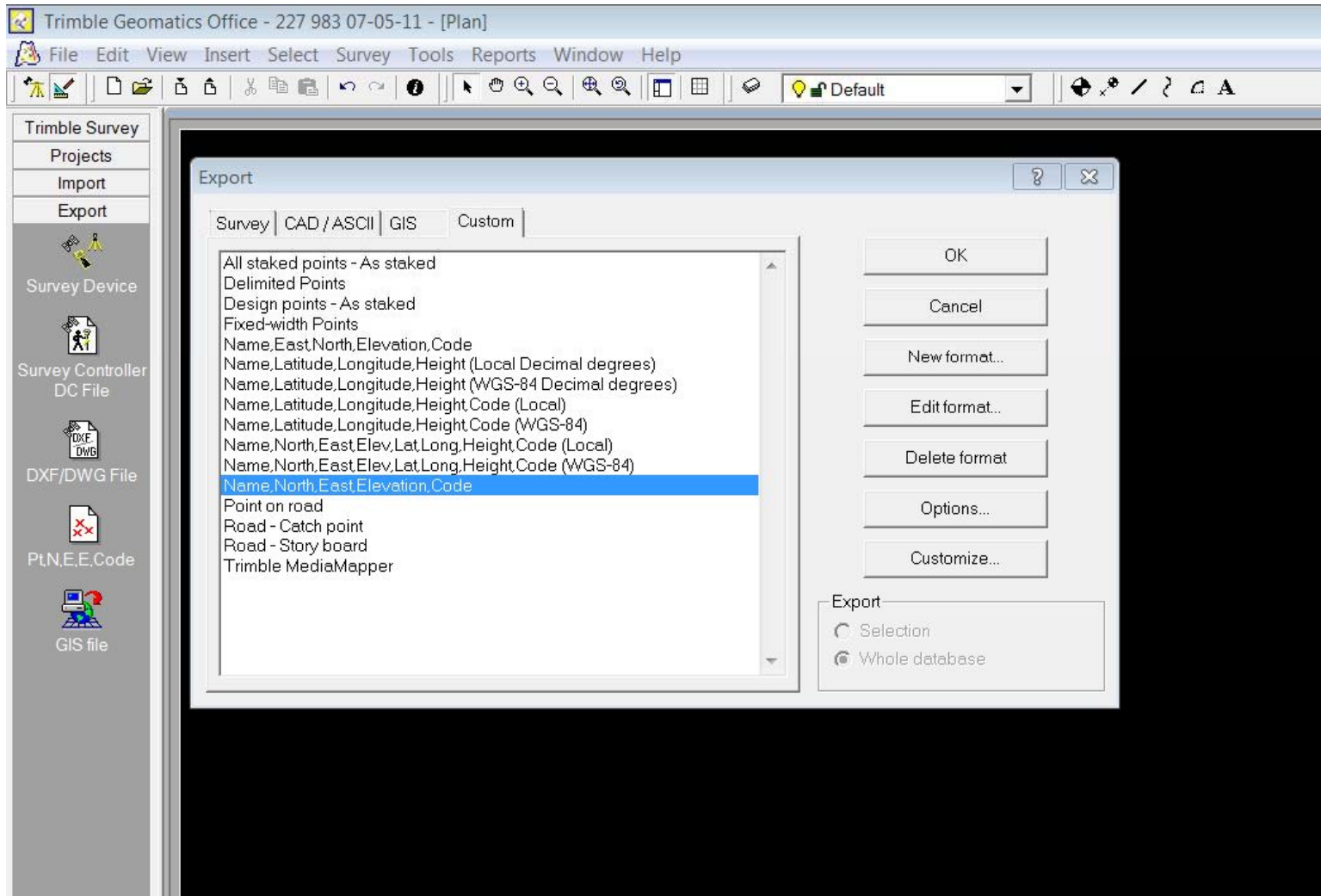Sandia National Laboratories
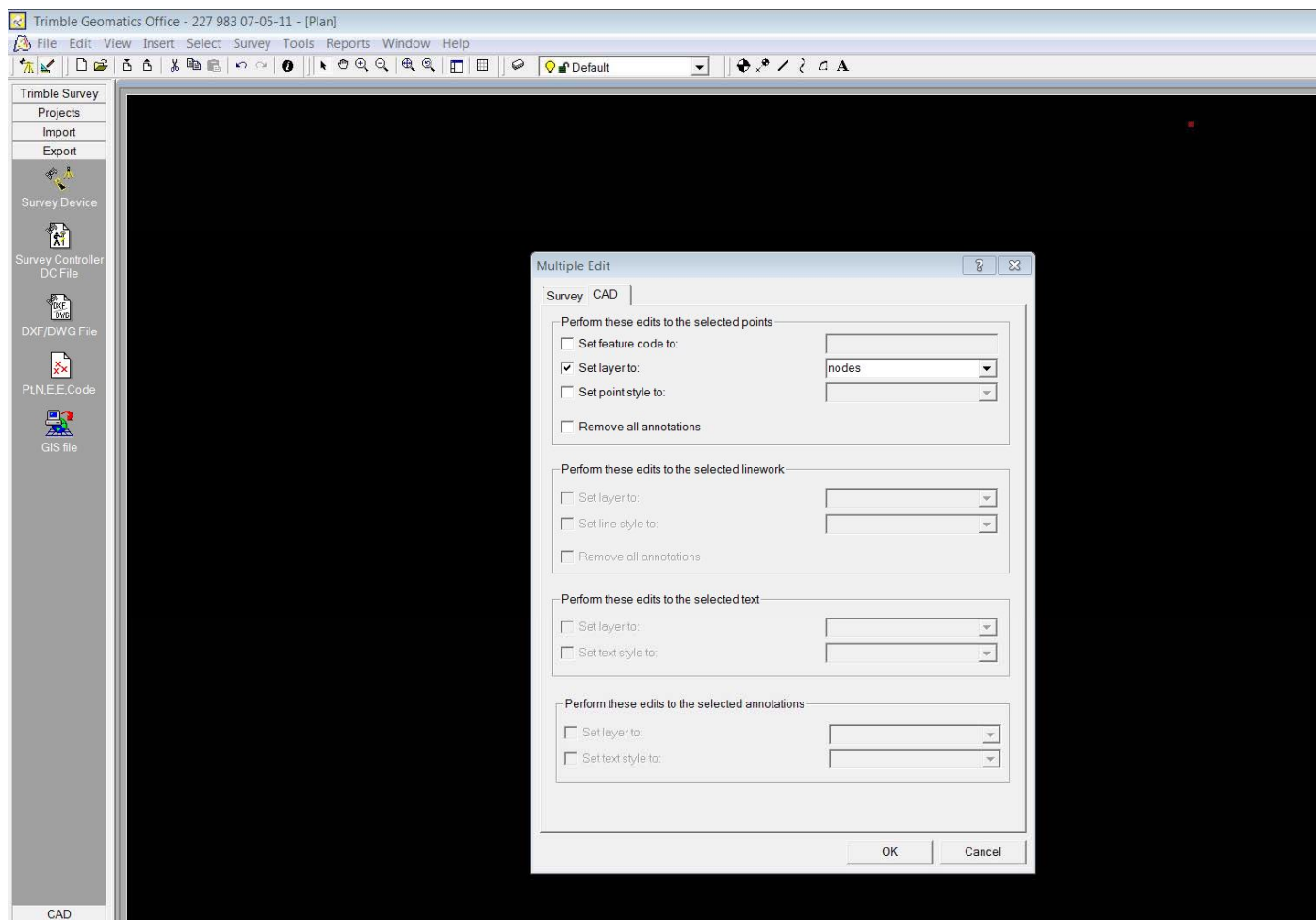
Using TGO to Process Survey Data

