Louisiana Transportation Research Center

Final Report 539

DOTD Standards for GPS Data Collection Accuracy

by

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16. Abstract

The Center for GeoInformatics at Louisiana State University conducted a three-part study addressing accurate, precise, and consistent positional control for the Louisiana Department of Transportation and Development. First, this study focused on Departmental standards of practice when utilizing Global Navigational Satellite Systems technology for mapping-grade applications. Second, the recent enhancements to the nationwide horizontal and vertical spatial reference framework (i.e., datums) is summarized in order to support consistent and accurate access to the National Spatial Reference System. Third, the Center provides quality control information to the Pavement Management System section against which Moving Vehicle Rapid Mapping data may be compared and assessed.

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Project Review Committee

Each research project will have an advisory committee appointed by the LTRC Director. The Project Review Committee is responsible for assisting the LTRC Administrator or Manager in the development of acceptable research problem statements, requests for proposals, review of research proposals, oversight of approved research projects, and implementation of findings.

LTRC appreciates the dedication of the following Project Review Committee Members in guiding this research study to fruition.

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ABSTRACT

The Center for GeoInformatics (C4G) at Louisiana State University (LSU) has conducted a three-part study addressing accurate, precise, and consistent positional control for the Louisiana Department of Transportation and Development (DOTD).

First, this study focused on Departmental standards-of-practice when utilizing Global Navigational Satellite Systems technology for mapping-grade applications.

Second, the recent enhancements to the nationwide horizontal and vertical spatial reference framework (i.e., datums) was summarized in order to support consistent and accurate access to the National Spatial Reference System.

Third, the C4G provided quality control information to the Pavement Management System section against which Moving Vehicle Rapid Mapping (MVRM) data may be compared and assessed.

ACKNOWLEDGMENTS

C4G acknowledges the support from the project review committee, each of whom have provided valuable contributions for the successful implementation of this project. C4G also wishes to acknowledge the support from the Pavement Management System section for providing coordination for traffic control along the highway.

J. Ashley Horne with DOTD chose the test sites, coordinated the arrangements with local districts, and kept things on track. The leaders and safety teams at each district earned the authors' thanks for their expertise and diligence keeping the data collection operations safe at each of the chosen sites.

IMPLEMENTATION STATEMENT

The deliverables from this report will help the Louisiana Department of Transportation and Development global navigation satellite systems (GNSS) users, contractors, and staff meet a minimum standard for mapping, clarify and recommend ways to deal with recent changes to the national geoid model, and perform quality assurance measurements on the Department's inventory of road survey points.

Research findings and recommendations have been compiled within this final report and the survey data produced by this study is included and available to the DOTD Pavement Management System staff via internet (FTP) services maintained by the investigators.

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INTRODUCTION

This project focuses on three applications of Global Navigational Satellite Systems (GNSS) technologies currently utilized by the Louisiana Department of Transportation and Development (DOTD): data collection accuracy standards when utilizing global positioning system (GPS) technology for mapping grade applications; summary of recent enhancements to the nationwide horizontal and vertical spatial reference framework (i.e., datums); and providing quality assessment and quality control information for the DOTD Pavement Management System (PMS) section when assessing data collected using the Moving Vehicle Rapid Mapping.

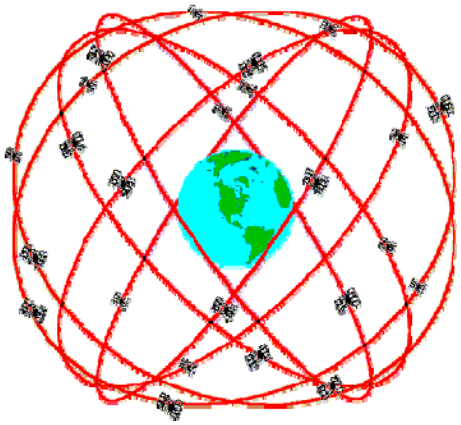

Figure 1
GPS satellite constellation

GNSS, which includes GPS technologies maintained by the United States (U.S.), are used extensively throughout government and industry. These technologies continue to revolutionize positional data collection activities. Despite the increased accuracy, reduced cost, and improved data acquisition efficiencies afforded, the Louisiana DOTD has no established standards or methods to guide its general staff and contractors in the appropriate use of GNSS technology for ensuring application-specific data accuracy requirements and that Department minimums are met. While the DOTD Location and Survey section already have standards for collecting highly accurate and precise data, there is a need to develop standards and techniques for Department staff who collect GPS data separate from the survey section. Such guidance will help ensure as a standard a minimum level of accuracy, precision and consistency, not only for confidence in the data, but also to ensure compatible software and equipment support and training.

In addition to standards, the quality and consistency of GNSS data collection practices are essential to surveying, engineering design, and other positional measurement practices. Recent advancements in the national spatial reference framework (i.e., datums) from which horizontal and vertical positions are measured have resulted in fundamental changes to the way positions are measured when using GPS technologies. As a consequence, many technicians, engineers, and scientists lack knowledge of specific details about the short and long-term implications of these changes. Accordingly, the authors have provided a summary of these changes and their effect on existing operational practices, which now may be used by various technicians and professionals within the Department.

Figure 2
Example MVRM vehicle

Finally, quality assurance and quality control relating to GPS positional accuracy is essential for all sections within DOTD, particularly the PMS section, which maintains a spatially-referenced inventory of all State maintained roads. This inventory utilizes advanced GPS and inertial navigation technologies to capture the horizontal and vertical position of points spaced along the road. To assess and ensure the accuracy and precision of this inventory, the PMS section requires collection of control point measurements that may be used to assess the capability of contractors and the quality of the data to be expected from them.

The following paragraphs are from recent work from the authors Cavell, J. A. and Dokka, R. K. (2009) "The conventional, conservative method for establishing surveying reference control points using GNSS is a technique called Post-Processed Static (PPS) in which groups of two or more GNSS receivers are located precisely relative to the control points and allowed to remain stationary while collecting satellite data for one to several hours…

"A newer GNSS technique has gained popular use called Real-Time Kinematic (RTK) in which a 'base' receiver is located precisely relative to a control point and broadcasts its data, usually via radio, to a "rover" receiver that may precisely determine its position instantaneously following a short period of initialization…

"A combination of the best of both techniques is evolving as networks of permanently static receivers are connected through software that continuously monitors their measurements, giving it the stability and precision of PPS while it has the ability to generate the data a base receiver would, if it was located at any given point within the network, a Virtual Reference Station (VRS)."

OBJECTIVE

The Center for GeoInformatics (C4G) at Louisiana State University (LSU) executed a three-part study addressing accurate, precise, and consistent positional control for the DOTD.

First, this study focused on Departmental standards-of-practice when utilizing GNSS technology for mapping-grade applications.

Second, the recent enhancements to the nationwide horizontal and vertical spatial reference framework (i.e., datums) are summarized in order to support consistent and accurate access to the National Spatial Reference System (NSRS).

Third, the Center provides quality control information to the PMS section against which MVRM data may be compared and assessed.

Objective 1: Standard Operating and Collection Procedures

The purpose of this objective is to establish Departmental standards-of-practice for GNSS data collection. Investigators first evaluated handheld GNSS technologies recommended by studies performed for the Department: LTRC report 11-2P (Barnett, Harrison, and Steede-Terry, 2012).

The goal of project 11-2P was to create a management plan to guide the Department's use of GPS technology into the future, based on best practices. The plan proposed at least one high quality GPS receiver at each district office and several for sections located at DOTD headquarters. Receivers are to have LASER range finders so points can be collected faster and at safe distances. The report did not identify what was meant by a "high quality GPS receiver." However, the context of the report leads one to infer it is that sort of GNSS equipment generally referred to as "mapping grade" within the report.

Within the field of surveying, the term mapping grade receiver usually refers to a receiver that uses the positioning code for location determination; as do the so-called "recreational grade" receivers. What separates them most significantly is the use by the mapping grade receiver of differential corrections from a reference base-station or network. The corrections may be applied by post-processing after the field data collection or applied in real-time while in the field. The resulting precision of all grades of GNSS equipment has improved dramatically over the last two decades, which blurs the lines between the categories. The so-called mapping grade equipment is designed to allow operators to consciously apply the needed details that provide the consistency that primarily characterizes the advantages of mapping grade data over recreational grade data.

The so-called mapping-grade results have improved, from what was thought at the time, an amazing 16 ft., improved to 10 ft. and then to just under 3.3 ft.; a level that held pretty steady for quite a while. Recently, advances in computer processing capabilities allow the producers of GNSS equipment to apply more sophisticated, survey grade like, processing to the data allowing them to claim precisions of

a few inches.

The equipment used in this project (Trimble GeoXH 6000) when using a special antenna and sufficiently good differential corrections is rated at 4 in. Despite the claimed precisions, it must be realized by the user that when one uses equipment more precise than 3.3 ft., the technique used becomes as important as the equipment used to get results of an accuracy approaching the precision potential of the device. For example, if the expected precision is 3.3 ft., it matters little if the operator has the antenna in his hand or over a backpack. On the other hand, if he is expecting 4 in., the location of the antenna relative to the point of interest becomes critical, so in those circumstances the use of an antenna rod with a well-adjusted level bubble is required so the offset from the antenna to the point of interest may be precisely known.

Guidelines have been developed that emphasize accuracy (i.e., positional correctness) and precision (i.e., positional consistency) for performing various data collection tasks under a variety of environmental conditions. It must be kept in mind that emphasizing accuracy and precision in isolation is frequently counter-productive, because fantastic precision is possible but the care and time required to achieve it is not worth the cost of reduced productivity. So it is critical to any GNSS mapping project that the appropriate techniques are utilized to achieve useful results in a time-efficient manner.

The guidelines include protocols and technologies that may ensure consistent and repeatable results (e.g., occupation time, LASER range-finders and accessories, external antennae, real-time corrections, etc.). This project utilized a mapping-grade device, Trimble GeoExplorer 6000XH (and operational accessories), which is capable of sub-foot accuracy as specified by the GPS Technology Oversight Committee (GTOC). Note that this research is not intended to cover survey grade applications (finer than centimetre accuracy).

Outcomes of this objective have produced a DOTD specific document (i.e., operational cheat-sheet) including an introduction, terminology, explanation of possible errors affecting accuracy and precision, and specific techniques to ensure accuracy and precision (e.g., dilution of precision, avoiding overhead cover, tree interference, etc.) for applications requiring mapping-grade GNSS technologies so as to achieve acceptable levels of accuracy and precision according to operational requirements and prevailing environmental conditions. The document is to become the Standard Operating and Collection Procedures (SOCPs) intended to ensure quality data collection, and thus support the DOTD data collectors with guidelines for operation and practice. The SOCPs will also serve as the basis for the LTRC Training Section to implement a training curriculum as a separate effort for Department personnel and contractors operating mapping grade GNSS data collectors. Such training programs will help to ensure that these technologies are properly and optimally utilized by Departmental personnel and contractors, thus avoiding sources of wasted time and resources.

Objective 2: Horizontal and Vertical Datum Research Summary

The second objective was to research and assess the effects of using different datums when measuring horizontal and vertical positions using GNSS technologies. In mid-2012, the National Geodetic Survey (NGS) updated the models that defined both horizontal and vertical positions for the nation. The horizontal update included an adjustment of the geometric shape of North America (i.e., reference frame). This update is referenced as the *North American Datum of 1983 (NAD83), national adjustment of 2011 (NA2011), epoch 2010.0*. The vertical update accommodated the horizontal adjustment, and was enhanced to provide a new reference model for measuring elevations above global 'sea level' (i.e., geoid). This update for orthometric elevations (height above sea level) is referenced as the *North American Vertical Datum of 1988 (NAVD88), geoid 2012A*. Together, the horizontal and vertical reference frame establish the *National Spatial Reference System (NSRS)*.

Overview

Recent updates to the National Spatial Reference System (NSRS), from which horizontal and vertical positions are measured, have resulted in inconsistencies observed between contemporary and historic GPS measurements. The inconsistencies are particularly apparent when measuring orthometric heights (e.g., elevations) using GNSS (global navigation satellite system) and GPS (global position system) technologies. As a consequence, many professionals, surveyors, engineers, and scientists have asked for a clarification and recommendations for dealing with these updates. Accordingly, the DOTD requires a summary of the changes and their effects on existing operational practices. This document summarizes these findings for distribution to various technical, engineering, scientific, and surveying professionals within the Department.

Background

Studies have established that GNSS technologies, which includes GPS, can be used to measure precise, relative positions in a three-dimensional, Earth-centered coordinate system (Zilkoski, Carlson, & Smith, 2008). GNSS technologies compute positions using signals transmitted from satellite (space vehicles or SVs) in orbit around Earth's center of mass. Positions are derived by measuring the transmission's time delay (computed to distance) between the GNSS ground antenna and the known positions of four or more satellite vehicles to attained a Cartesian coordinate of the antenna. This position is then translated using various geodetic algorithms that transform the geometric coordinates (e.g., X, Y, X) to a location on Earth's surface (e.g., latitude and longitude). While effective, all GNSS derived positions have ambiguities, which affect the precision and accuracy of these observations. Of particular note, horizontal measurements have, on average, twice the precision that vertical measurements have. For this reason, advanced geodetic models are needed to achieve reasonably accurate, precise, and consistent values.

Objective 3: Provide Updated Control Point Measurements for the Pavement Management System

The final objective for this project provides updated control point measurement surveys at select locations in each district on roadways maintained by the DOTD. Horizontal and vertical measurements have been collected using survey-grade GNSS techniques at locations designated by the PMS Section. The locations are essentially the same locations surveyed and reported in Project 09-2GT (Cavell & Dokka, 2009). Investigators also addressed how vehicle speed affects horizontal and vertical accuracy (jointly and separately) from kinematic surveys enhanced by a real-time GNSS network.

All GNSS measurements were augmented by the LSU C4GNet real-time network (RTN), an official source for vertical control in Louisiana (Louisiana statute; R.S. 50: 173.1). Horizontal positions are reported in US Survey Feet converted from the State Plane Coordinate System for Louisiana (north and south zones) relative to the NAD83 (NA 2011). Vertical positions are reported relative to both ellipsoid heights (geometric) and orthometric heights (elevation). Geometric heights, measured in meters, are reported relative to the NAD83 reference ellipsoid for the North American tectonic plate. Orthometric heights, reported in US Survey Feet, are reported relative to the NAVD88 (2012A) datum.

The outcome from this objective will allow the PMS Section to use these control surveys and speed observations to assess the MVRM data for quality and accuracy.

SCOPE

The scope has been organized according to the three principle objectives: (1) standards-of-practice when utilizing GNSS technology for mapping-grade applications; (2) summary of nationwide horizontal and vertical spatial reference framework (i.e., datums); and (3) collection and dissemination of control point survey data that can be utilized by PMS for quality control and quality assurance checks of road inventories.

Scope 1: Standard Operating and Collection Procedures Development

Research conducted to develop Departmental standards-of-practice for utilizing GNSS technologies for mapping-grade applications were coordinated through the GTOC, the project review committee (PRC), and guidance obtained through LTRC report, 11-2P (Barnett, Harrison, and Steede-Terry, 2012). The standards and procedures developed for this task are applicable to mapping-grade GNSS hardware and equipment selected by the DOTD GTOC and approved by the PRC (see Table 1). Note that this research is not intended for survey-grade applications (e.g., sub-centimeter accuracy).

