GIS SURVEY AND REAL ESTATE SERVICES FOR NEW 19.5 MILE RAW WATER LINE

CASE HISTORY

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INTRODUCTION

The Tarrant Regional Water District (TRWD) is one of the largest raw water suppliers in the state of Texas, providing water to more than 1.6 million people in the North Central Texas area. Its customers include the cities of Fort Worth, Arlington, and Mansfield and their subsidiary communities; it also supplies raw water to the Trinity River Authority. Operations span a 10-county area that reaches from Jack County to Freestone County, and includes maintaining more than 150 miles of pipeline used for water transport.

The Richland-Chambers Reservoir in Eastern Texas is one of TRWD's major resources; 80 miles of pipeline connect them to Lake Benbrook south of Fort Worth. Up until now, the missing link in bringing needed water to the thirsty Fort Worth area has been a pipeline between Lake Benbrook and Eagle Mountain Lake. Construction on that $140 million, 19.5-mile pipeline connection is now complete. The new pipeline supplies a new water treatment plant built on the west side of Fort Worth to accommodate population growth.

TranSystems' surveying, mapping, and property/easement identification paved the way for the pipeline project's final design and implementation. Use of the latest GPS (Global Positioning System) techniques and innovative data manipulation allowed the TranSystems' team to supply the data in a format compatible with TRWD's GIS (Graphical Information System). Location conditions, property access information, utility crossings, and even the complete history of a pipeline segment became available at the click of a mouse when the new pipeline went into service in 2008. TranSystems' work represents one of the first implementations of TRWD's state-of-the-art GIS for a new pipeline project.

PROJECT OVERVIEW

The new Benbrook to Eagle Mountain Connection involves construction of 19.5 miles of 84" raw water line. TranSystems provided mapping, topography surveys, easement surveys and utility coordination. Work included property research, owner notification, centerline staking, and boundary surveys.

Approximately 100 easements, parcel maps and property descriptions were prepared. Bathymetric surveys were made at Benbrook and Eagle Mountain Lakes. Perhaps most importantly, all mapping, survey, property information, and utility location data was made

available to TRWD in a format that could be directly incorporated into its GIS system for ease of future access.

The TranSystems' team of surveyors first established a second order, horizontal-vertical survey control network based on GPS static observation. Monuments were set up at approximately one-mile intervals.

Once the real-world geographic coordinates were established, the team researched and identified ownership of the 100 properties in the projected path of the pipeline. Boundary surveys were performed as the basis for property and easement descriptions. The projected pipeline path was staked for the property owners. The easement and property descriptions necessary for property acquisition by TRWD were then developed and submitted.

In addition to this traditional survey and real estate services function, TranSystems created an extensive database of property information for incorporation into to the TRWD GIS. This database contains information about recording deeds, easement acquisition terms, property descriptions and even records of property owner discussions and concerns. This data is linked to the survey data in the GIS. For any location along the pipeline, easement access restrictions, for example, will be immediately retrievable.

Similarly, the TranSystems team conducted extensive topographic surveys of the 19.5 mile pipeline route, identifying all physical features and elevations. These surveys allowed the pipeline alignment to be fine-tuned to meet the topography features. In addition, the team identified environmentally sensitive areas for mitigation. This allowed permitting issues to be addressed. TranSystems' survey team even discovered a "lost" town site with church baptismal and cemetery on one unsuspecting property owner's land. The pipeline was re-aligned to avoid impact on the historical area.

The survey data was also converted into files compatible with the TRWD

Bathymetric surveys of the origin and destination lakes were also provided by the TranSystems team. Sonar techniques were used to measure depths from a boat; these were then marked via shore-based survey control. The data was used to prepare survey topographic maps.

GIS. Now that the construction of the pipeline is complete, the GIS provides information on the pipeline history for any given location pinpointed in real-world coordinates: the manufacturer of the pipeline joint; the contractor who laid it; the history of its maintenance and repair; and any other relevant information to tracking the possible causes of a problem.

During the topographic surveys, the team located all utilities that cross the proposed pipeline route. This data was also provided in a format for incorporation into the TRWD GIS. Information about a nearby utility is now available for any location on the pipeline. Correlatively, utility companies may use the information for cross reference to the location of the pipeline before commencing any maintenance or repair.

Bathymetric surveys of the origin and destination lakes were also provided by the TranSystems team. Sonar techniques were used to measure depths from a boat; these were then marked via shore-based survey control. The data was used to prepare survey topographic maps that were in turn used to determine the optimal design of intake and outfall structures at the two lakes.