Open Project in TGO

Import Survey Data from Data Collector

Define Data File Format
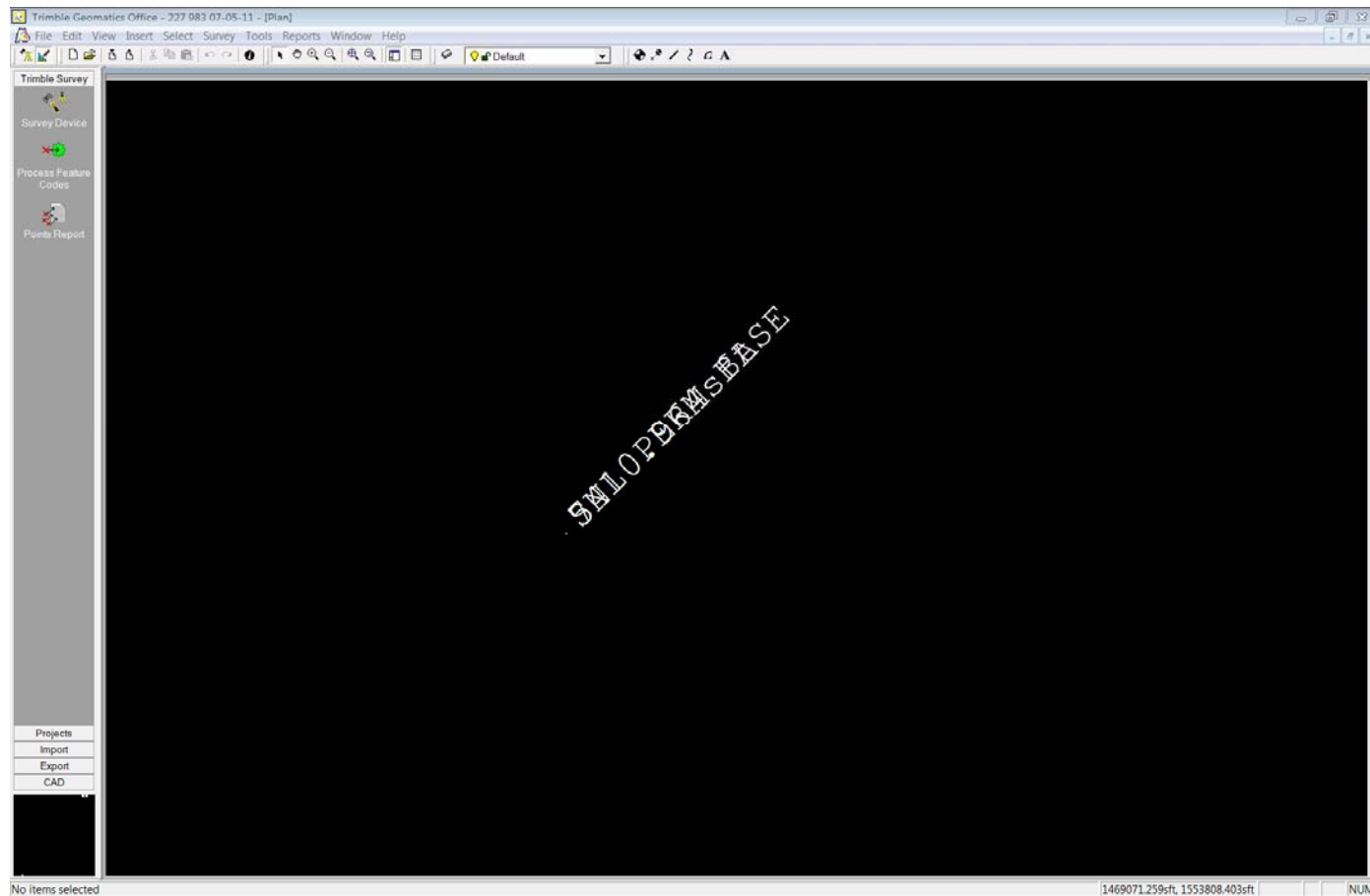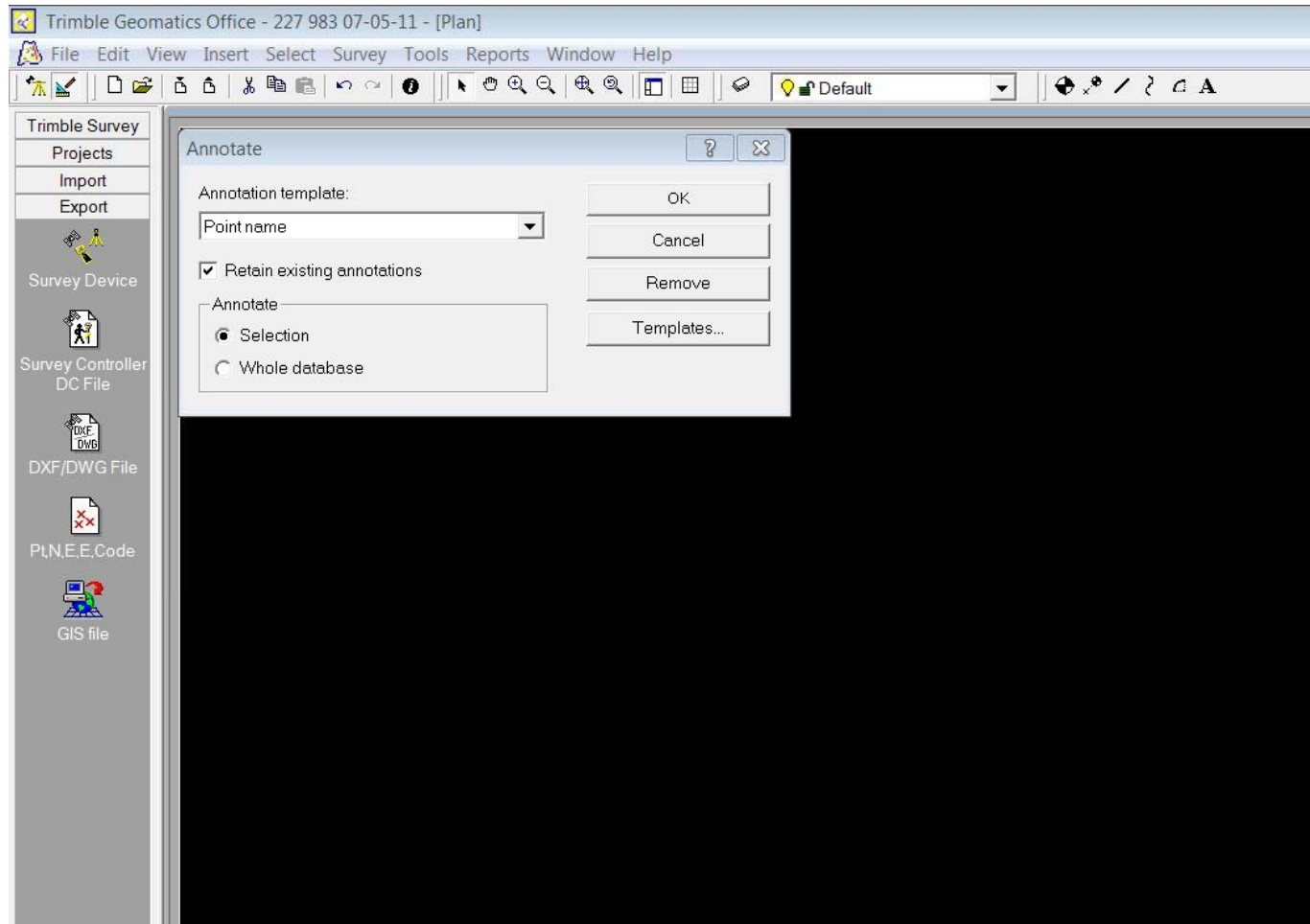