Table 1
GPS hardware and software technologies utilized developing Departmental SOCP

ITEM	MANUFACTURER	DESCRIPTION
GeoExplorer 6000XH	Trimble	Mapping-grade GPS data collector
GeoExplorer Accessories	Trimble	Zephyr Model 2 Antenna; custom hard case; Li-Ion Battery Pack; range pole, range pole bracket; antenna cables; vehicle power supplies.
360R Laser Rangefinder	TruPulse	Ranger finder with integrated Bluetooth (rugged and waterproof).
TerraSync Professional	Trimble	Data collector software
Pathfinder Office	Trimble	Post-processing software
Positions	Trimble	Data collector and project management software
ArcMobile	ESRI	Data collector software

To produce an effective, requirements-based, standards-of-practice document (i.e., operational cheat-sheet), acceptable levels of accuracy and precision must be defined according to operational requirements and prevailing environmental conditions. Accordingly, investigators coordinated with the GTOC and PRC on the creation of an operational matrix comprised of DOTD-specific feature types/applications contrasted under varying conditions for both horizontal and vertical accuracy.

Feature type/application examples include:

- Benchmarks
- Soil borings
- Sound barriers
- Bridge/overpass structures
- Roadway pavement
- Levees, and
- Sound wall, etc.

Condition examples include:

- Positional dilution of precision values,
- Scenario-based random and systematic error,
- Canopy densities,
- Correction networks,
- Occupation times, and
- Travel speeds, etc.

Additional features and factors affecting operational accuracy and precision will be further defined by DOTD according to operational requirements and prevailing environmental conditions.

Scope 2: Horizontal and Vertical Datum Research

Introduction

Anecdotal accounts of GNSS derived orthometric heights (e.g., elevations) measured after 2012 have revealed unexplained differences when comparing previous observations. The source of these differences has been attributed to changes in the vertical reference frames (geoid models) with which the orthometric heights are computed. Accordingly, this research will briefly summarize the background of the NSRS reference datums, explore existing operational reference models currently available, and examine the differences between previous and contemporary reference frameworks. These findings have been compiled and summarized to provide recommendations for recording and maintaining GNSS derived positions that require precise, accurate, and consistent geodetic control for past, present, and future projects. Furthermore, these recommendations will support existing standard operating procedures by detailing specific techniques for attaining positions relative to the NSRS, thus ensuring accuracy and precision by Departmental personnel and contractors.

Researchers examined the effects associated with different North American datums used to report horizontal and vertical position measurements using GNSS technologies within Louisiana.

1. Horizontal datum research focused on recent realizations of the North American Datum (NAD) of 1983.
2. Vertical datums research focused on recent realizations of the North American Vertical Datum (NAVD) of 1988.
3. Vertical datum research also examined the geoid models used to derive orthometric elevations with GNSS measurements.

Scope 3: Control Point Measurements for the Pavement Management System

The scope of objective #3 involves collection of elevation horizontal and vertical position measurements for one test area in each DOTD district. A test area includes a segment of road typically a mile in length. The nine areas were selected by the DOTD, and represent the same locations identified in LTRC Report

09-2GT (Cavell & Dokka, 2009). Table 2 lists the survey locations and districts.

Table 2
Districts and locations of control surveys

District	Parish	Control Section	Description
District 02	St. Charles Parish	450-14	East bound I-10 bridge at Lake Pontchartrain
District 03	St. Martin Parish	450-06	East bound 1-10 bridge east of Henderson.
District 04	Caddo Parish	455-08	North bound I-49 bridge and ramp, north of LA 3132 Inner Loop Expressway.
District 05	Madison Parish	451-09	West bound I-20 bridge and ramp west of the Mississippi River.
District 07	Calcasieu Parish	450-30	East bound I-210 bridge south of Maplewood between Lake Charles and Sulphur.
District 08	Sabine Parish	034-01	East bound bridge over LA Highway 6 over Toledo Bend Reservoir.
District 58	Caldwell Parish	015-06	North bound U.S. Highway 165 northeast of Olla.
District 61	Iberville Parish	450-07	East bound I-10 bridge over the Whiskey Bay Outlet.
	East Baton Rouge	450-08	West bound South I-10 Frontage Road at Lobdell.
	East Baton Rouge	257-04	North bound Burbank Drive at South Kenilworth Parkway.
District 62	West Baton Rouge	450-08	East bound I-10 at Reserve Relief Canal near LaPlace.

In each district, a test section was identified (three in District 61) by DOTD to be measured by LSU C4G using the LSU *C4GNet* Real-Time Network. Point observations were measured at approximate 10 ft. (≈3.3 m) intervals. The target precision of the measurements will be finer than 1.5 in. (≈3 cm) at three-sigma (3σ). The results of the measurements are to serve as a quality control check for Moving Vehicle Rapid Mapping (MVRM) systems. This scope did not include performing a quality control (QC) analysis of any MVRM events.

Table 3
DOTD Districts

DISTRICT 02 - NEW ORLEANS	Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, St. Charles, Terrebonne Parishes
DISTRICT 03 - LAFAYETTE	Acadia, Evangeline, Iberia, Lafayette, St. Landry, St. Martin, St. Mary, Vermillion Parishes
DISTRICT 04 - SHREVEPORT	Bienville, Bossier, Caddo, Claiborne, DeSoto, Red River, Webster Parishes
DISTRICT 05 - MONROE	East Carroll, Jackson, Lincoln, Madison, Morehouse, Ouachita, Richland, Union, West Carroll Parishes
DISTRICT 07 - LAKE CHARLES	Allen, Beauregard, Calcasieu, Cameron, Jefferson Davis Parishes, blah
DISTRICT 08 - ALEXANDRIA	Avoyelles, Grant, Natchitoches, Rapides, Sabine, Vernon, Winn Parishes
DISTRICT 58 - CHASE	Caldwell, Catahoula, Concordia, Franklin, LaSalle, Tensas Parishes
DISTRICT 61 - BATON ROUGE	Ascension, Assumption, East Baton Rouge, East Feliciana, Iberville, Pointe Coupee, St. James, West Baton Rouge, West Feliciana Parishes
DISTRICT 62 - HAMMOND	Livingston, St. Helena, St. John the Baptist, St. Tammany, Tangipahoa, Washington Parishes

METHODOLOGY

This project was implemented in four tasks.

Task 1: Standard Operating and Collection Procedures for GNSS Technologies at DOTD

Research was conducted to develop Departmental standards-of-practice for utilizing GNSS technology. Utilizing mapping grade GPS technologies, investigators identified standards and procedures needed to achieve the levels of accuracy defined in previous studies funded by the DOTD and published by the LTRC. The deliverables include a documented collection of SOCPs that combine requirements, technologies, and best-practices techniques that will ensure adoption and compliance by Department staff and contractors.

Figure 3
GeoXH™

Literature Review and Research on the Existing State of Practice

Investigators reviewed the current state of practice for GPS/GNSS data collection. This included methods utilized by the DOTD and other states and agencies and the information previously published in LTRC research reports 11-2P and 09-2GT. Deliverables include a detailed work plan outlining tasks and recommended approach to accomplish objectives of this task.

Evaluate the Technology Proposed by the GPS Technology Oversight Committee

As per the technology adopted by the GTOC, investigators have purchased the single-frequency Trimble GeoExplorer 6000 GeoXH™ hand-held GPS unit for evaluation. Acquisition of this unit includes the accessories (e.g., external antenna, back-pack, and LASER range finder) that can be utilized by Department personnel. Additional purchases include the Trimble Positions Software and ESRI ArcMobile, Trimble TerraSync Professional, and Pathfinder Office Software.

The GeoExplorer 6000 series GeoXH™ handheld has built-in Bluetooth® wireless technology for cable-free connection to other devices, and Wi-Fi connectivity for connections to networks and is equipped with a wireless cellular modem for downloading and transmitting data over the Internet. The GeoXH handheld uses both EVEREST and H-Star™ technology to provide decimeter (10 cm) accuracy, either in real time or after postprocessing. The unit also has an accessory antenna (Zephyr H™ Model 2) and antenna pole.

Another accessory is a LASER rangefinder by Laser Technology, Inc., the TruPulse 360 R model. It measures distance, height and azimuth. Its capabilities include: provides Azimuth(AZ), Inclination, & Slope Distance; solves 3D missing line calculations between any two remote points; integrates with GPS for efficient GIS data capture; Bluetooth® capabilities, produces AZ results regardless of the tilt or pitch

used to aim the LASER; and, rugged, waterproof housing:

TruPulse 360 Calibration Video: http://www.lasertech.com/videos/TruPulse-360-Calibration-Video.mp4

TruPulse 360 R Video: http://www.lasertech.com/videos/TruPulse-360-R-Video.mp4

One can see, by reference to the appendix, that the piece of the TruPulse system most susceptible to unnoticed, accidental interference is the azimuth component based upon detecting Earth's magnetic field. Referring to the manufacturer's documentation, quoted in the appendix, the TruPulse 360 needs a safe clearance of 6 in. from metal rim glasses, pen/pencil, metal watch band, batteries, binoculars, cell phone, camera; 18 in. from clipboard, data collector, computer, GPS antenna, 2-way radio, hatchet and much greater distances (as much as 30 ft.) from more substantial metal things like electrical boxes, manholes, automobiles, trucks, metal buildings, and heavy machinery, not to mention electrical transformers, etc. The obvious "take-away" is not to place much trust in the azimuth reading because many, if not most, of the items one can be anticipated to measure will be more conveniently measured near objects like those in the list known to adversely affect the magnetic compass and therefore the azimuth recorded. All is not lost, however.

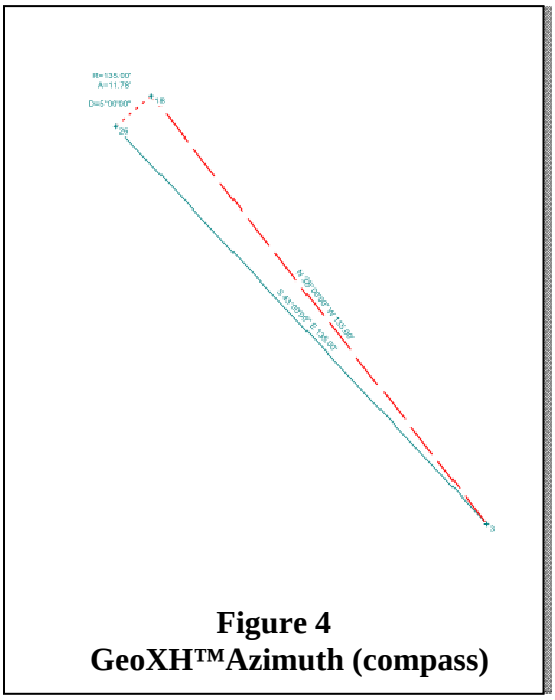

Figure 4
GeoXH™Azimuth (compass)

Trusting the azimuth reading may seem like the proverbial *Easy-Button* and will be tempting to users in the field. For example, imagine the incentives for one performing an inventory of signs and poles. The operator drives his truck to the shoulder of the road near a pole. The GPS antenna is mounted to the roof of the truck. Taking the LASER rangefinder and targeting the pole is simple and direct and the tool provides a distance (accurate) and azimuth (doubtful) and all seems well. But when the designed clearances do not fit or other complications arise because the pole was mapped in a wrong place, all assumed savings are lost.

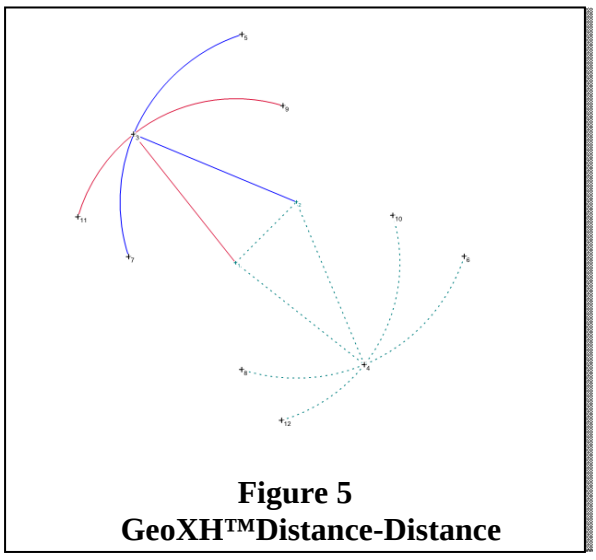

Figure 5
GeoXH™Distance-Distance

A slightly different scenario, almost as frugal with operator's time and effort, overcomes any potential problems with magnetic azimuths. Imagine the incentives for one performing an inventory of signs and

poles. The operator drives his truck to the shoulder of the road near a pole. The GPS antenna is mounted to the roof of the truck. Taking the LASER rangefinder and targeting the pole is simple and direct and the tool provides a distance and the operator knows not to trust the azimuth. The operator then moves ahead some convenient distance and finishes collecting the location of the pole by targeting it again. The mapping receiver software combines the two accurate antenna positions with the two accurate distances to locate the pole with certainty. There is the mathematical results of two points. The second is 180° from the intended (e.g., other side of the road) and easily eliminated from consideration.

GNSS technology is not as easy to use as it may seem. Areas where errors can occur that will degrade the GNSS precision include equipment and software configuration, collection techniques, and data processing techniques. Configuration errors can occur in configuration of: Positional Dilution of Precision (PDOP), Signal to Noise Ratio (SNR), elevation, positioning mode, minimum positions, offsets, and multipath errors. Good practice includes software and equipment configuration checklists; extensive training; automating the data processing; and finally, allowing for a single database manager to oversee the data processing and someone singularly responsible for setting standards for the whole department regarding datums, projections, coordinate systems and other geodetic minutia. Following these procedures will go a long way to prevent bad GNSS data from entering a database.

GNSS Theory. What follows is a brief overview of GNSS theory with examples based on GPS operations. This description is very basic. The better a user understands how it works, the better equipped he will be to understand and deal with problems of GPS. GPS uses Department of Defense (DOD) satellites, called a constellation. They orbit the earth twice in just under 24 hours. The satellites are constantly updated with data on all the satellites in the constellation. This data is stored as an almanac. Each satellite has several atomic clocks, finely controlled by daily updates. This information is contained in the satellites' signals.

The GPS receivers pick up these signals. The GPS receiver is able to select the best four satellites to use for trilateration calculations to derive the position. Basically, each measurement requires the four values in the equation. Obvious needs are the x, the y, and the z values. Of critical importance is the fourth t value for the time the signal was transmitted from the satellite. When one has four unknowns, he is required to have four sources of data to solve the equation. Therefore, four satellites must be observed simultaneously for the receiver to arrive at a solution. More satellites, in general, are beneficial to the solution.

The positional accuracy for as-designed GPS is about 50 ft. Attaining precisions of 10 ft. or better differential correction is necessary. Differential correction requires two sources of GPS data. One source is the GPS data captured by the GPS rover receiver, and the second is the GPS information from a base station at a known place.