AN INITIAL APPLICATION OF GIS FOR A NEW PIPELINE

TRWD's GIS system had been in place for several years. However, this project represents one of the first times the GIS was used to incorporate all the mapping, survey, and property information collected in association with the planning of a new pipeline. Similarly, the project offered the opportunity to incorporate information about the physical pipe laid for the project from the moment it is put in the ground.

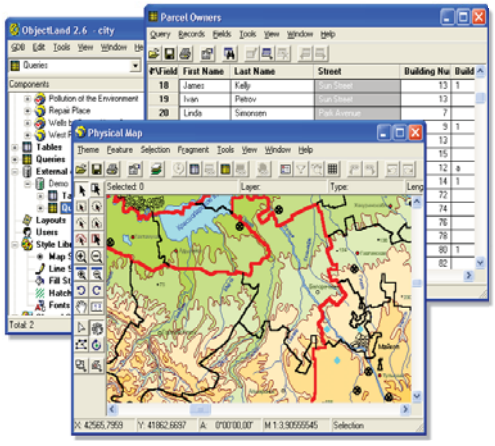
TranSystems' extensive use of advanced GPS techniques for all mapping and surveying served as the basis for providing all of the data to TRWD in GIS-compatible format. This included not only mapping and survey data, but the extensive real estate database information.

DATA IN GIS-READY FORMAT EXCEEDS EXPECTATIONS

Providing the mapping, survey and property data to TRWD in GIS-compatible format was an innovative process based on trial-and-error. Since new pipeline data had not been previously incorporated into the GIS, no one was quite sure how the process would work. TranSystems coordinated closely with the TRWD GIS team to experiment with data formats and data locations in the file structures until the optimal format for incorporation was found.

In addition, the TranSystems team ensured that survey data gathered at ground level using state plane coordinate systems was convert-

ed into the proper mapping projection for incorporation into the GIS. This conversion eliminated the small but significant errors that can impair exact location positioning. The resulting precision will allow the final pipeline alignment to be accurately incorporated into the GIS.



The services contract between TRWD and TranSystems did not specify that the data be supplied in these optimal and scrupulously accurate formats. TranSystems' final product exceeded the client's expectations in terms of compatibility and ease of use.

FUTURE PIPELINE SECURITY AND PUBLIC SAFETY ENHANCED

The end result of the innovative incorporation of mapping, survey and property information into the TRWD GIS lays the basis for a superior public response system to any future problem with the pipeline, ranging from normal aging and deterioration to natural or man-made disaster. With one click on a pipeline location in the GIS, a response team would get immediate access to all relevant information about that location:

- The comprehensive property database of information would identify the property owner and provide easement access restrictions
- The ability to pinpoint individual pipeline joints would reveal the manufacturer of the pipeline joint; the contractor who laid it; its maintenance and repair history; and any other relevant information to tracking the possible causes of a problem
- Information about any nearby utility will be available for the location, allowing for coordination with the relevant utility before a repair team is sent to the site

In contrast, reliance on paper-and-file-based systems could result in significant delays before this information might be located. The public can rest assured that all information necessary to keep water flowing through the pipeline and out of the tap is readily available to TRWD.

HISTORICAL AND ENVIRONMENTAL IMPACTS AVOIDED

The TranSystems' team identified environmentally sensitive areas during the course of the surveys. This allowed mitigation and permitting issues to be addressed in the public interest.

The team also discovered a historic town site with church baptismal and cemetery that had been lost to the public. The pipeline was re-aligned to

avoid impact on the historical area and the information is available to the general public and preservationists alike.

BASIS FOR OPTIMAL ROUTE AND PIPELINE DESIGN PROVIDED

The information provided as the result of TranSystems' mapping and survey work allowed the optimal pipeline alignment to be designed and implemented. In addition to GIS-compatible data, a reference Map Book consisting of 41 maps covering the entire pipeline length was provided. Properties were identified and the owners informed of the project, with all information collected for future reference. Historical and environmentally sensitive areas were avoided or mitigated. And the bathymetric lake survey provided the basis for optimal design of the outfall and intake structures at Benbrook Lake and Eagle Mountain Lake.

CONCLUSION

The TranSystems team attacked this rather standard pipeline surveying project with state-of-the art technology, innovative data conversion and formatting techniques, and a commitment to both accuracy and ease-of-use of the final product. Client expectations were exceeded, and in the process, the team laid the basis for enhanced pipeline security and public safety both now and in the future. TranSystems' work also mitigated historical and environmental impacts and laid the groundwork for optimal pipeline design. The project was treated by the TranSystems team as anything but routine, and the result is a project that benefits the entire population of north central Texas.

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