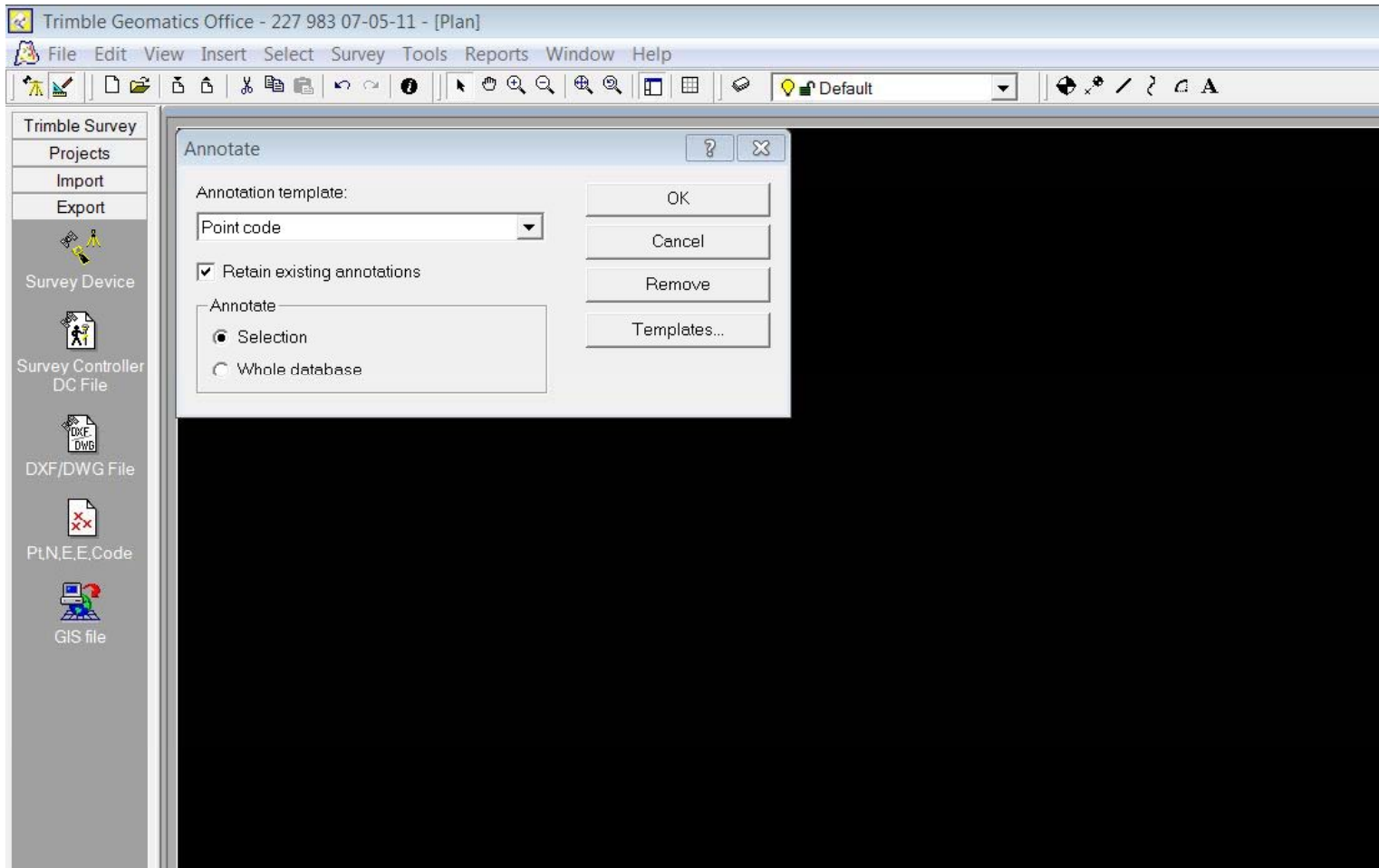
Define Survey Node Parameters
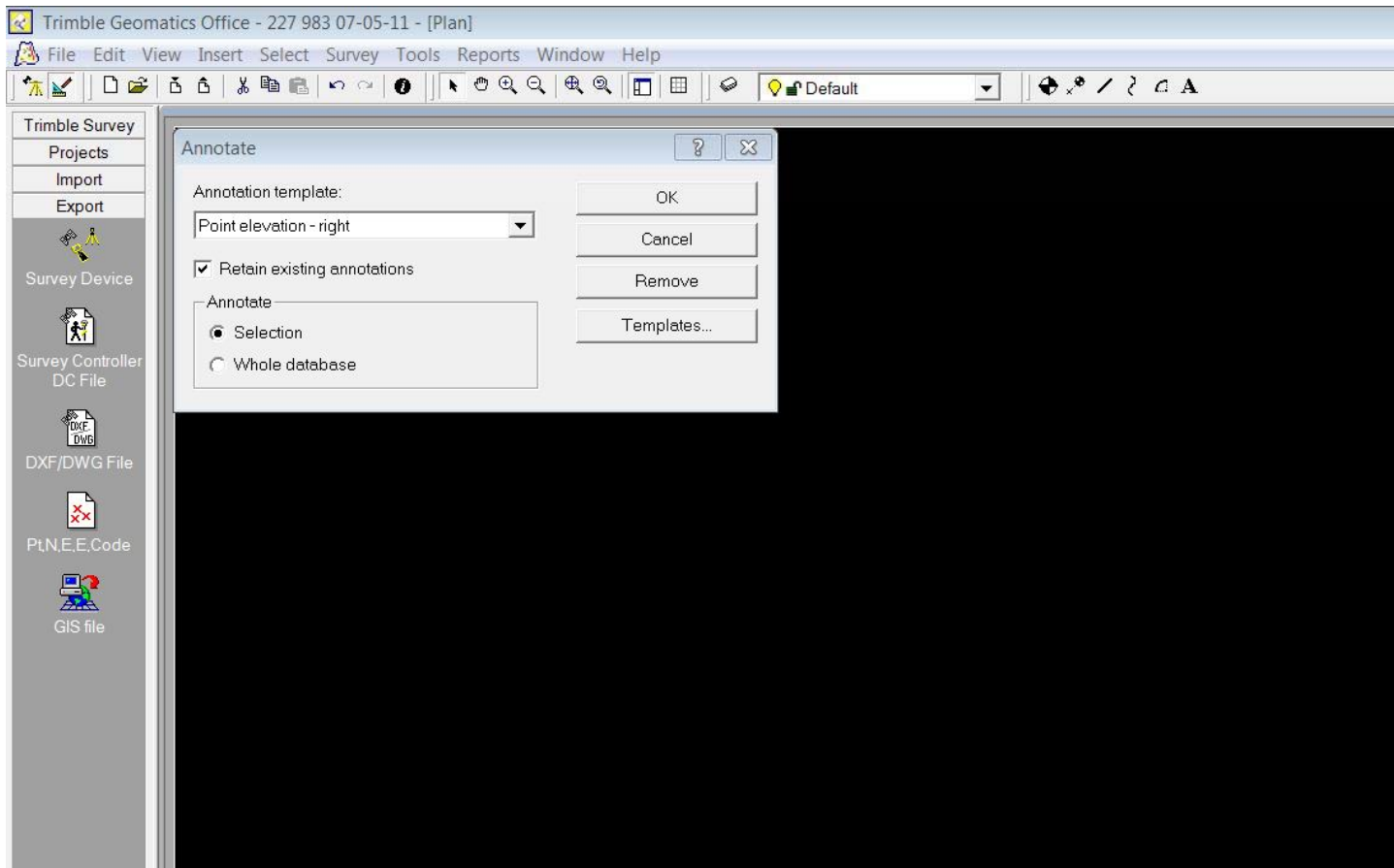
Process Data Points in TGO