A base station is a stationary GPS receiver whose antenna has been precisely located. The base station

data has its raw data compared to what it ought to have been in a perfect environment generating the variances for each satellite every second. The rover's raw data is corrected by simply subtracting those variances from its own raw data, greatly improving the precision. The base station data may be applied to the raw data collected by the GPS rover either in real-time or by post-processing.

Operational Matrix. Investigators developed an operational matrix comprised of DOTD-specific feature types/applications contrasted under varying conditions for both horizontal and vertical accuracy. Feature type/application examples include benchmarks, soil borings, sound barriers, bridge/overpass structures, roadway pavement, levees, etc. Condition examples include PDOP values, canopy densities, RTN correction network, occupation times, travel speeds, etc. The result was less informative than hoped for because the precisions/accuracies within each of the categories formed a ranging spectra of values rendering a straightforward chart unmanageable. Instead, a chart/table is presented with examples of minimal or maximal limits within which one might expect the equipment to record accurate positions with acceptable precisions.

A matrix is an oversimplification in that it is not a reasonable expectation to cover the myriad of situations that a DOTD field technician may find himself. Each category has a broad spectrum of possibilities. There may be times when the tree cover seems daunting but the luck of the day has satellites placed at that time, in that place, just so to permit clean signals to be captured by the antenna. In another apparently open area, the satellites may play a game of hide-and-seek behind whatever objects are available thwarting the quick collection of a good position. The urban canyon can be treacherous to good positioning. Whereas often under canopy some mix of earlier direct and or several multipath signals arrive at the antenna, in the worst cases of urban canyon, the antenna may see only the cleanly reflected signal of a satellite the direct signal of which is blocked completely by a building on the opposite side of the street. This can be confusing for the receiver because it will try to use the "clean" signal to calculate a bogus position. This is especially so when trying to collect positions quickly. The receiver may, with sufficient time, be able to determine the reflected signal as bad and alert the operator. Sometimes it may be able to disregard the bad signal and, using the remaining signals, calculate a good position. An occupation of a few seconds does not give the processor time to make that analysis.

Collecting continuous positions while moving presents a different set of things to consider. A moving antenna will make multipath signals dramatically change their characteristics enabling the receiver to do a better job of rejecting the bad signals. Movement means the time spent on any one position is fleeting, affording the receiver very little information about that individual position so despite the help with some multipath, the receiver is sensitive to any bad data that gets through. When one is moving the precise orientation of the antenna to the reference surface (usually the ground or water surface), it is more difficult and subject to constant disturbance. This is unavoidable and needs to be anticipated in order to minimize it and make expectations of users of the data understand that it is not likely to be of the same

precision as that collected in a static situation. Nevertheless, the matrix contains some fairly good rules of thumb based on generally reasonable assumptions. Bear in mind the Smart Settings will vary from the matrix in an intelligent algorithmic effort to get the best result in any situation presented.

Table 4
Operational matrix

Feature types/applications	Max PDOP	Canopy	RTN	Occupation time	Travel speed
Benchmarks	6.0	Very minimal	Yes	300 positions (5 minutes)	None
Soil borings	6.0	Minimal	Yes	5 positions (5 seconds)	None
Sound barriers	6.0	Minimal	Yes	1 to 5 positions (5 seconds or less)	None to walking
Bridge/overpass structures	6.0	Minimal	Yes	1 to 5 positions (5 seconds or less)	None to walking
Roadway pavement	6.0	Minimal	Yes	Continuous to 5 positions (5 sec. or less)	None to 60 mph
Levees	6.0	Minimal	Yes	Continuous to 300 pos. (5 min. or less)	None to 30 mph

Evaluate the Pros/Cons & the Cost/Benefit (Short & Long Term) of Enterprise GNSS Implementation

An organization with state-wide responsibilities including the safety and welfare of the public byways necessarily employs great numbers of people, equipment, vehicles and other resources. Proper cost evaluation of widely employed resources may be critical in serving the public weal by keeping trust that financial and other resources are employed efficiently. Newer and more esoteric technologies, such as GNSS, often have great potential but evaluating the most cost-effective way to implement their use is often elusive.

The first, obvious consideration is the immediate, direct cost of purchase (or rental in some cases). A very important second consideration is compensation for personnel to operate said technology. Consider having purchased various paints and brushes and stretched canvas for a minimal cost in order to paint portraits. What will it cost to hire a qualified artist versus training unqualified employees to perform with an acceptable level of competency?

A third consideration is the cost of maintenance. The "stuff" may be disposable or long-lived. If long-lived, then how is it to be maintained and by whom? GNSS and mapping technology is today essentially electronic in nature and most of the regular maintenance involves software/firmware updates and upgrades. These may be done as one-offs or as part of maintenance agreements, which act much like rentals with regular (e.g., annual) payments for the right to any updates should they occur.

A fourth consideration is how the technology will be distributed or made available to the personnel qualified to employ it. Consider personal computers, cell-phones, or vehicles. Many large organizations provide almost every employee access to a personal computer with which to accomplish their day-to-day duties. Many provide cell-phones and vehicles to employees who must work outside the office. In some cases, equipment is placed in conveniently located areas for employees to check-out on an as-needed

basis (vehicles, tractors, boats, some tools, etc.).

Presently, DOTD survey-grade GNSS equipment is assigned to each survey party and generally stays with them in their assigned truck. Also, there is assigned equipment to each district for check-out usage. The GTOC has already begun modeling the allocation of mapping–grade GNSS resources for the DOTD but the final situation is still being realized.

The people responsible for GIS have already identified the expense of resources, especially personnel time, wasted by using recreational-grade GNSS tools. The data collection was poorly executed or the data inherently unsuitable for their cartographic or geographic analysis needs. So it has been demonstrated that the apparently inexpensive acquisition of cell phones or recreational GNSS receivers did not result in a viable cost/benefit ratio. There was apparent low cost but with almost no benefit.

$$\textbf{\textit{Recreational}}: \frac{\textbf{\textit{Low Purchase}} + \textbf{Nominal } \textbf{\textit{Labor}}}{\textbf{\textit{No Useful Data}}} = \textbf{\textit{Very High Ratio}}$$

If one looks at the allocation of survey-grade GNSS tools, he may wonder about the equipment that is at least an order of magnitude more costly and the compensation of technicians and professionals qualified to operate it as leading to a very bad ratio. The equipment can be expensive with a higher unit cost, the salary of qualified people is higher than average, and the total number of points to be recorded as data is fewer. It seems a bad outcome and may be a foregone conclusion, but if examined a bit closer and work the equation, another outcome may develop.

The equipment is capable of both accuracy and precisions unbelievable only a few years ago with then conventional survey techniques. Survey measurement and positional data is a critical element of engineering design and construction efficiency. Increased survey precision and reliability is rewarded many fold in the savings in construction cost over-runs and engineering re-designs, making accurate survey data practically priceless. The efficiency of survey-grade GNSS is hundreds of times more productive than older methods so the necessary labor costs are reduced at least an order of magnitude or more.

$$\textbf{\textit{Survey}}: \frac{\textbf{\textit{High Unit Purchase}} + \textbf{\textit{Lower Labor}}}{\textbf{\textit{Priceless Data}}} = \textbf{\textit{Extremely Low Ratio}}$$

The great majority of data captured with mapping-grade GNSS tools will serve purposes that fit the category of GIS. There are typically a plethora of points the accuracy of which is critical but for which the precision need not be nearly as high as required of survey-grade data. Recent years have seen the cost of suitable mapping grade GNSS tools decrease greatly, nearing the former level that recreational tools once were. The purchase prices may be classified as moderately low. With minimal training, a technician may collect data suitably precise for inventory location and GIS analysis so labor is moderate.

The data, taken individually, is not as critical as survey-grade data but most GIS data today is usually of

a precision higher than necessary to the task and much may be collected with moderate to almost no effort: as an add-on to another function already accounted for (e.g. route data collected using vehicles already charged to travel for other purposes).

$$\textbf{\textit{Mapping}}: \frac{\textbf{\textit{Moderately Low Purchase}} + \textbf{\textit{Moderate to No Labor}}}{\textbf{\textit{Large amount of Useful Data}}} = \textbf{\textit{Very Low Ratio}}$$

Another point worthy of analysis is the wisdom, or not, of using the same equipment across the department versus using systems from different manufacturers that have similar capabilities. It would seem the GTOC has performed some preliminary analysis and prefers the benefits of a single style/brand of tools to enhance uniformity across the board. The decision, effects, and discussion of the decision will predictably come in waves.

The benefits of uniformity are fairly obvious to those who try to manage tools for a large group. It would seem the benefits are greatest when there is a uniformity of tools to be administered. The procedures may be made standard with practically no exceptions required. Compare this to fleets of vehicles, company computers and telephonic devices. Initially, a decision for uniformity will lead to a common mode of usage, maintenance and productivity. Eventually, the environment or the manufacturer will have moved on to a newer form-factor with more attractive "bells-n-whistles." Attrition by loss or damage will require replacement of the uniform models with what is available. The uniformity will be gradually lost, perhaps leading to a new cycle of replacement to achieve uniformity. The uniformity will inevitably diminish until, at some point, steps will be taken to restore uniformity. It will be cyclic and, with experience, it may be managed periodically.

DOTD GPS User Documentation & SOCPs. Investigators developed specific documents in association with the device's user manual for DOTD GNSS users (to be used in subsequent training, not part of this project) in the proper GNSS data collection techniques. This includes descriptions of the technology/equipment, terminology, explanation of possible errors affecting accuracy and precision, and specific techniques and ways to ensure accuracy and precision. It has been combined with items of Task 2, involving datums. Together they will serve to improve and ensure accuracy.

The native software written by Trimble, the manufacturer, for its hardware and resident on the device is TerraSync. Other programs may act as shells for the GeoExplorer 6000 series handheld. One such is the ArcPad, software by ESRI. ESRI develops GIS that function as an integral component in a broad spectrum of organizations around the globe. ArcPad is mobile field mapping and data collection software designed for GIS for capturing, editing, and displaying geographic information quickly and efficiently. Critical data can be checked in and out of a multi-user or personal geodatabase and shared across an organization. ArcPad is part of an enterprise GIS platform and integrates directly with ArcGIS

ESRI's ArcGIS is a GIS for working with maps and geographic information used for: creating and using maps; compiling geographic data; analyzing mapped information; sharing and discovering geographic information; using maps and geographic information in a range of applications; and managing geographic information in a database and provides an infrastructure for making maps and geographic information available throughout an organization, across a community, and openly on the World Wide Web.

Figure 6
ArcPad Desktop Tools concept

GIS technicians familiar with ESRI's products may favor the ArcGIS interface over the TerraSync interface. If so, he will need to become familiar enough with the GeoExplorer 6000 series handheld, and perhaps TerraSync, to be sure all the hardware settings are optimal. If one is collecting positions in an activity that is not integrally driven by existing GIS database operations, it would seem working directly with the manufacturer's native software may be the simpler, more direct way to go. One familiar with ArcGIS on a mission to verify a database, update, and/or add features to it would export appropriate files to the ArcPad and use that interface to its best potential. Another user, not so familiar with ArcGIS or not directly verifying a database, would likely increase his productivity by use of the TerraSync software.

Outside of environmental concerns and proper field techniques, Table 5 covers those GNSS receiver settings and set-ups that help insure accurate, precise data in descending order of importance.

Table 5
GNSS receiver setting for accuracy & precision

1.	When using the TerraSync software to collect data, **use accuracy-based logging** to ensure that only GNSS positions that meet the specified estimated accuracy are logged. GNSS positions that do not meet accuracy requirements are not logged.	For more information, see **page 72** of the *Trimble GeoXH6000_Manual*.
2.	**Use real-time dual-frequency differential corrections from an RTN network**, i.e., C4Gnet, source to give you better accuracy as you collect data. Differential global navigation satellite systems (DGNSS) corrections are often broadcast over the Internet. For example, corrections generated by an RTN network are commonly broadcast over an Internet server. An RTN network uses data from several base stations (C4Gnet uses 90+) to provide rover receivers with corrections that are generally more accurate than corrections from a single base station. Alternatively, connect to a server that provides DGNSS corrections from a single base station (a seldom used but available, C4Gnet option).	For more information, see **page 74** of the *Trimble GeoXH6000_Manual*.
3.	Configure the GNSS settings for the receiver to **use Smart Settings** to increase the precision of the data, and to minimize the effect of atmospheric interference and poor satellite geometry.	For more information, see **page 76** of the

	Using Smart Settings, the GNSS receiver generates the best possible position for any given environment, without the need to adjust receiver settings to match the conditions.	*Trimble GeoXH6000_Manual*.
4.	**Connect to the external antenna**. The GeoExplorer 6000 series handheld has an internal antenna, which is suitable for use in most conditions. Connect an external Tornado antenna for improved precision. Configure antenna settings in the GNSS field software, once the external antenna is connected to the handheld.	For more information, see **page 77** of the *Trimble GeoXH6000_Manual*.
5.	**Plan GNSS data collection** around the times of the day when satellite geometry is best. To maximize productivity, plan GNSS data collection around the times of the day when satellite geometry is best. The TerraSync software and the GPS Controller software both include a Plan section with an animated sky plot and dilation of precision (DOP) graph for the next 12 hours. Use the timeline to zoom in on times when geometry is poor. As GNSS settings are changed, the Plan section is updated, showing effect of different quality control settings.	For more information, see **page 78** of the *Trimble GeoXH6000_Manual*.

Task 2: Horizontal and Vertical Datum Research Summary

This task examined and assessed the effects of using different datums when measuring horizontal and vertical positions using GNSS technologies. Deliverables from this task include specific techniques for attaining consistent and reliable GNSS position measurements relative to the NSRS (see Task 1.). Such information can be essential for accurately comparing historic with contemporary GPS/GNSS observations.

Literature Review and Research on the Existing State of Knowledge

Significant improvements in Geographic/Land Information Systems (G/LIS), and surveying and mapping technologies during the last three decades dictated a reassessment of the role of the National Geodetic Reference System (NGRS). The National Geodetic Survey (NGS) responded to demands from a wide range of users for improved three dimensional positional accuracy and accessibility to the reference system by developing the National Spatial Reference System (NSRS). The NSRS improves the availability and accuracy of positional information necessary for the development of accurate parcel based G/LIS, active GNSS navigation and surveying activities, and improve understanding of the geophysical dynamics of Earth.

The National Geodetic Reference System (NGRS) exists as a collection of discreet geodetic elements. Horizontal positions referenced to a two-dimensional datum, the North American Datum of 1983 (NAD 83), and elevations referenced to a one-dimensional datum, the North American Vertical Datum of 1988 (NAVD 88) define the major components of the NGRS. Approximately less than 10 percent of the horizontal and vertical reference systems coincided. NGRS data has traditionally been confined to geodesists, surveyors, and cartographers in the federal, state, and local mapping communities.

The NGRS already incorporated the features necessary to support the integrity of the National Spatial Data Infrastructure. However, the term *Geodetic* has often been intimidating to many data users. Changing the name to *Spatial* is intended to be more consistent with the needs of the public and should not require data users to run for their dictionaries to find out what the term means.

The change is not just cosmetic. It represents a fundamental change by NGS including development of

the Federal Base Network (FBN), Cooperative Base Network (CBN), User Densification Network, Continuously Operating Reference Stations (CORS), GPS Orbits, a high accuracy geoid, and improved data access. (Doyle, 1994)

Geodetic Datums. Geodesy is the science of measuring the size, shape, and orientation of Earth. Computing precise locations on Earth's surface is predicated on well-defined geodetic reference systems that best account for these characteristics (i.e., datums). Earth positioning necessitates geodetic datums, which provide a realization of a coordinate system suitable for terrestrial surveying (Meyer, 2010). For GNSS derived positioning, the surface of Earth is approximated most effectively by the reference ellipsoid (Figure 7).

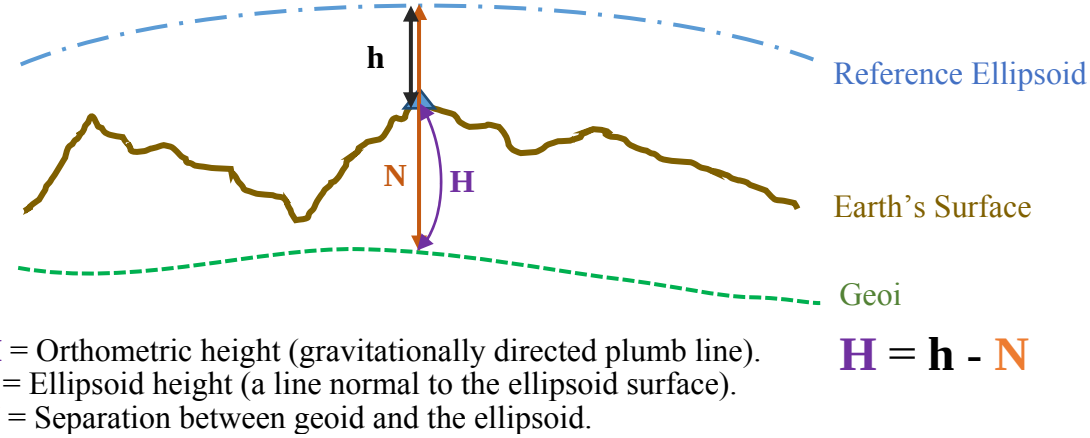

Figure 7
Derivation of orthometric heights using the geoid and ellipsoid parameters

The reference ellipsoid serves as the geometric foundation on which geodetic coordinate systems (e.g., latitude, longitude, and height) are applied. Currently, all GPS observations use the World Geodetic System of 1984 (WGS 84) terrestrial reference system. The current iteration of WGS84 (G1150) is practically identical with the International Terrestrial Reference Frame of 2000 (ITRF2000) (Snay & Soler, 2000). Systems within the GNSS each use their own reference system. However, the relationships of one to another are known, well within the precision specifications of the mapping tools that are the subject of this investigation. The illustrative purposes are met by using WGS84 as example.In order to relate the geometric positions on an ellipsoid to a geodetic position on Earth's surface, various terrestrial reference systems have been defined. These systems account for gravity, geophysical movement of Earth's crust (e.g., tectonic drift), polar motion, and more (Meyer, 2010). Many reference systems exist, which are traditionally defined for an individual nation or continent. For the United States, the NSRS (national spatial reference system) is the authoritative coordinate reference system for geodetic datums (NGS, 2013a). A ***datum*** is a single piece of information, as a fact; from Latin: something given.

Traditionally, despite acknowledging the nearly spherical shape of the earth, surveying results have been

presented using plane geometry primarily to ease interpretation by the layman. For most projects the surface of the earth represented is so small as to permit representation as if the earth is flat except for its topography. As a result, most publicly useful datums fell into two categories: horizontal (2D) and vertical (1D):

- ***vertical datum (1D)***: a basis for vertical control surveys consisting of any level surface, line, or point used as a reference in measuring elevations.
- ***horizontal datum (2D)***: a basis for horizontal control surveys, consisting of a certain point, the azimuth of a certain line from this point.
- ***horizontal datum (3D)***: (1) a basis for horizontal control surveys, consisting of the longitude and latitude of a certain point, the azimuth of a certain line from this point, and two constants used in defining the terrestrial ellipsoid; a classical datum. (2) a basis for 3D control surveys, consisting of the position of the center of mass of the earth, the azimuth of a line from any point parallel to the mean axis of rotation is north-south and two constants used in defining the terrestrial ellipsoid; an inertial datum.

Discussions of geodetic datums seems very esoteric and foreboding to one not familiar with the subject. Once one is initiated, the subject is not quite so intimidating but taking in the finer points will remain a challenge for most even then. What is important to this discussion is not so detailed or challenging. Basically, the chosen datum allows one to know the starting point from which relevant coordinates are reckoned. Typically, one uses a benchmark that has an elevation value conventionally assigned to it. That means the top of that benchmark is positioned the height of that value above the surface calculated to be zero elevation. Typically one uses a reference mark that has a set of horizontal coordinates (latitude/longitude or northing/easting) conventionally assigned to it.

Latitude is an expression of the angle formed between the equator and one's location above or below the equator. Longitude is an expression of the angle formed between where the north/south line of an arbitrary place (Greenwich England) crosses the equator counter-clockwise around the earth to the point where the north/south line of the point of interest. The U.S. lies more than 180° counter-clockwise from Greenwich so it is usually more convenient to represent longitude as "west" or as "negative" coming in a clockwise direction from Greenwich, e.g., Longitude 270° goes thorough New Orleans. It may also be expressed as -90° or W90°. They are equivalent.

Frequently, positions expressed relative to a horizontal datum are easier to digest if projected onto a plane surface. A ***projection*** is a the representation of a line, figure, or solid on a given plane as it would be seen from a particular direction or in accordance with an accepted set of rules

There is unavoidable distortion when this is done but the convenience makes it tolerable as long as one understands the compromises involved in trying to represent a spherical surface as a flat surface. Louisiana has three official projections north, south, and offshore (State Plane Coordinate Systems). The

reason for three is to avoid undue distortion caused by the projection itself. State place coordinate systems are designed to avoid greater than 1:10,000 distortions.

Those using GIS and other mapping tools who do not understand the distortions inherent in projections often chose another projection that covers the whole of the state. It "feels" more convenient but, of necessity, it will contain larger distortion. A popular choice is the Universal Transverse Mercator projection. It covers from the equator to the pole and as a result designed to only avoid greater than 1:1,000 distortions.

Custom state-wide projections optimized for GIS use are possible and preferable by far to UTM. Mississippi created such a projection for their GIS use. Clifford Mugnier defined one such projection for Louisiana (Mugnier, 1986).

DOTD is cited in RS 50:9 and designated as the authorized state agency to administer, to collect and distribute information, and generally to advise with and assist appropriate state and federal agencies and individuals interested in the development of the provisions of the Louisiana Coordinate System. As such it is incumbent to always be aware of contemporary developments and potential improvements, especially those promulgated by the National Geodetic Survey, responsible for maintenance of the National Spatial Reference System. The current best references to the NSRS are the 3D horizontal North American Datum of 1983 epoch 2011 and the 1D vertical North American Vertical Datum of 1988 epoch 2012.

RS 50:9 seems to make it incumbent upon the DOTD to employ or authorize a licensed state surveyor with the authority to determine, administer, collect, distribute, advise and assist in the interest of the Louisiana Coordinate System. Considering the growth and importance of proper use of projections and coordinate systems for proper, legitimate GIS use, it would seem crucial for the agency charged as DOTD is by RS 50:9 to also employ or authorize a GIS expert in the use and application of GIS in order to meet, in part, the duties required by the statute.

GNSS do not have a natural up direction. Since they orbit the earth, any location along their path has a different direction of up than the rest. What GNSS does provide is very accurate positions expressed as latitude, longitude, and height above or below the ellipsoid or alternatively as X, Y, Z from the origin of the reference frame. Ellipsoid height is projected normal to the surface of the reference ellipsoid. Complications arise because the direction of the pull of Earth's gravity is not along the same line as ellipsoid height. It is dependent upon the distribution of mass

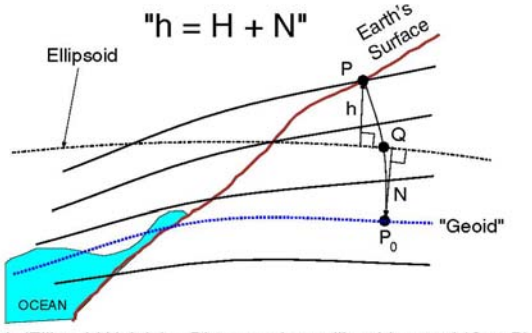

Figure 8
Gravity potential

within the earth and most significantly in the neighborhood of the place of interest. Simply stated, the direction of up for GNSS is not the same as that which determines whether a building will fall or which way the water flows.

Conventional leveling covered short distances at a time and every set-up was oriented to the pull of gravity via the levelling bubbles, so it was very reasonable to consider the product of such surveys as elevations (i.e. orthometric heights). Today GNSS may be used to estimate orthometric heights to a high degree of accuracy by subtracting modeled geoid heights from measured ellipsoid heights.

$$H = h - N$$

Where:

$$H = orthomegtric\ height$$
$$h = ellipsoid\ height$$
$$N = geoid\ height$$

The geoid heights derive from a model of the geoid. It is like a digital terrain model (DTM) of the equipotential surface that is the geoid (similar to sea level). As with any model, it is imperfect and dependent upon many observations spaced out in the area of interest. Geoid models were once the matter of top secret files and esoteric academic research. For the last 25 years or so, the NGS has made available to the public geoid models with ever increasing precision as observations are densified.

The current best geoid model for relating to the National Spatial Reference System (NSRS) is called *Geoid12A*. Mapping-grade and recreational-grade tools do not have the necessary precision to be useful providing accurate vertical values, particularly in Louisiana, which is relatively flat. Being flat means the importance of the precision of the height measurement is even more critical because a small change in elevation involves large differences in area. (A small difference in the height of flood waters may mean many square miles of additional inundation.) Mapping grade elevations may be useful in areas with greater topographic relief (hilly or mountainous places) but are not recommended for use by DOTD.

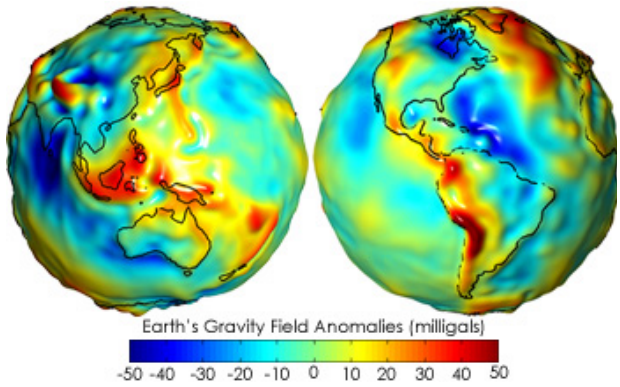

Figure 9
Visualization of geoid undulations

The National Spatial Reference System. It is the mission of the NGS to define, maintain, and provide access to the NSRS. The NSRS is comprised of a horizontal and vertical datum: geodetically defined reference systems that can translate GNSS positions on the reference ellipsoid to actual positions on Earth. As noted above, terrestrial reference systems are designed to account for multiple, dynamic geophysical characteristics, all of which continuously evolve and, thus, distort these frameworks (e.g., tectonic motion, subsidence, polar precession, etc.). When combined with increasingly more precise equipment, improved geophysical models, and longer observations, the evolution of these parameter values necessitates revisions to the reference systems. Accordingly, the NGS will often update or adjust the realizations defining both the horizontal and vertical positions for the nation.

NAD 1983 – Horizontal Reference Frame for the United States. The North American Datum (NAD) is the authoritative source for comprehensive horizontal control in the United States. The NAD has evolved many times since its inception in 1927. The 1927 datum for North America (NAD 27) was established on coordinates centered at Meades Ranch, Kansas, the Clarke 1866 reference ellipsoid, and geodetic measurements between networked reference stations located across the continent. While state-of-the-art for its time, the NAD 27 control network proved difficult to expand and sustain. Over the decades of use, numerous local distortions accumulated, which demonstrated that the NAD27 based on the Clarke ellipsoid was insufficient for serving the needs of modern geodetic surveys (Schwarz, 1989). By the 1970s, a new geocentric datum for the nation was proposed.

Utilizing technologies not available to its predecessor, the 1983 datum (NAD 83) relied on Doppler satellite observations (The TRANSIT satellite system began in 1958 sponsored by the Navy was the first satellite positioning system, based on the premise that if the satellite's position were known and predictable, the Doppler shift of its signal could be used to locate a receiver on Earth. It was made obsolete by the GPS, and navigation service ceased in 1996. Very long baseline interferometry (VLBI) measures the time difference between the arrival of the radio waves emitted by very distant quasars at different antennas on the Earth surface. VLBI also determines the precise position of the antennas and the way Earth rotates and moves. VLBI's precision for a one-day session is as good as 1 mm in the horizontal and 3 mm in the vertical and simultaneous least squared adjustments over 200 thousand reference stations in North America (Schwarz, 1989). The reference ellipsoid adopted by NAD 83 is the Geodetic Reference System of 1980 (GRS 80), a geocentric system similar to that of WGS 84 (Snay R. A., 1999; Meyer, 2010). Since its creation, the NAD 83 datum has seen multiple realizations, each of which correspond to improved understanding and measurement of Earth’s center, orientation, and scale (Table 6).

Table 6 Improvements to the Horizontal Reference System for the United States		
Datum	**Time Span**	
NAD 83 (NA 2011) epoch 2010.0	2011-present	http://www.ngs.noaa.gov/web/surveys/NA2011/
NAD 83 (NSRS 2007)	2007-2011	http://www.ngs.noaa.gov/NationalReadjustment/
NAD 83 (CORS 96) epoch 2002.0	1993-1997	http://www.ngs.noaa.gov/NationalReadjustment/difference.html
NAD 83 (HARN)	1990-1993	
NAD 83 (1986)	1986-1990	
NAD 27	1927-1986	

The most recent update to NAD 83 occurred in the summer of 2012, when the NGS (2012a) completed the National Adjustment of 2011 [NAD 83 (NA 2011), epoch 2010.0]. This nationally constrained adjustment optimally aligned the GNSS-derived passive NGS control (e.g., benchmarks) with the active control provided by Continuously Operating GPS/GNSS Reference Stations (CORS). As noted by the NGS (2012a), the final adjustment resulted in a median horizontal and vertical shift of 2 cm from previously published values, though some station coordinates experienced more significant differences. Also of note, all passive marks on NGS datasheets that use NAD 83 (NA 2011) coordinates are considered "…consistent with results obtained using CORS and the NGS Online Positioning User Service (OPUS)" (NGS, 2013a). Thus, the adjustment effectively created a new realization of the horizontal geodetic control framework for the U.S.