Annotate Point Names
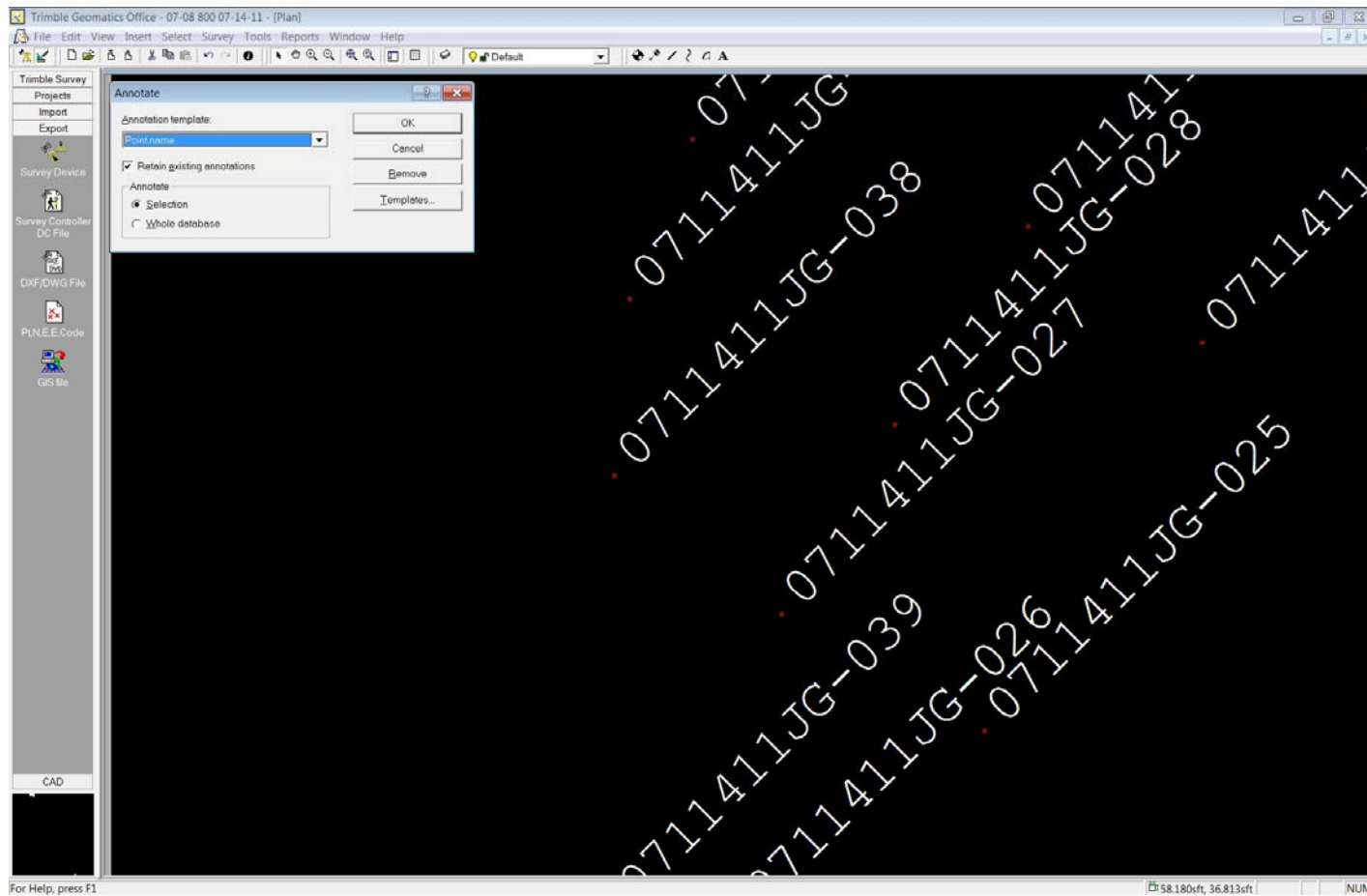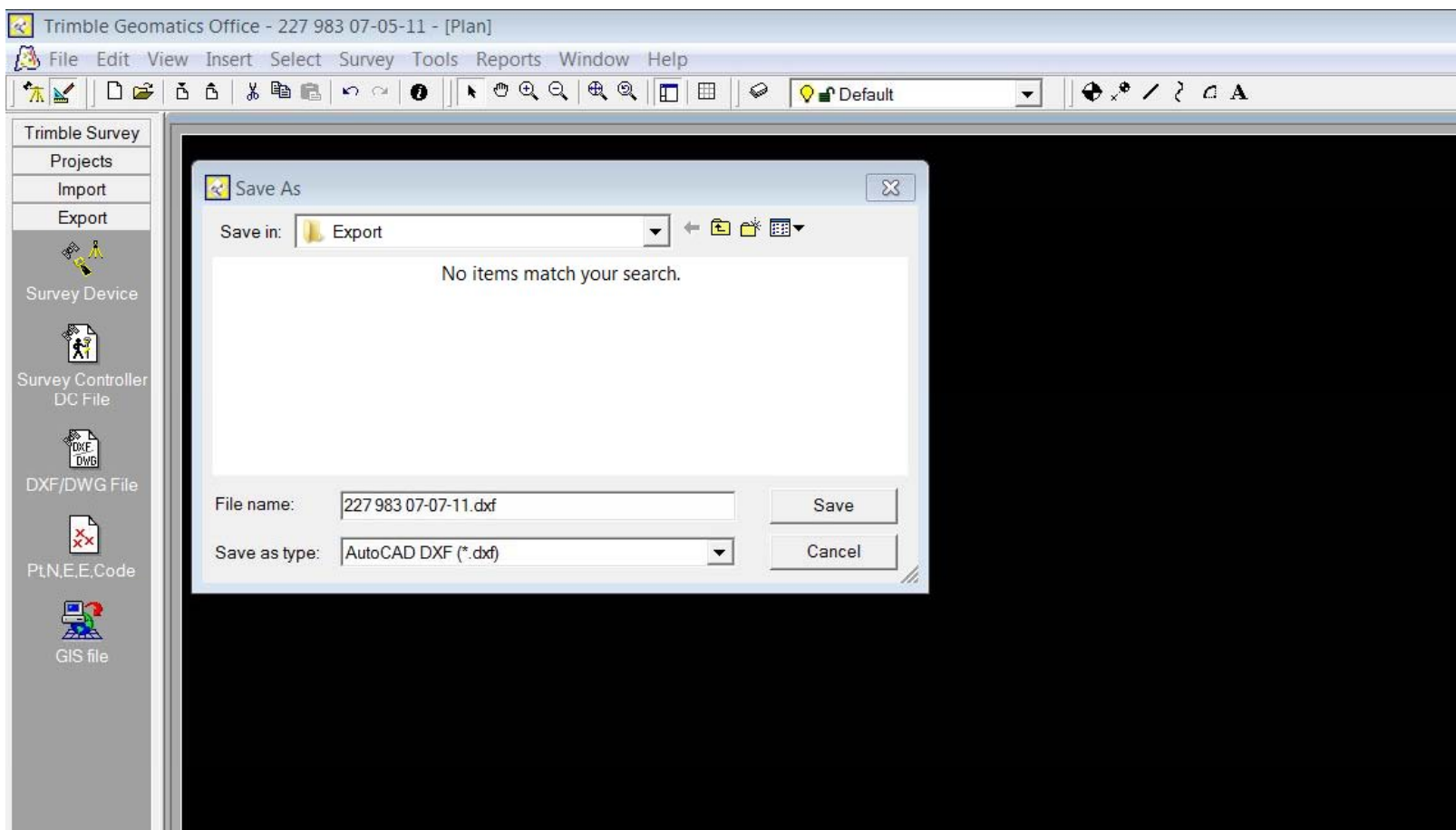
Annotate Point Codes