It is important to note that an adjustment is not a new horizontal datum (http://www.ngs.noaa.gov/CORS/coord_info/myear_FAQ.shtml#CoordDiff). For instance, the NSRS 2007 was effectively an update to the CORS96 realization of NAD 83: updating the coordinates of nearly 70,000 passive benchmarks relative to the well-established CORS sites, which were held fixed. Similarly, the NA 2011 project was a constrained adjustment applied to the active (CORS) and passive (benchmark) coordinates within the geometric reference frame for the North American plate (http://www.ngs.noaa.gov/NationalReadjustment/). The 2011 adjustment involves no fundamental change to the NAD 83 datum, which means that the origin, scale and orientation of NAD 83 (NA 2011) are identical to those of NAD 83 (CORS 96). The coordinates, however, are not the same between the old and new realizations. Factors affecting the coordinates include updated antenna calibrations, new and revised processing algorithms, improved identification of discontinuities, updated observation data, changes in reference epoch, and an improved definition of the global reference frame. The marks may have moved some and the ability to measure them improved as well. As such, the proper terminology is to refer to the updated datums as a new "realization" of the existing reference frame.

Geoid Model Assessment

NAVD 1988 – Vertical Reference Frame for the United States. Created in 1990 to replace the National Geodetic Vertical Datum of 1929 (NGVD 29), the North American Vertical Datum of 1988 (NAVD 88) is the authoritative source for comprehensive vertical geodetic control in the United States. A vertical datum is basically a surface of zero elevation, typically referencing heights relative to mean sea level (NGS, 2013b). The NAVD 88 datum was developed using minimally-constrained, historic geodetically leveled values collected across the North American continent (e.g., Canada, Mexico, and the United States (U.S.). The datum held fixed the tide station in Rimouski, Quebec, Canada, the primary tidal benchmark for establishing mean sea level height (Zilkoski, Richards, & Young, 1992). When combined with gravimetric data, leveling data was used to derive Helmert orthometric heights to approximate the location of the geoid: the equipotential surface of Earth's gravity field that coincides with global mean sea level. From these calculations, surveyors and engineers compute orthometric height, or elevation above sea level.

Table 7
Improvements to the Vertical Reference System for the United States

Datum	Time Span
North American Vertical Datum of 1988 (NAVD 88)	1990 – present
National Geodetic Vertical Datum of 1929 (NGVD 29)	1973 – 1990
Mean Sea Level Datum of 1929	1929 – 1973

Congruent with the 2011 national adjustment, the NGS updated the NAVD 88 in 2012 to correspond to the updated horizontal reference system. The NGS enhanced this reference system with a new, hybrid geoid model (i.e., Geoid 2012A) that combined the NAD 83 (NA 2011) derived ellipsoid heights with the latest satellite based gravimetric models of the U.S. (e.g., the US Gravimetric Geoid of 2012). By tying the GNSS-derived heights with geodetically leveled values, the NGS was able to develop a surface that effectively wrapped the gravimetric geoid to the geodetic bench marks. The resulting system provides updated orthometric heights for North America.

A ***geoid*** is the equipotential surface of Earth's gravity field which best fits, in a least squares sense, global mean sea level. It is impossible to build a perfect model of the geoid. Not every place on Earth may be measured and there may be non-periodic changes in sea level meaning the geoid should also change in time. These are just a few examples of the difficulties in compiling a geoid model. (NGS 2001) Table 8 shows information compiled comparing and contrasting various geoid models available for Louisiana, an empirical assessment of geoid differential values to help identify spatial trends in variation.

Table 8
Comparison of geoid heights

City	N. Latitude	W. Longitude	Geoid90	Geoid 93	Geoid96	Geoid99	Geoid03	Geoid09	Geoid12A
New Orleans	30° 0' 0"	90° 0' 0"	-87.91	-86.90	-86.16	-86.19	-85.88	-85.72	-85.61
Lake Charles	30°12'53"	93°12'31"	-92.00	-90.86	-89.79	-89.75	-89.49	-89.32	-89.19
Lafayette	30°13' 0"	92° 2' 0"	-91.77	-90.71	-89.80	-89.76	-89.68	-89.50	-89.25
Baton Rouge	30°27' 0"	91° 8'24"	-90.26	-90.26	-89.27	-89.23	-89.21	-89.05	-88.86
Alexandria	31°17'34"	92°27'33"	-89.08	-87.91	-86.58	-86.59	-87.12	-86.94	-86.84
Monroe	32°30'34"	92° 7' 6"	-86.97	-85.79	-84.51	-84.64	-85.09	-84.88	-85.07
Shreveport	32°30'53"	93°44'50"	-87.60	-86.35	-85.14	-85.23	-85.50	-85.43	-85.54

One observes that the gross nature of the changes in values shrinks over time to a plateau of about 0.10 ft. from earlier changes typically a foot or more with a cumulative change in value of about 2.5 ft. As the precision of the model improves, one sees the magnitude of change shrink. The average change for these seven points is about a foot from Geoid90 to Geoid93, about 0.75 ft. from Geoid 93 to Geoid 96, very little change from Geoid96 to Geoid99, about 0.15 ft. from Geoid 99 to Geoid03 and from Geoid03 to Geoid09. It was only about 0.01 ft. from Geoid09 to Geoid 12A.

The averages can be a bit deceiving. Looking at the average magnitude of change is similar through Geoid96, which shows about 0.25 ft. changes in Geoid03, about 0.15 ft. in Geoid09 and Geoid12A. This may indicate that the gross shape of the geoid is pretty well known here. The flat nature of much of Louisiana's topography amplifies the significance of small deviations in the geoid because relatively small differences in tides, river stages, or storm surges will make huge differences in the areas affected by them.

The stated best precision of the GeoExplorer 6000 series handheld and then requiring utilizing high-quality corrections and external antenna, is 4 in. The GeoExplorer 6000 series handheld, as powerful a tool as it is for collecting horizontal positions and data for GIS use, is not a device one uses to verify, validate or establish elevations for Louisiana.

Something's Fishy in the Corn Patch. As noted earlier, GNSS technologies only provide measurements relative to the ellipsoid. Computation of GNSS derived elevations necessitates a reliable geoid surface that relates to both the ellipsoid and the earth surfaces (Figure 7). However, our knowledge of the geoid is only approximate (Mugnier, 2012). Furthermore, this knowledge is very faulty in Louisiana because of the constant surface and subterranean vertical movement due to consolidation, faulting, salt domes, crustal flexure, and subsidence – the consequences of which are largely responsible for coastal erosion and the inability of geodetic benchmarks to remain reliable for only a few years.

The subsidence measured in Louisiana, and indeed much of the northern Gulf of Mexico, is spatially and temporally variable (Shinkle & Dokka, 2004). This variability has consequences to the derivation of a reliable geoid model. As the landmass subsides, it results in a change in mass, and thus a change in geoid. While the magnitude of change should be very small, it is a truism that 10 cm of vertical change results in a 1 cm change to the geoid – an order of magnitude difference. As the terrestrial surface subsides, its orthometric height corresponds. Only through long-term observation of CORS measurements, coupled with periodic gravity readings, can a more precise model of the geoid be derived (Mugnier, 2012).

The 2012 geoid update to the NAVD 88 was not without problems. Upon release of the hybrid geoid model, users quickly discovered anomalous measurements at locations in Alabama, Louisiana, Mississippi, Oklahoma, Texas, and Wisconsin. These defects were attributed to erroneous values obtained from geodetically leveled bench marks (NGS, 2012b). The NGS quickly acknowledged the errors, and issued a revised hybrid geoid model, 2012A, in September 2012 (NGS, 2012c). An assessment comparing the predicted geoid value with those derived using geodetically leveled benchmarks was compiled and distributed by the NGS (Dennis, 2013). The figure below depicts the nationwide Geoid 2012A hybrid model accuracy at the 95% confidence interval, which establishes an accuracy range between ±3.9 cm (green colors) and ±8.8 cm (orange colors).

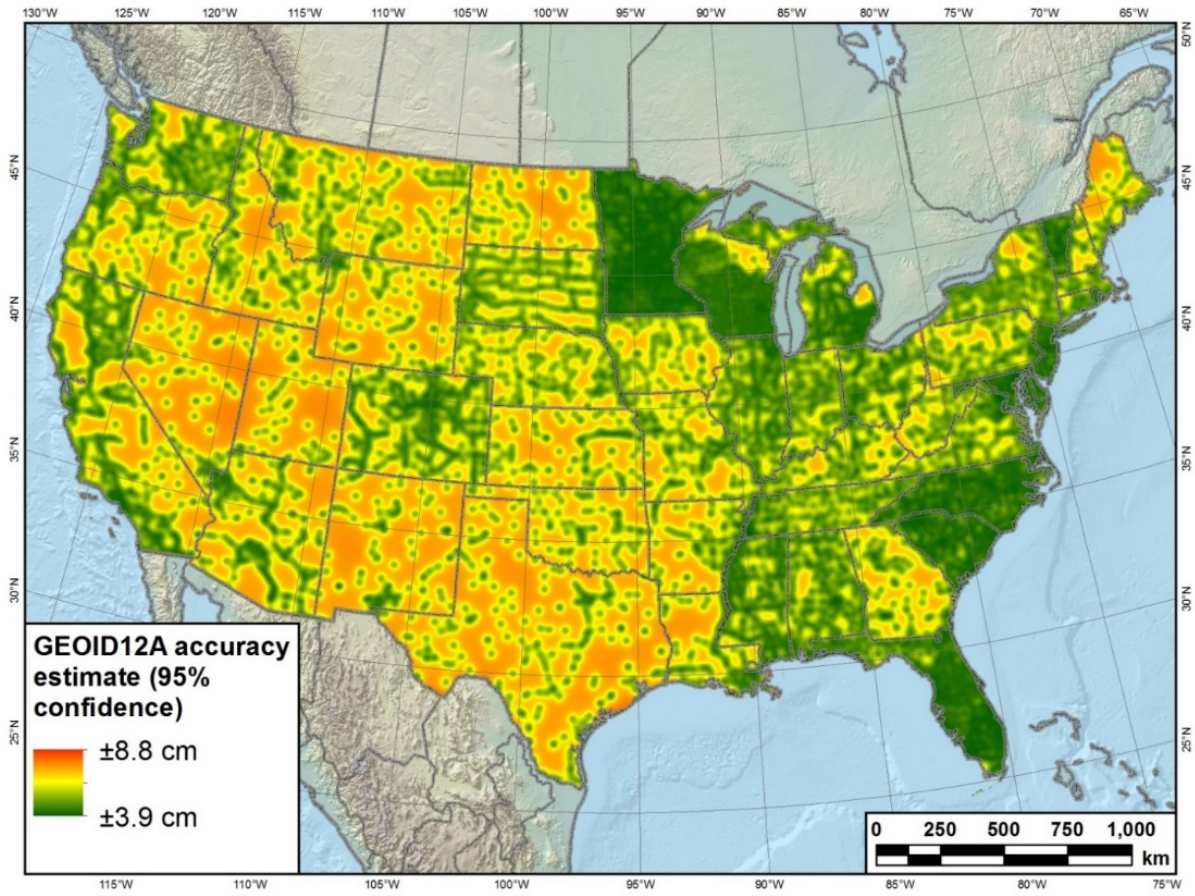

Figure 10
Nationwide Geoid 12a accuracy (Dennis, 2013)

Because of the problems associated with the initial 2012 geoid model, the revised model received close scrutiny by many within the surveying community. Shortly after its release, users noticed a number of inconsistencies for geoid 2012A derived NAVD 88 orthometric heights. These problems were initially observed when compared to previous elevations measured using geoid 2009. Later, discrepancies were observed when comparing observations with published values at NGS benchmarks. Apart from the ambiguities common to GNSS-derived heights (Zilkoski, D'Onofrio, & Frakes, 1997), there can be two principal explanations for the differences in NAVD 88 elevation values. The first explanation is the explicit difference between geoids 2009 and 2012A. The second explanation relates to the reference ellipsoid used to derive orthometric heights.

Differences between NAVD 88 Geoid Models. Geoids 2009 and 2012A both produce legitimate NAVD 88 orthometric heights. Both models may be used to determine the vertical datum for the United States. But the orthometric heights are derived relative to different horizontal reference frames. As such, geoids 2009 and 2012A produce different heights. The differences stem from the underlying gravimetric and geodetic control data used to derive the model. As described by the NGS (2012c), contemporary geoid models are hybrid products that combine gravimetric and geodetic leveling data assets. The gravimetric models establish the equipotential gravitational surface (i.e., the geoid). The GNSS-derived ellipsoid heights obtained from geodetically leveled benchmarks provide the separation between NAD 83 ellipsoid and NAVD 88 geoid surface. Combining the two into a single model effectively warps the gravimetric values to the benchmark data. Over time, these constraints vary, which requires regular observations to account for geophysical changes of the earth. The updates reflect both the geophysical changes as well as improved measurements. Fortunately, the degree to which these changes occur can be quantified.

Geoid09 was fit to the data available in 2009. For those who still use data from 2009, Geoid09 will fit better. However, NGS has changed the heights in the database for many of these points. Hence, Geoid09 will no longer fit the current values to (in some cases) better than the dm-level. Geoid12A was developed using current values. Hence, Geoid12A should be used now in order to get results consistent with those shown on the NGS datasheets (NGS' current best estimate of actual heights) as well as OPUS solutions. Both Geoid09 and GEOID12A yield estimates of NAVD 88. However, GEOID12A fits better based on NGS' current understanding of the true position of the coordinates.

The next two figures illustrate the difference between the 2009 and 2012A geoid, which can be quite profound. These difference maps were constructed using data and software provided by the NGS (http://www.ngs.noaa.gov/GEOID/GEOID12A/GEOID12A_data.shtml). First, a point cloud of regularly spaced locations at approximately 0.7 miles was generated for the contiguous U.S. (i.e., CONUS). The point coordinates were used to estimate the geoid 2009 and 2012A surfaces. Next, the geoid surface models were subtracted from one another (2012A – 2009) to produce the absolute difference depicted in the figures. The average difference between 2012A and 2009 for the CONUS is - 0.029 ft.; s=0.037; n=3,081,690). When extracted for Louisiana, the mean difference is -0.39 ft.; s= 0.054; n= 46,437).

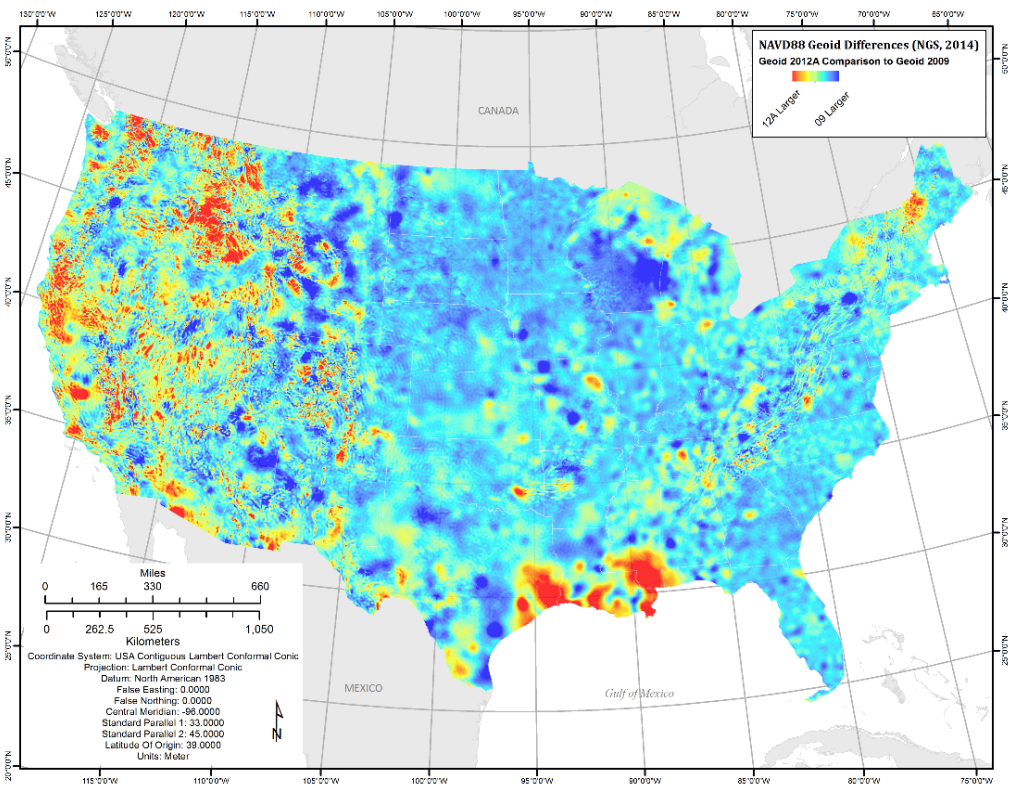

Figure 11
NAVD 88 geoid difference for the coterminous United States (2012A – 2009).

Associations between Horizontal and Vertical Datums. It is important to again stress that geoids 2009 and 2012A both produce legitimate NAVD 88 orthometric heights. But, those values are only valid with respect to the horizontal reference frame in which they were measured. By virtue of their measurements, the geometric and geodetic observations of the ellipsoidal and geoid surfaces are intrinsically tied to a horizontal datum (NGS, 2012c). Since 2007, all GNSS derived orthometric heights are computed relative to a specific realization of the NAD 83 horizontal datum. As depicted in Table 9, the GNSS derived positions referenced to NAD 83 (NSRS 2007) produce NAVD 88 orthometric heights relative to geoid 2009. Similarly, GNSS positions derived relative to the NAD 83 (NA 2011) produce NAVD 88 orthometric heights relative to the geoid 2012A. Specific datum associations are necessary due to the comprehensive adjustments to the NAD 83 datum in 2007 and 2011. Accordingly, GPS derived orthometric heights need only reference the NAD 83 (HARN) in use at the time of observation.

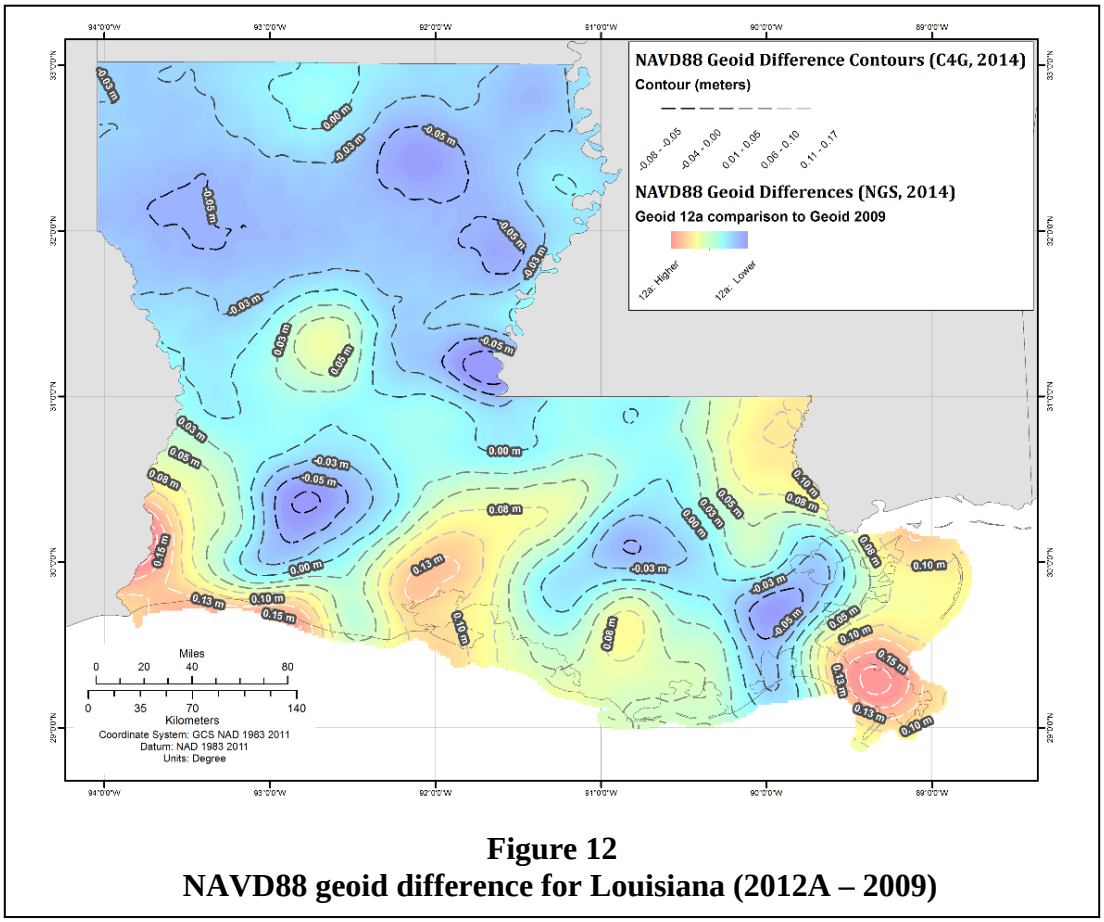

Figure 12
NAVD88 geoid difference for Louisiana (2012A – 2009)

Table 9
Association between horizontal and vertical reference systems

HORIZONTAL REFERENCE	VERTICAL REFERENCE	
North American Datum of 1983(NAD83)	North American Vertical Datum of 1988 (NAVD88)	
NAD 83 (NA 2011) epoch 2010.0	GEOID 2012A	www.ngs.noaa.gov/GEOID/GEOID12A/faq_2012A.shtml
NAD 83 (NSRS 2007 or CORS96) epoch 2002.0	GEOID 2009	www.ngs.noaa.gov/GEOID/USGG2009/faq_2009.shtml
NAD 83 (HARN)	GEOID 2003	www.ngs.noaa.gov/GEOID/GEOID03/tech.shtml
NAD 83 (HARN)	GEOID 1999	www.ngs.noaa.gov/GEOID/GEOID99/faq.shtml
NAD83 (HARN)	GEOID 1996	www.ngs.noaa.gov/GEOID/GEOID96/faq.shtml

Reference Framework Strategies

The authors assessed and summarized the pros and cons of using ellipsoid (i.e., geometric) heights versus orthometric heights (elevations), which require geophysical (i.e., geoid) models to estimate orthometric heights when GNSS data is used, as references for vertical control.

The Datum Transformation. Although a datum defines the basic control for a region or continental area, its accuracy varies according to the "order" of the original survey. Classical triangulation techniques have evolved in accuracy as a result of improvements to instrumentation, field procedures, and adjustment techniques. The measured chains of quadrilaterals represent the actual observations made over decades of datum development. Relating two datums to each other is valid only when one can identify common points that are part of main triangulation arcs. A meaningful transformation cannot develop between datums when we are indiscriminate in our choice of common points and common "order." Furthermore, the larger the region, for which we attempt to develop a relation, the larger the uncertainty obtained for our relation. Accordingly, sometimes it is necessary to use additional parameters to define a relation and decrease the uncertainties for a region or given data set.

There is going to be a difference in the coordinates of a point common between the old, classical survey and a current survey observed with GPS instrumentation. Such a difference is observable with respect to horizontal positions more so than with vertical heights. As explained in prior paragraphs, horizontal differences are attributable to different datums (NAD 1927 versus NAD 1983); and as long as we recover an old monument by observing its new position on the new datum, the process of dovetailing "old" work into "new" work is straightforward. Just like classical horizontal datums evolve with the decades, so has the reference frames used to define GPS observations. The NGS publishes parameters for easily transforming from one inertial reference frame to another. From time-to-time, LSU will publish similar transformations for reference frames realized within Louisiana. See the "Composite Coordinate Tables and Reference Frame Transformation Parameters" at the NGS Web site: http://geodesy.noaa.gov/CORS/coords.shtml for more information.

The complexity of datum transformations increases in Louisiana when heights and elevations are involved. Louisiana is the focus of a local crustal motion area that has demonstrated significant changes in heights largely due to subsidence. With rare exception, the elevation of a point in Louisiana is lower than it used to be, and the differences in elevation vary in rate and time from one place to another (Shinkle & Dokka, 2004). The philosophy employed by NGS for geodetic leveling is to tie to existing level lines at both ends of a leveling section such that a minimum of three established benchmarks are observed at each end of the section. By always attempting to follow this rule of thumb, the observer can insure that the beginning and ending observations are reliable in that any discrepancies will be immediately recognized by inconsistencies among each existing triplet of benchmarks. Of course,

existing field conditions may not always provide such convenient ties. However, the relative differences in heights from one benchmark to another benchmark are records that are critical to the future usability of the observations. The NGS Technical Report 50 by Shinkle & Dokka (2004) was the first historical analysis of subsidence ever performed on First-Order benchmarks in Louisiana. That scientific breakthrough was possible only because the relative differences in heights from one benchmark to another benchmark had been preserved for the entire 20th century by NGS.

Transformation Parameters. When establishing GNSS control for a project, one will eventually have to relate old data to the new project. Specific knowledge of the datum parameters ensures consistency of a reference frame transformation. Different transformation methods exist. In addition to temporal and geophysical evolution of the reference frames, each method formally converts the geometric, XYZ, position of one reference frame to that of another by accounting for the geo-center translation, scale, and rotation (Meyer, 2010).

Frame Translation. This parameter accounts for the different locations of the reference frame's center. Translating the difference is mathematically achieved through vector addition. The vector may be quite large when translating from a non-geocentric reference frame. The Helmert three-parameter method is a frequently used method for translation-only datum transformations [equation (1)].

$$P_i = T + P_0 \tag{1}$$

where P_0 is the geocenter of the input reference frame, Pi is the geocenter of the original reference frame, and T is the translation vector between the reference frames for the X, Y, and Z axes. The translation parameters from a specific reference frame are typically represented as TX, TY, and TZ, and usually presented as meter units.

Frame Scale. This parameter establishes the three-dimensional (i.e., Earth-centered, Earth-fixed) location of intersecting baselines measured between global reference stations. Baseline values are traditionally measured using space geodesy techniques, including very long baseline interferometry, laser ranging, GNSS, and satellite-based Doppler readings. Equation (2) relates the baselines values between the Cartesian coordinates measured between stations:

$$\begin{bmatrix} \Delta X_b^{i,j} \\ \Delta Y_b^{i,j} \\ \Delta Z_b^{i,j} \end{bmatrix} = \begin{bmatrix} X_j - X_i \\ Y_j - Y_i \\ Z_j - Z_i \end{bmatrix} \tag{2}$$

where, the baselines, b, derived from geometric coordinates (X, Y, X) are computed between stations i and j. The scale difference between reference frames is denoted by the unitless variable, s.

Frame Rotation. This parameter aligns the axes of two different reference frames using a rotation matrix. As per Meyer (2010), the matrix, A, is defined by three small angles for each axis: ωx, ωy, and ωz. Equation (3) depicts the rotation matrix:

$$A = \begin{bmatrix} 0 & \omega_x & -\omega_y \\ -\omega_z & 0 & \omega_x \\ \omega_y & -\omega_x & 0 \end{bmatrix} \quad (3)$$

where, the sign of the angle is attributed to the direction of rotation. Units are provided in milliarcseconds (mas). Some transformation models (e.g., Bursa-Wolf Seven Parameter) depict the small rotations (ωx, ωy, ωz) as (ω, ψ, ε).

Transformation Methods. Accurate transformation of a position from one reference frame, P_0, to another, P_1, can utilize either the Helmert Seven-Parameter or the Bursa-Wolf 7-Parameter transformation models. The Helmert model takes on the form depicted in equation (4):

$$P_1 = T + (1 + s)(I + A) \cdot P_0 \quad (4)$$

where, T is the translation vector, s is the incremental scale difference, A is the rotation matrix, and I is the Identity matrix.

The Bursa-Wolf model takes on the form depicted in equation (5):

$$P_1 = P_0 \cdot (I + A) \cdot s + T \quad (5)$$

where, T is the translation vector, s is the incremental scale difference, A is the rotation matrix, and I is the Identity matrix.

Specifications and detailed formulae for conducting a datum transformation in Louisiana are available in the Appendix. This appendix depicts the transformation and associated parameter values needed to convert positions from NAD 83 (CORS96) to NAD 83 (NA 2011). The position values are those of continuously operating GPS reference stations (CORS) located in Louisiana and maintained by C4G.

Task 3: Field Survey of Roadway Test Sites

Staff from the C4G collected horizontal and vertical measurements for control points located at designated test sites within each DOTD administrative district, eleven sites in all. Test locations are comprised of approximate one mile segments of roadway located most often on elevated structures or bridges. Additionally, investigators assessed the relative precision of kinematic data collected for various driving speeds on an isolated road segment. This will create benchmarks across the state for PMS to compare against contractor measurements. The stated purpose was to evaluate performance at several different speeds. Originally the concept proposed 35, 55 and 70 miles per hour (MPH) but due to safety concerns and the maximum posted speed limit of the test site, 35, 45, and 55 MPH speeds were

used. The original purpose was met while maintaining safety.

Control Point Survey

GNSS measurements were collected using a survey-grade receiver and antenna at one-second intervals (i.e., 1 epoch) every 10 ft. along each (approximately one-mile) test site. Longer duration measurements (e.g., 300 epochs) were collected at the start and finish ends of each control survey to provide higher accuracy measurements to act as accuracy checks for the one-second data.

DOTD provided a list of the recommended schedule for performing the surveys. To ensure safety during the field collections, the DOTD provided traffic control at each test site.

Kinematic Speed Assessment

Corrected and un-corrected GNSS measurements were collected using both mapping and survey-grade technologies at one-second intervals (i.e., 1 sec. epochs) from a moving vehicle traveling at 35, 45, and 55 MPH on an isolated test site (61b) in Port Allen, LA. Measurements were assessed relative to the different driving scenarios and equipment to help establish minimum and maximum accuracy expectations.

Except as stated elsewhere, all measurements are provided in U.S. Survey Feet, converted from the State Plane Coordinate System, Louisiana North and South, NAD83 (NA2011); elevations are provided in feet, NAVD88 (using the Geoid 2012a model). Data may be transformed to NAD83 (NSRS2007) U.S. Survey Feet, with elevations referenced to NAVD88 (geoid 2009).

Task 4: Reporting

Semi-annual and annual reports on the progress and research findings were provided as scheduled by the LTRC. The final report covers the following:

- Summary of findings for requirements-based standard operating and collection procedures for GNSS technologies at DOTD. The report directs the results into a Departmental Standard that may be used to develop a training session for DOTD Staff and contractors; demonstrating the benefit of establishing GPS standards with respect to accuracy, technology procurement, support, interoperability, and training.
- Summary of data collection methodology, providing an overview map of each area surveyed.
- Summary of geoid model research and findings, including recommendations for long-term management of GNSS survey data that emphasizes maintaining detailed metadata of the horizontal and vertical datums used.