Annotate Point Elevations

Annotated Survey Points in TGO

Export Annotated Points to DXF Format

Closing out the Survey

• The GPS Technician archives DXF file of the survey in ProjectWise.
• The GPS Technician archives TGO project file for the survey on a shared server.

Using Utility Survey Data from TGO to Update FGIS Master Files

- **The GPS Technician loads the DXF file into Bentley Map and runs SNL FGIS macros to format and group the point data.**
- **The GPS Technician merges the DXF GPS points now formatted in Bentley Map into the master GPS file for each system.**
  - SNL maintains a master Bentley Map / MicroStation File for every utility and infrastructure system that contains all GPS points taken for the system.
- **When points are in MicroStation format, the Technician divides them into separate utility files.**
  - The Technician creates a file for each utility system and sketches out path of utilities surveyed in Bentley Map.
  - The Technician stores the processed survey files in ProjectWise.

Sandia National Laboratories

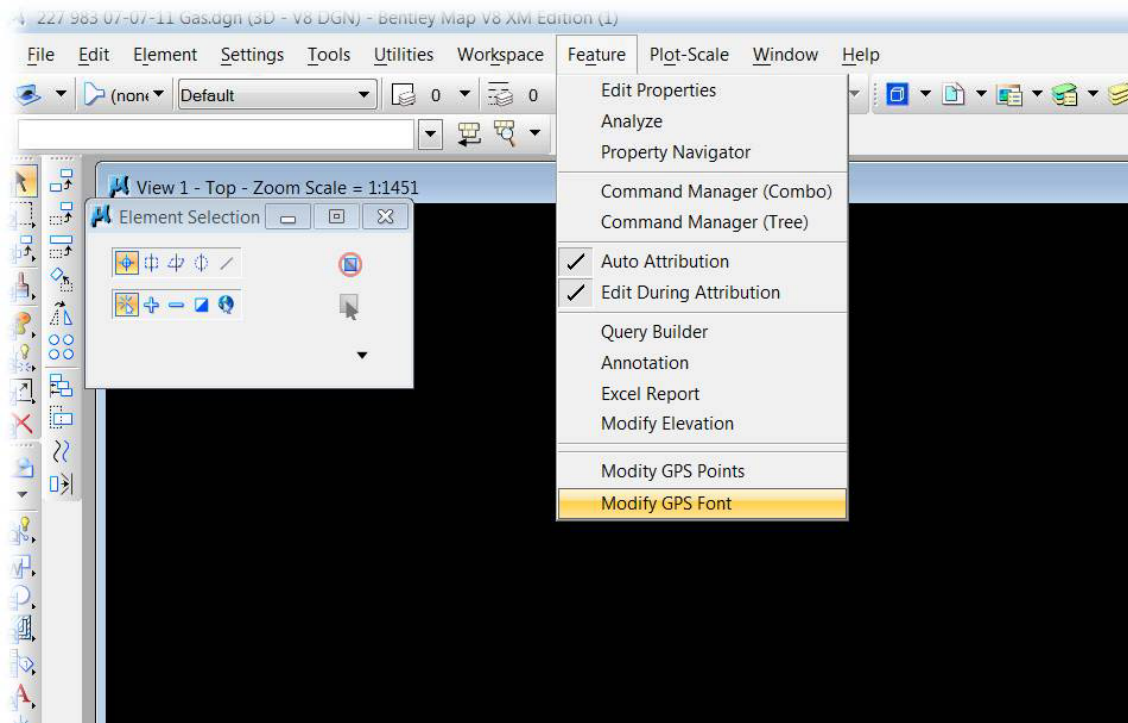# Using Utility Survey Data from TGO to Update FGIS Master Files (Cont.)

- **Next the GPS Technician notifies FGIS CAD Technicians that new data has been loaded into ProjectWise. (Technicians share roles and responsibilities.)**
  - Communication is sent via email to FGIS file owner.
  - Log activity in GPS Tracker (VPAT)
  - The FGIS Technician prints out draft of utility and reviews with SE as required.
  - A hard copy of any field sketches are provided to FGIS technicians
  - This process is repeated for each utility system that was surveyed in the field

Sandia National Laboratories

Using Utility Survey Data to Update FGIS Master Files (Cont.)

- **Upon receipt of new data and hard copy print-out**
  - **The FGIS Technician applies the as-built number to the print-out**
    - *Refers to GPS Tracker for available as-built project numbers as necessary*
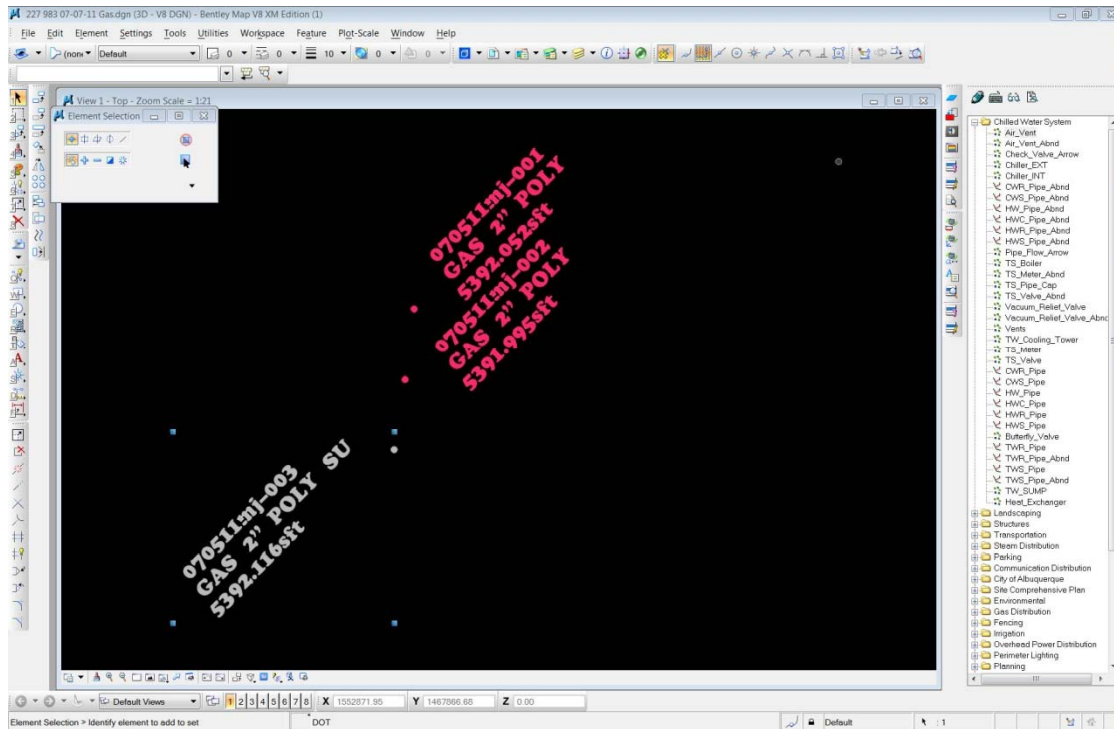 - **Files as-built hard copy records in binder**
  - **Logs activity in GPS Tracker**

FGIS Workflow

- **FGIS Tech imports the DXF file made in TGO into Bentley Map.**
- **FGIS Tech runs the SNL Modify GPS Points Macro in Bentley Map.**
- **FGIS Tech runs the SNL Modify GPS Font Macro in Bentley Map.**
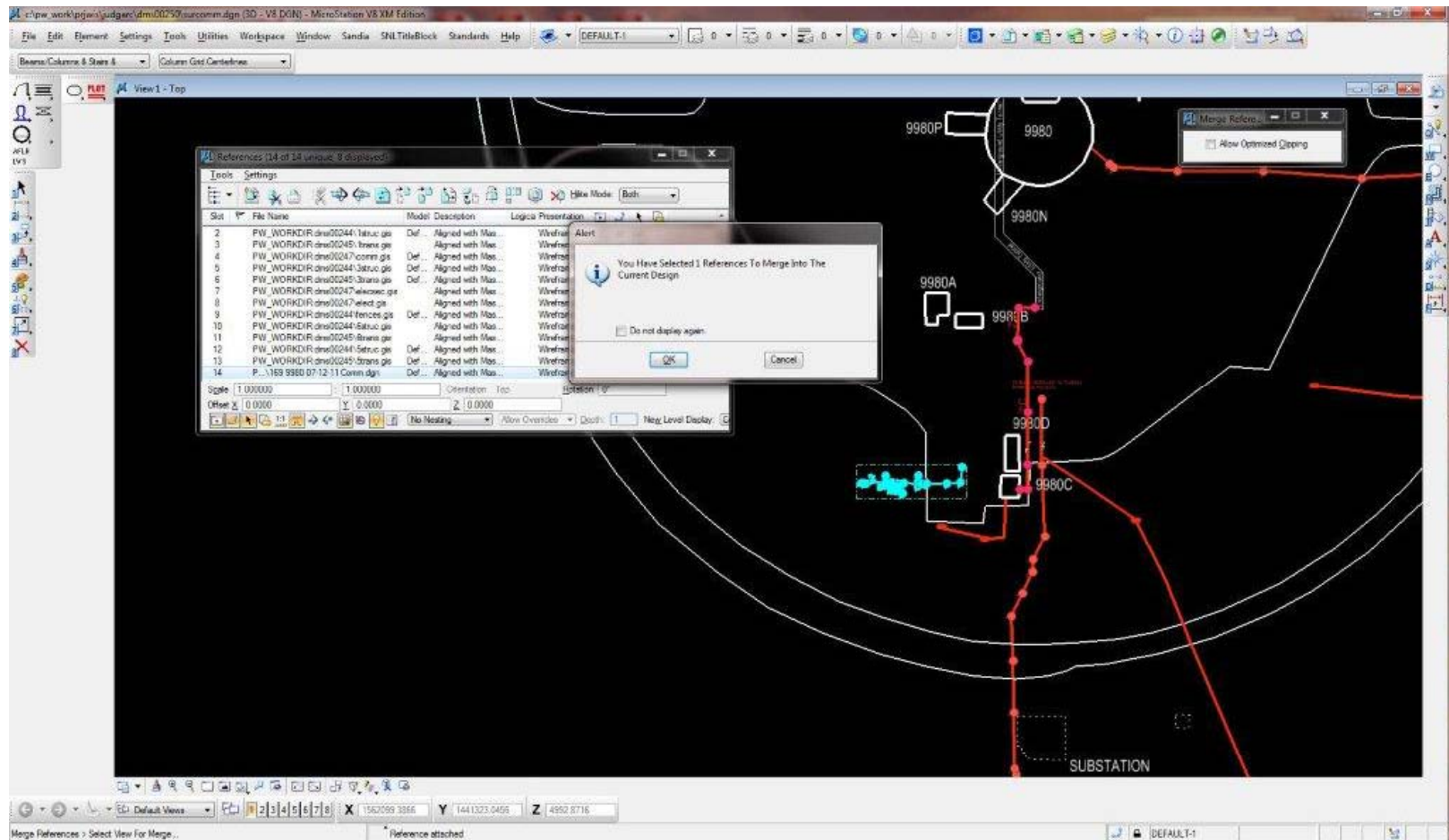
FGIS Workflow (Cont.)