DISCUSSION OF RESULTS

Objective 1: Standard Operating and Collection Procedures

First, this study focuses on Departmental standards-of-practice when utilizing GNSS technology for mapping-grade applications.

The equipment selected by the GPS Technology Oversight Committee, a Trimble GeoXH 6000 system, was acquired by the LSU C4G for use and testing in this objective. Namely, it was used primarily in two ways: it was employed to ascertain its potential and develop reasonable performance expectations of accuracy and precision and it was studied with an eye to developing advice specific to DOTD's mapping needs. The committee also selected a TruPulse 360 R LASER rangefinder, which was aquired, tested, and included in the SOCP.

The results in brief are the precision indicators displayed by the GeoXH are a practical real-time indicator of the performance of the system. With appropriate care and expertise, the system is capable of performing at a level that exceeds the usual mapping requirements of the DOTD. In the most usual, quick-operation with C4Gnet, an expectation of sub-foot performance when extraneous interference (canopy, tall structures, some weather, etc.) is absent is the usual condition. One additional requirement to achieve that level of precision is an accurate offset from the point of interest.

A pro-forma Standard Operating and Collection Procedures manual accompanies this report and is made a part by reference. Also included are operational manuals from the GeoXH system and the 360R rangefinder.

Objective 2: Horizontal and Vertical Datum Research Summary

Second, the recent enhancements to the nationwide horizontal and vertical spatial reference framework (i.e., datums) are summarized in order to support consistent and accurate access to the National Spatial Reference System (NSRS).

Recommendations

As noted elsewhere, datums evolve with time – modified as a result of a re-computation or re-adjustment of older reference frameworks. Comparing surveyed values collected using different reference systems presents a number of challenges. When venturing into a "new," there will be some pre-existing (i.e., historic) survey values that must be incorporated into that dataset. Although a GNSS /GPS controlled project is largely free of systematic error when properly executed, the prospect of quantifying the systematic error of an older data set and incorporating that older data into the new system can be daunting. A successful project depends on the merger of the old with the new. An understanding and knowledge of past practices, techniques, and reference systems is the pre-requisite to that success.

Strategies for Future-Proofing GNSS-Derived Positioning

All GNSS-derived observations must be performed on the current terrestrial reference frame as recognized by NGS. Whenever adjustments are issued, the NGS will publish the particular adjustment epoch and geoid model. As indicated in Table 3 (page 7), contemporary adjustments are specifically intended for use with a particular reference frame. For this reason, classifying data types and coordinate systems only in terms of specific map projection and ellipsoid is a mistake. Instead, the most important classifier is the datum and its adjustment date (e.g., NAD 83, NA 2011 epoch 2010.0). Once the specific datum has been identified, all other parameters follow by definition.

Accordingly, DOTD should pursue three principal strategies:

1. Surveyed values collected for new projects should adopt the most current realization of the NSRS available.
2. Surveyed values collected for active (i.e., not ended) projects should be maintained according to the NSRS realization available at the start date of the project;
3. Surveyed values obtained from archived projects should be transformed into the most current realization of the NSRS available.

Comparison across various generations of surveyed values necessitates special care. Since reference frames are continuously updated alongside their concomitant geoid models, **it is absolutely imperative that all GPS-observed positions are archived with ellipsoid heights and/or geocentric X, Y, Z coordinates in order to provide historical vertical data records capable of being updated to newer geoid models**. Furthermore, this archive should also include the reference frame tag (i.e., the realization of the horizontal and vertical datum and its corresponding epoch) used to obtain the position. Corresponding to the best practices typically employed for surveying, the following values are recommended when comparing GNSS-derived observations collected for different realizations of the NSRS:

1. Orthometric height (elevation)
2. Ellipsoid height
3. NSRS Realization (tagged name and epoch of the horizontal and vertical systems used).

Translating between different realizations of the same datum [e.g., convert NAD 83 (CORS96) to NAD 83 (NA 2011)] is accomplished by mathematical re-computation of the position values. The mathematics employed to compute the transformation between two datums is identical to what is used to transform among reference frames. The magnitudes are different in that the transformation parameters from a classical datum to a modern inertial datum can typically range from tens of meters to hundreds of meters. The magnitude of transformation parameters from one inertial reference frame to another inertial

reference frame will rarely exceed a few meters and typically will be in terms of centimeters. The reason for this is classical datums were established from single astronomical observation points, and the collection of a nation's or region's control points have been extended from the origin point using triangulation surveys and distances that have largely been determined with the law of sines. As a result, enormous numbers of errors have propagated through chains of triangles for hundreds if not thousands of miles. On the other hand, inertial reference frames are snapshots in time of the current relation of continental plates to an imaginary reference system defined by orbital elements of artificial satellites. The change of one inertial reference frame to another is primarily the result of continental drift that amounts to a few centimeters per year of the major continental plates. An inertial reference frame is defined for a particular date or instant in time with respect to where each of the earth's continental satellite tracking stations are at that instant. The collection of tracking and receiving stations located on each continental plate is then defined by a set of parameters with respect to a previous reference frame representing an earlier instant in time. These International Terrestrial Reference Frames are defined every so many years, and are examples of the change from one reference frame epoch to another.

Objective 3: Updated Control Point Measurements for the Pavement Management System

Third, C4G provides quality control information to the PMS section against which MVRM data may be compared and assessed. The data are provided in the appendices. In each such appendix one will find the coordinates for the points collected expressed in the appropriate Louisiana Coordinate System but, in keeping with the requirements of this report expressed in US Survey Feet. Each is prefaced by a heading with details of the survey and a plot of the points overlaying an aerial image from Google Earth and a profile view of the same line of data adjusted to exaggerate the vertical by a factor of ten.

CONCLUSIONS

Objective 1: Standard Operating and Collection Procedures

Departmental standards-of-practice when using mapping-grade GNSS technology are examined. The most important standard is: be aware of one's surroundings.

Avoiding Interference such as Overhead Cover, Trees, etc.

The GNSS technique depends upon the antenna receiving timing signals directly from satellites in space. A clear view of the sky is essential for high-precision positioning. Any interference with the signal along its path to the antenna will result in degradation of the final precision and may render the result unusable.

Be aware of surroundings. Look out for overhead towers, cables, trees, tall buildings nearby, summer afternoon squall lines, nearby metallic objects such as a vehicle or parking lots and highway signs.

Keep a thinking cap on at all times. If the environment is not conducive to a direct approach, be alert for alternatives that may be the next best. Are there geometric characteristics that may be exploited? Will measuring offsets work well (LASER rangefinder or simple tape measure)? Here are some examples:

- Large oak trees – Taking GNSS under the canopy is, of course, not a good idea but even if one did try, the center of the tree is still not available. What to do?
    - Consider walking the drip-line of the tree. Often that is more valuable information to a designer than the location of the trunk.
    - Consider placing a temporary marker (stake) at one location outside the canopy. Back up, then sighting the tree and the marker with one eye closed, measure a position. Then go to the opposite side of the tree and sight through the tree to the marker (this is harder but it is possible to estimate when the center of the tree and the marker are aligned) and measure that position. This gives two positions that form a line segment that goes through the center of the tree. Repeat the procedure from a different angle.
    - Where the two lines cross is the center of the tree.
- Typical footprint of a building with a roof overhang – This problem is similar to that of the oak tree but with a few differences. The center of the tree is a point and the footprint of the building is a polygon. Typical buildings have straight sides.
    - Take a position outside the roof line but aligned with a wall by sighting the wall with one eye.
    - Go outside the roof on the other end of the wall and repeat.

    - Repeat for all of the most outside walls. The resulting lines will outline the extremes of the footprint.
    - Any indentations or inside angles will require finding a clever way to measure them.
    - It may be as simple as a tape measure or making use of a LASER rangefinder or exploiting some other aspect of the building.

- Measuring the widths or offsets of collinear (parallel) features can be made very efficient under the right circumstances
    - Most sidewalks and drives are of a constant width. There is often no need to measure both sides of such a feature. Use the attributes and comments to indicate which side of the feature is being measured as a line and its width. The office software can add the other edge as a line offset the amount that was input on the side indicated parallel to the line of travel taken on the side actually measured.
    - If the highest precision is not necessary, a good estimate of the distance from the top of bank of a ditch to its center may be entered and by taking offset positions along the bank the center of the ditch is recorded.

- Highway signs – Signs, like trees, can create a hostile environment for GNSS. A typical sign is metallic, flat and highly reflective to radio signals. If one is close to a sign it forms quite a shadow from its opposite side and a very potent reflection of signals from the same side.
    - If one must measure a sign, approach it from its edge and stop at its end. Take a position then repeat on the other end. The reflective nature will be reduced to a minimum this way but beware. It may not be reduced enough.
    - The highly reflective nature of the signs may be used to advantage by employing a LASER rangefinder to measure the location by offset.

The LASER rangefinder may seem to be a magic bullet when it comes to gathering positions of object difficult to approach. It can indeed be a wonderful tool. All too often the users of the tools don't realize the myriad ways its purpose may be confounded. The LASER rangefinder has three vital functions: (1) a distance meter that records the distance from the device to the object that reflected the beam, (2) a compass that records the azimuth the device was pointed when the distance reading was made, and (3) Bluetooth or cable means to provide the information to the GNSS data collector. The distance meter seems foolproof at first glance, but it can frustrate good results if certain basics are overlooked.

- Measuring the right point – in many situations, the LASER beam will reflect off several things and it depends upon settings which reflection will be recorded.

- Consider a building, a sign, or a pole with vegetation overgrowth, the settings in the rangefinder should be set to record the last return because the building is behind the other reflective things, leaves etc.
- Consider a brush-line – the setting might be set to first return to be sure to record the edge of the vegetation instead of somewhere inside it.

- Measuring the point right – Few tools seem as much like a toy as a compass, but when one considers how critical an accurate compass measurement can be to a LASER rangefinder, the importance of its calibration and use becomes obvious. A tiny error in angle becomes an ever larger distance error as the length of the shot grows.
  - Follow the calibration procedures EVERY time the unit is used in a different place. In some cases, a different place may be only a few feet away if there is a lot of iron, steel, or electrical influence in the area.
  - If the device is being used inside or adjacent to a vehicle, assume the compass is disturbed by the metal of the vehicle itself and unreliable.
  - Perhaps the most reliable means to overcome bad influences on the compass is to, in fact, eliminate dependence upon the compass. Basic geometry explains that one needs two measurements to establish a point horizontally. The rangefinder provides a distance and a bearing from a known GNSS point, but the bearing is often suspect. If, instead, one takes two distances from two known GNSS points the place that the two distances intersect is the desired location achieved without having to trust an often doubtful compass bearing.
- Measuring man-made features often provide short-cuts that can increase accuracy as well as ease the work load.
  - Consider sidewalks or many similar things. They are typically straight with definite corners. If the straightness is in doubt, close one eye and look along the feature for confirmation. If it is straight (enough), one only needs to make measurements at the corners. For linear feature collection, pausing the recording between the corners does the trick. The resulting lines will be straight and the average location along the line almost always closer to the truth than the collection of many points along the line one knows is, in fact, straight.
  - Area features often benefit from the same procedure, pausing in between the corners. The difference being, of course, polygons close upon themselves to enclose an area
  - Curves along a route or edge of an area will benefit from clever user operation. Long gentle curves are well delineated by regular time intervals at normal speeds. When a

curve is more acute the field technician simply slows the pace appropriately to insure that the time intervals fall close enough to one another in distance to make a well-defined curve for the end product.

Objective 2: Horizontal and Vertical Datum Research Summary

Recent enhancements to the nationwide horizontal and vertical spatial reference framework (i.e., datums) are summarized in order to support consistent and accurate access to the NSRS.

Conclusion

The recent updates to the NSRS have produced anecdotal accounts of unexplained discrepancies for GNSS-derived orthometric heights (e.g., NAVD 88 elevations) when compared to values measured relative to earlier realizations of the datum. The source of these differences have been attributed to NGS updates to the horizontal and vertical reference frame from which the orthometric heights are computed.

The 2011 update to the horizontal datum [NAD 83 (NA 2011) epoch 2010.0] was a nationally constrained adjustment optimally aligned the GNSS-derived passive control (e.g., benchmarks) with the active control provided by the national CORS network. The final adjustment resulted in a median horizontal and vertical shift of 2 centimeters from previously published values, though some station coordinates experienced more significant differences. The 2011 adjustment effectively created a new realization of the horizontal geodetic control framework for the U.S.

Because the vertical component of the NSRS is inexorably tied to the NAD 83 horizontal reference frame, the NAVD 88 realization was revised in 2012. The NGS further enhanced the datum with a new, hybrid geoid model (i.e., Geoid 2012A) that combined the NAD 83 (NA 2011) derived ellipsoid heights with the latest satellite based gravimetric models of the U.S. (e.g., the US Gravimetric Geoid of 2012). Consequently, contemporary orthometric heights measured relative to the NAVD 88 (Geoid 2012A) are only valid for positions measured relative to the NAD 83 (NA 2011) datum. Orthometric heights measured with NAVD 88 (Geoid 2009) are only valid relative to positions measured relative to NAD 83 (NSRS 2007 or CORS96).

Although a properly executed GNSS/GPS controlled project is largely free of systematic error, comparing surveyed values collected using different reference systems presents a number of challenges. In order to mitigate the challenges for future adjustment comparisons, the following recommendations should be implemented for GNSS-derived positions:

1. Surveyed values collected for new projects should adopt the most current realization of the NSRS available.
2. Surveyed values collected for active (i.e., not ended) project should be maintained according to the NSRS realization available at the start date of the project.

3. Surveyed values obtained from archived projects should be transformed into the most current realization of the NSRS available.

Because reference frames are continuously updated alongside their concomitant geoid models, it is absolutely imperative that all GPS-observed positions are archived with ellipsoid heights in order to provide historical vertical data records capable of being updated to newer geoid models. Furthermore, data archives should include the datum tag (i.e., the realization of the horizontal and vertical datum and its corresponding epoch) used to obtain the position. Corresponding to the best practices typically employed for surveying, the following metadata values are recommended when comparing GNSS-derived observations collected for different realizations of the NSRS:

1. Orthometric height (elevation).
2. Ellipsoid height.
3. NSRS Realization (tagged name and epoch of the horizontal and vertical systems used).

Translating between different realizations of the same datum [e.g., convert NAD 83 (CORS96) to NAD 83 (NA 2011)] can be accomplished using the same mathematical computations as those employed for datum transformations. Transformation parameter values for the realization of the NAD 83 (NA 2011) epoch 2010.0 reference frame are provided in the Appendix. When implemented, these values can provide the appropriate conversion between positions measured relative to different datums and datum realizations.

Terrestrial reference systems are constantly evolving. With the mission to define, maintain, and provide access to the NSRS, the NGS regularly publishes updates for accurately realizing the horizontal and vertical datums (2013c). Accordingly, the NGS is committed to providing tools and guidance to help the broader geodetic community of users satisfactorily and correctly reference their geospatial data to the NSRS. Toward that end, the DOTD is advised to consult with the Regional NGS advisor whenever revisions to the NSRS are made.