- **Final product is Bentley Map points files that are ready for import into SNL FGIS master survey points file.**
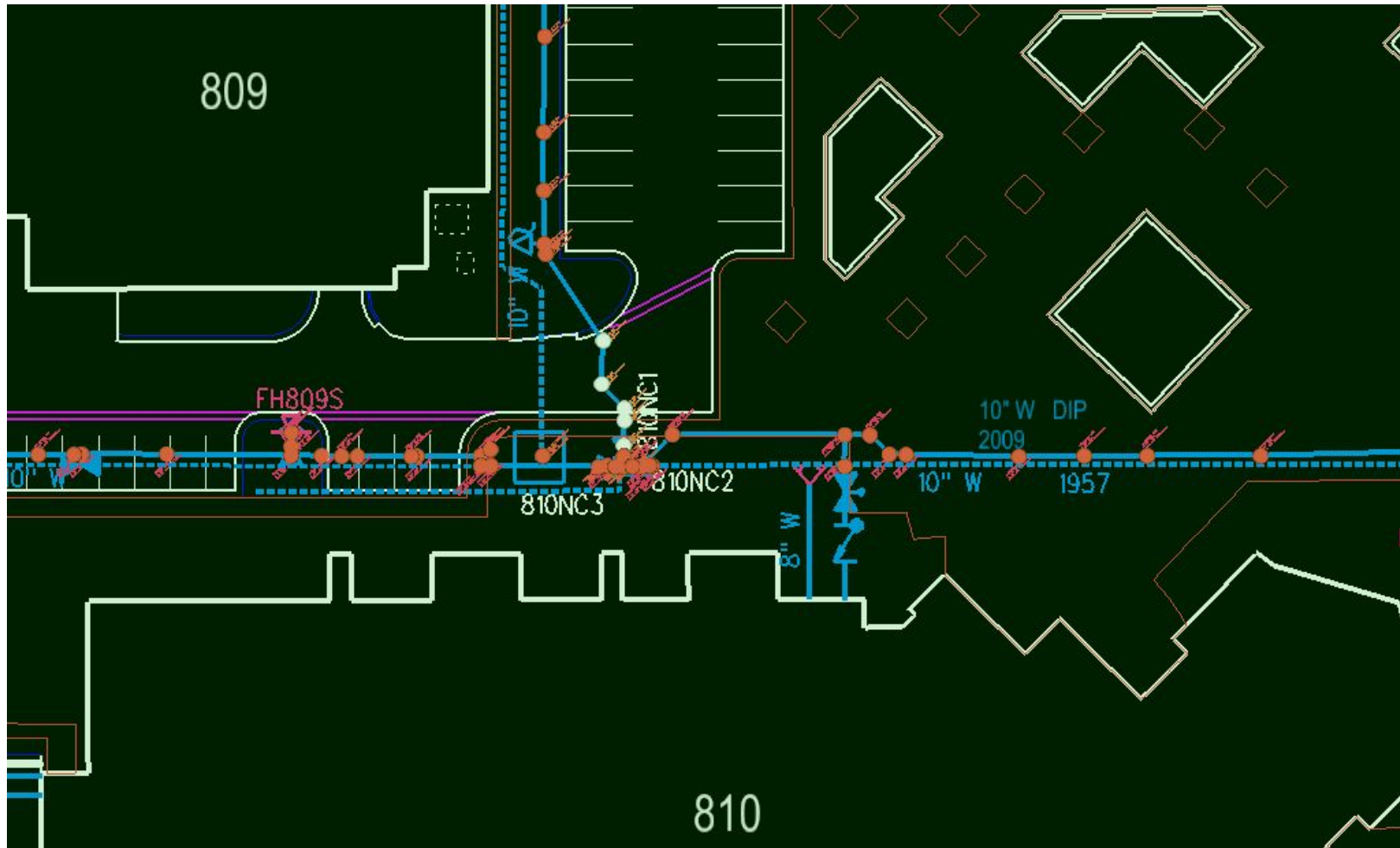- **FGIS Technician stores the files in the ProjectWise survey folder.**

FGIS Workflow (Cont.)

- The FGIS Tech opens corresponding utility master survey file with Bentley MicroStation XM and references in new survey information from ProjectWise.
- The FGIS Tech reviews position of the new survey points with, digital plans, and or Utility System Engineer to verify location.
- The FGIS Tech merges new survey points into master survey file, and closes file.
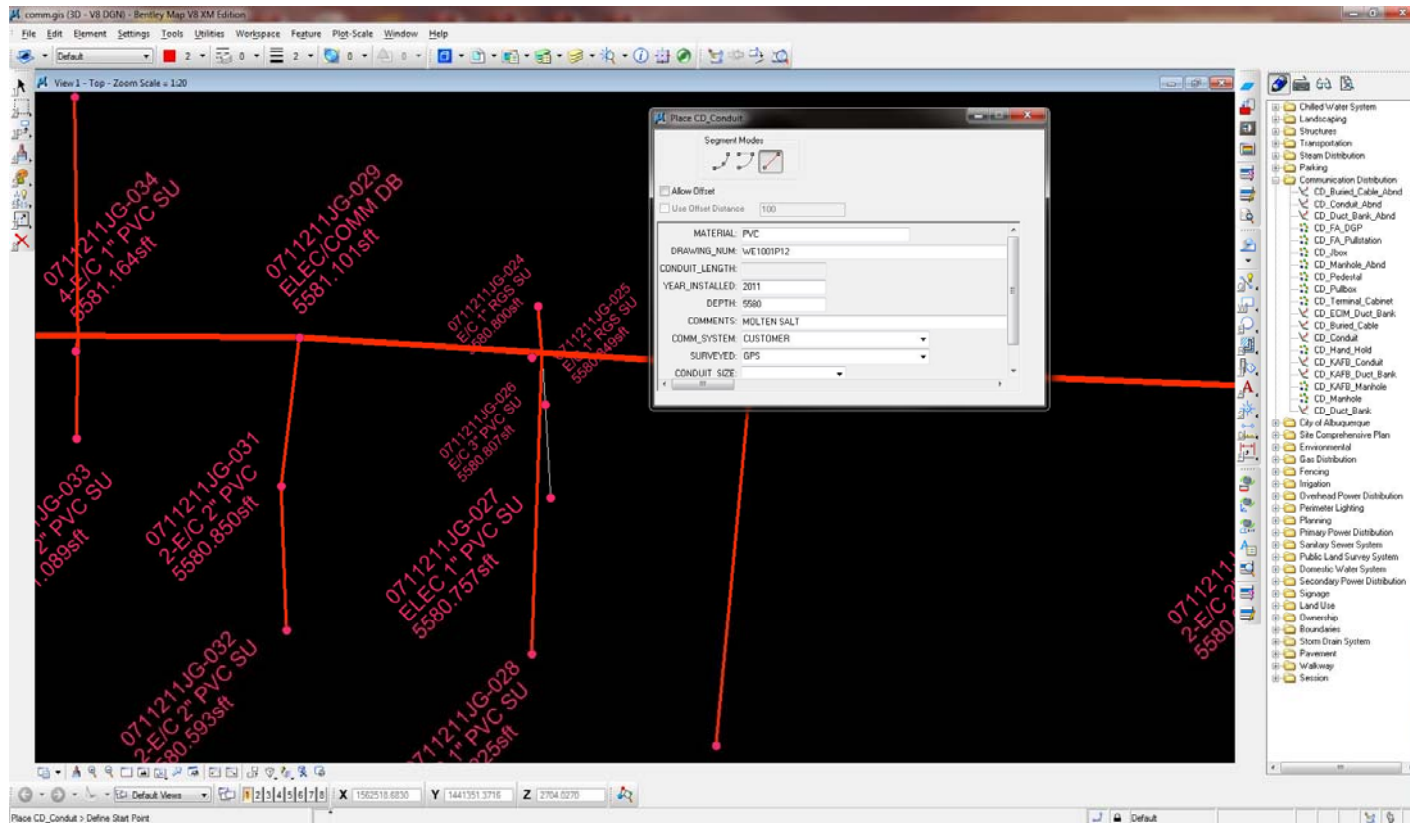
FGIS Workflow (Cont.)

FGIS Workflow (Cont.)
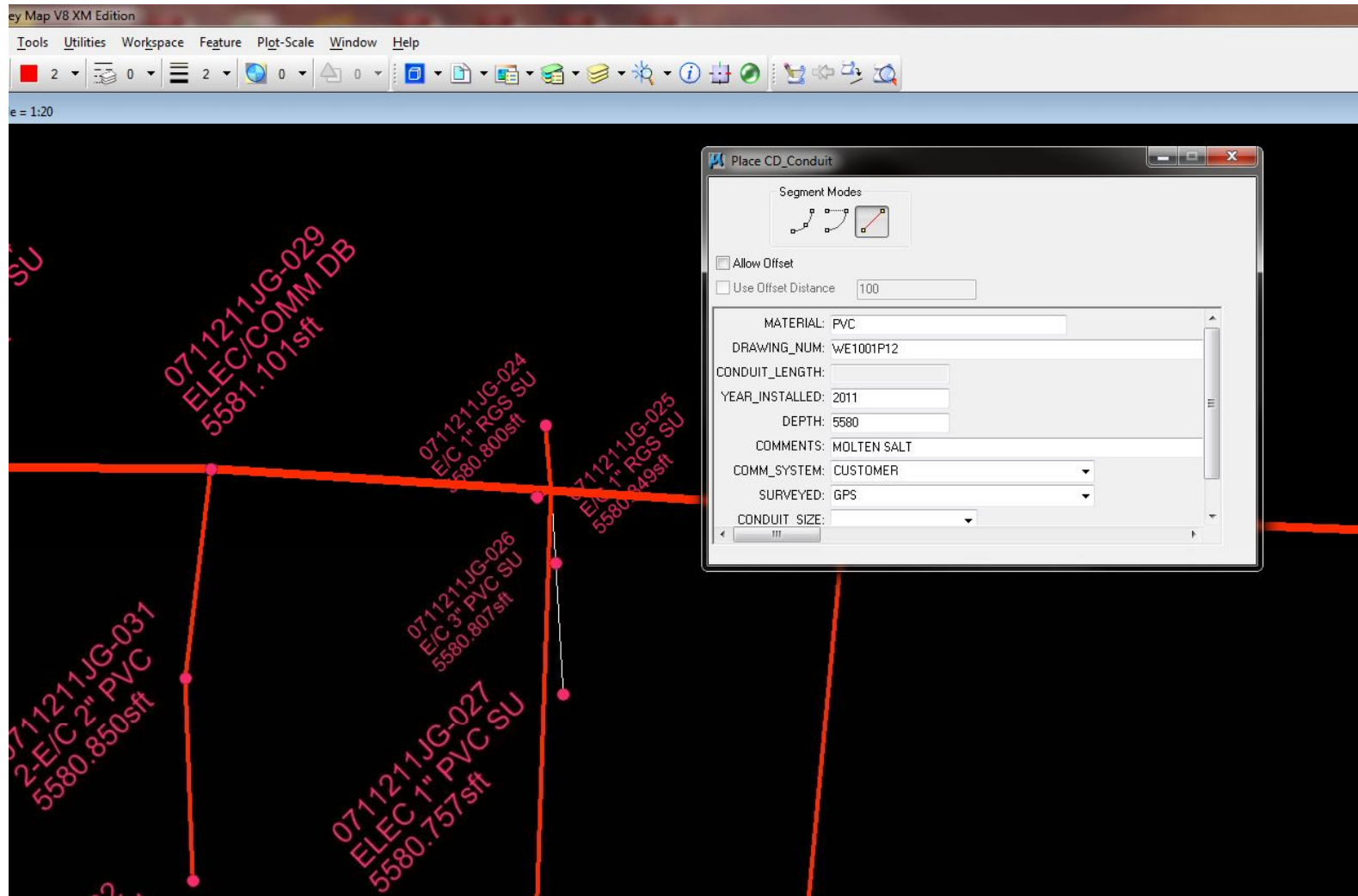
FGIS Workflow (Cont.)

- The FGIS Tech opens corresponding FGIS utility file using Bentley Map.
- The FGIS Tech reviews pertinent survey points in the referenced master utility survey file.
- The FGIS Tech places new or edits current FGIS graphics and attached tables and attributes accordingly to match site conditions that reflect newly acquired GPS survey information.
- All changes to the FGIS master file are recorded using the Bentley Design History Tool.
- The FGIS Tech saves the FGIS file and closes it out.
- The FGIS Tech sets survey file in ProjectWise to "archive" state.
- The FGIS Tech logs data completion into VPAT log created by the GPS Tech.

FGIS Workflow (Cont.)

FGIS Workflow (Cont.)

Future Planned Improvements

- We are looking at software options to aid in the processing of our survey data into Bentley Map software.
  - Upgrading to Trimble Business Center, Inroads Survey, or Bentley Power Civil
- We provide input and requests for software improvement to Bentley at user conferences and in working with our account managers.
- We have begun utilizing 3D scanning to improve the efficiency of large-scale mapping and topographical data collection efforts. We anticipate using this technology on future large-scale infrastructure and line-item projects.
- We are working on creating a 3D site model that complements our TRIRIGA Facilities Management System, geospatial indexing capabilities, and the FGIS.

Sandia National Laboratories