Objective 3: Provide Updated Control Point Measurements for the Pavement Management System

The final objective for this project provides updated control point measurement surveys at select locations, in each district, on roadways maintained by the DOTD. Horizontal and vertical measurements have been collected using survey-grade GNSS techniques at locations designated by the PMS Section. The locations are essentially the same locations surveyed and reported in Project 09-2GT (Cavell & Dokka, 2009). Investigators also addressed how vehicle speed affects horizontal and vertical accuracy (jointly and separately) from kinematic surveys enhanced by a real-time GNSS network.

All GNSS measurements were augmented by the LSU *C4GNet* real-time network (RTN), an official source for vertical control in Louisiana (Louisiana statute; R.S. 50: 173.1). Horizontal positions are

reported in U.S. Survey Feet converted from the Louisiana Coordinate System (Louisiana statute; R.S. 50: 1-7) relative to the NAD83 (NA 2011). Vertical positions are reported relative to both ellipsoid heights (geometric) and orthometric heights (elevation). Both reference systems are defined using metres as the unit of length, however in this report Ellipsoid or geometric heights are reported in metres relative to the NAD83 reference ellipsoid for the North American tectonic plate. Orthometric heights are converted to U.S. Survey Feet relative to the NAVD88 (Geoid2012A) datum.

The outcome from this objective will allow the PMS Section to use these control surveys and speed observations to assess the MVRM data for quality and accuracy.

It cannot be emphasized enough that having the reference quality control data without implementing its use as part of contract administration is tantamount to not using it at all. The control surveys provide mile long benchmarks against which MVRM performance may be compared. If it is used prior to the start of a MVRM project the tools may be tested in order to anticipate the level of precision to be expected. If it is used after the fact then it serves as an audit sample for work already completed. Perhaps the most important conclusion regarding the reference quality control data remains the recommendations contained in the report for 09-2GT.

"… to require any MVRM vehicle that is going to survey the roads of Louisiana for DOTD to be driven over the test site or test sites near to where its intended use is located following the protocol below:

A. **Ideal State.** MVRM operators should drive their vehicle over the test site with the Global Navigation Satellite System (GNSS) RTK and Inertial Navigation working as designed and record the results. These results will be compared to the benchmark data to ascertain the expected deviation from the system "truth" under optimal conditions, which may help set expectations of the highest precisions attainable with the particular system. Repeating the passes will increase the confidence in the prediction.

B. **Brief Inertial State.** MVRM operators should drive their vehicle over the test site with GNSS RTK blocked just before entering the test area and Inertial Navigation working as designed. These results will be compared to the benchmark data to ascertain the expected deviation from the system "truth" when the normal GNSS signal blockages occur. Repeating the passes will likely increase the confidence in the prediction.

C. **Extended Inertial State.** MVRM operators should drive their vehicle over the test site with GNSS RTK blocked for extended time and Inertial Navigation working as designed. These results will be compared to the benchmark data to ascertain the expected deviation from the system "truth" when the longer than normal GNSS signal blockages occur. Repeating the passes will likely increase the confidence in the prediction.

D. **Post-Processing State.** MVRM operators should drive their vehicle over the test site with GNSS RTK blocked for extended time and Inertial Navigation working as designed. Results will be post-processed to generate positions. These results will be compared to the benchmark data to ascertain the expected deviation from the system when using post-processing. Repeating the passes will likely increase the confidence in the prediction. Some passes should be considered with the GNSS signal blocked as in B and C.

The comparison of the results on a test site while re-creating the conditions commonly expected to be experienced in the field will allow the prediction of the MVRM system performance."

RECOMMENDATIONS

Objective 1: Standard Operating and Collection Procedures

A separate document attached to Appendix A by reference is the recommended Standard Operating and Collection Procedures deliverable. It contains concise procedures and operations for various conditions and objectives. The most important standard remains: be aware of one's surroundings.

Avoiding Interference such as Overhead Cover, Trees, etc.

- A clear view of the sky is essential for high-precision positioning.
- Be aware of surroundings.
- Use widths for features such as sidewalks, drives, and some ditches.
- Be alert for when an alternative that may be the best technique.
    - Consider walking the drip-line of the tree.
    - Cosider creating an intersection.
    - Locate signs on their edges.

When considering using LASER rangefinder:

- Calibrate every set-up.
- Avoid magnetic influences such as cell phones and truck bodies.
- Make sure to measure to the right point.
- Use distance-distance intersection option.

Man-made features often simplify locating procedures

- Regular geometric shapes may be well described by locating the vertices or the radius point and radii.

Recommendations for the creation and implementation of SOCP follow:

- Refer to Appendix A of this document for flow-chart and step-by-step procedures (cheat-sheet) to operate introduction to the GeoExplorerXH with TerraSync and with ArcPad.
- Refer to TruPulse-200-360-Quick-Reference-Guide, attached by reference to this report for step-by-step procedures (cheat-sheet) to operate and introduction to the TruPulse-LASER

rangefinder.

- Using GPS alone has the ability to achieve more precise results that combining GPS with GLONASS. However, any degradation is usually less than the desired precision for mapping. Therefore, using GLONASS combined with GPS is the recommended default set-up choice for most mapping applications.
- Any time the vertical component is of consequence, positions taken with the GeoExplorer must have a fixed offset from the point of interest, i.e., use an antenna mounted on a range pole.
- Terminology used in this document and for operation of the systems discusses may be found in the chapter entitled "ACRONYMS, ABBREVIATIONS, AND SYMBOLS."

Explanations of possible errors degrading accuracy and precision are covered throughout this report. A few of the most important are:

- Blockage of signals from satellites.
    - Urban canyon .
    - Tree canopy.
    - Power lines.
    - Metal fences & roofs.
- Taking measurements in a wrong place (not the feature intended).
- Using compass with magnetic interference.

Creating operational guidelines is a contemporary affair. Techniques, product capabilities and the situations in which they are to be employed vary from time to time and place to place. In the short time of this project new versions and models of the GNSS receivers have been introduced. Ephemerides, satellite design, etc. are subject to improvement, and the purposes to which DOTD wants to apply them, change.

- Using this document as a guideline along with the latest information from the GNSS receiver manufacturer.
- As long as that contemporary nature is kept in mind, this and other documents will prove valuable assets in the development of SOCPs and training curricula fr use both in-house and by contractors.

Clarification of buy/lease criteria may be found on pages 14-16 of this report.

- A large organization like DOTD will most likely decide to purchase equipment with a support/maintenance agreement to keep hardware/software up-to-date. This will require periodic re-evaluation to remain optimal.

Cost-benefits of accuracy and precision, maintenance, standardization, and single platform system:

- One way to estimate the cost/benefit ratio of investing in one type of system or another is illustrated by the following formulae showing the dependence upon context. The Survey Grade has a very favorable ratio if one requires the precision it can produce and despite its low investment outlay recreational GNSS has a very unfavorable ratio for several reasons.
  - ***Recreational GNSS***: $\frac{Low\ Purchase + Nominal\ Labor}{No\ Useful\ Data} = Very\ High\ Ratio$
  - ***Survey Grade GNSS***: $\frac{High\ Unit\ Purchase + Lower\ Labor}{Priceless\ Data} = Extremely\ Low\ Ratio$
  - ***Mapping GNSS***: $\frac{Moderately\ Low\ Purchase + Moderate\ to\ No\ Labor}{Large\ amount\ of\ Useful\ Data} = Very\ Low\ Ratio$

The charge for this project was to investigate the operation and capabilities of the devices chosen by the GPS Technology Oversight Committee, the GeoXH6000. Within DOTD, some already use earlier models of quality mapping grade systems: They ask, "*What would happen to the units that are already in place? Our section uses the Trimble GeoXT (lower grade) and the (lower grade) antenna for inventory. The accuracy is suitable for our needs.*"

The advice in the previous paragraphs stands as is. The manufacturer's User Guide for the GeoXT suggests using accuracy based logging, in similar fashion to the GeoXH6000 used in this study. The specifications seem indicate very similar capabilities except for the ability for Real-Time corrections.

Table 10
Accuracy (HRMS) after differential correction (from Trimble specifications)

Specifications - subject to change without notice (1σ ≈ 68%)	GeoXt3000	GeoXH6000
Code post processed	1.6 ft. + 1 ppm	1.6 ft. + 1 ppm
Carrier post processed		
With 10 minutes tracking satellites	7.9 in. + 2 ppm	
With 20 minutes tracking satellites	4 in. + 2 ppm	
With 45 minutes tracking satellites (GPS Pathfinder Office s/w limited to 6.2mi. from base)	0.4 in. + 2 ppm	0.4 in. + 2 ppm
Real-Time		
With SBAS (WAAS/MSAS/EGNOS)	< 3.3 ft.	< 3.3 ft.
With VRS or Single base		2.5 ft. + 1 ppm
With H-Star		4 in. + 1 ppm
The empirical rule, says nearly all values lie within three standard deviations (3σ) of the mean in a normal distribution. 68.27% lie within 1σ of the mean, 95.45% lie within 2σ and 99.73% (nearly all) lie within 3σ.		

Question Regarding Post Processing in Trimble Pathfinder Office

A late comment was received following the draft of this report: "Procedures need to be created for post processing in GPS Pathfinder Office as well."

Within the state of Louisiana, the recommendation is to use real-time corrections based on the C4Gnet network of CORS in part to assure agreement with the National Spatial Reference System.

As a courtesy, a copy of *The GPS Pathfinder® Office Software Getting Started Guide* (included with the software and is a fairly complete introduction to operating the software package) is appended to this document for reference. Appendix A contains further information regarding field use of the GeoXH and a SOCP has been created separately from this document, included with it and included herein by reference.

Objective 2: Horizontal and Vertical Datum Research Summary

Recent enhancements to the nationwide horizontal and vertical spatial reference framework (i.e., datums) are summarized in order to support consistent and accurate access to the NSRS.

- The latest realization of the NSRS published for public use by NGS should be employed, with rare exception, such as a particular local datum for a project. (This may require specific statutory language regarding datums to be modified and/or generalized.)
- The NAD 1983 (horizontal) realization was updated in 2011; a nationally constrained adjustment with the active control provided by the national CORS network.
- The NAVD 88 (vertical) realization was updated in 2012 along with a new, hybrid geoid model Geoid 2012A.
- Orthometric heights measured with NAVD 88 (Geoid 2009) are strictly valid relative only to horizontal positions measured relative to NAD 83 (NSRS 2007 or CORS96).
- Preserve ellipsoid heights in every GNSS project in order to provide a straight-forward means of translating from one datum realization to another.

Objective 3: Provide Updated Control Point Measurements for the Pavement Management System

Horizontal and vertical measurements have been collected using survey-grade GNSS techniques at essentially the same locations surveyed and reported in Project 09-2GT (Cavell & Dokka, 2009). Investigators also addressed how vehicle speed affects horizontal and vertical.

- Require MVRM vehicle to be driven over the test site near to its intended use using the protocols below:

A. Ideal State. MVRM operators should drive their vehicle over the test site with the GNSS RTK and inertial navigation working and record the results. Compare to the benchmark data to ascertain the expected deviation under optimal conditions, which may help set expectations of the highest precisions attainable with the particular system. Repeating the passes will increase the confidence in the prediction.

B. Brief Inertial State. MVRM operators should drive their vehicle over the test site with GNSS RTK blocked just before entering the test area and Inertial Navigation working as designed. These results will be compared to the benchmark data to ascertain the expected deviation from the system "truth" when the normal GNSS signal blockages occur. Repeating the passes will likely increase the confidence in the prediction.

C. Extended Inertial State. MVRM operators should drive their vehicle over the test site with GNSS RTK blocked for extended time and Inertial Navigation working as designed. These results will be compared to the benchmark data to ascertain the expected deviation from the system "truth" when the longer than normal GNSS signal blockages occur. Repeating the passes will likely increase the confidence in the prediction.

D. Post-Processing State. MVRM operators should drive their vehicle over the test site with GNSS RTK blocked for extended time and Inertial Navigation working as designed. Results will be post-processed to generate positions. These results will be compared to the benchmark data to ascertain the expected deviation from the system "truth" when using post-processing. Repeating the passes will likely increase the confidence in the prediction. Some passes should be considered with the GNSS signal blocked as in B and C.

The comparison of the results on a test site while re-creating the conditions commonly expected to be experienced in the field will allow the prediction of the MVRM system performance.

In addition to other aspects required of MVRM contractors, the following should be required:

- Require MVRM vehicle survey to result, in part, in reports being delivered in with values expressed relative to the NSRS (Currently NAD83 & NAVD88) and the La. Coordinate systems.
- In addition to any other reports of vertical data it must include ellipsoid heights relative to the NSRS (Currently NAD83).
- When linear units are used as coordinate values or distances, they should be expressed in metres or US Survey Feet. ($1\ m = 3937/1200\ US\ ft. \approx 3.28083333 \ldots US\ ft.$)

ACRONYMS, ABBREVIATIONS, AND SYMBOLS

C4G	Center for GeoInformatics
cm	centimeter(s), centimeter(s)
CO	Colorado
CORS	Continuously Operating Reference Station
DGNSS	differential global navigation satellite system(s)
DOD	Department of Defense
DOP	Dilution of Precision
DOTD	Louisiana Department of Transportation and Development
DTM	digital terrain model
EDOP	Easting Dilution of Precision
ft.	foot (feet)
FTP	file transfer protocol
GDOP	Geometric Dilution of Precision
GIS	Geographic Information System
GLONASS	(Russian: ГЛОНАСС) a satellite navigation system
GNSS	global navigation satellite system(s)
GPS	global positioning system(s)
GTOC	GPS Technical Oversight Committee
HDOP	Horizontal Dilution of Precision
H.I.	Height of Instrument
in.	inch(es)
LA	Louisiana
LASER	Light Amplification by Stimulated Emission of Radiation
LSU	Louisiana State University
LTRC	Louisiana Transportation Research Center
MVRM	Moving Vehicle Rapid Mapping
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NA2011	National Adjustment of 2011
NDOP	Northing Dilution of Precision
NGS	National Geodetic Survey NGS
NSRS	National Spatial Reference System
MD	Maryland
M	metre(s), meter(s)
mm	millimeter(s), millimeter(s)

MPH	miles per hour
PDOP	Positional Dilution of Precision
PDOP	position dilution of precision
PMS	Pavement Management System
PPS	post-processed static
PRC	Project Review Committee
QC	Quality Control
RMSE	root-mean square error
RTK	Real-Time Kinematic
RTN	real-time network
SIM	Subscriber Identification Module
Sec.	Second
SNR	signal to noise ratio
SOCP	standard operating and collection procedure(s)
TDOP	Temporal Dilution of Precision
U.S.	United States
VDOP	Vertical Dilution of Precision

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APPENDIX A

Operating and Collection Procedures

A deliverable product of this project is a document that is to become the core for Standard Operating and Collection Procedures (SOCP) intended to ensure quality data collection, and thus support the DOTD data collectors with guidelines for operation and practice is contained in a separate SOCP document so as to make its use more convenient in stand-alone form.

What follows is useful information, some in more depth than desirable in the SOCP and some innappropriate because of specific recommendations made in the SOCP, but nonetheless useful to some and of interest to others.

Terminology

Accuracy: positional correctness; the degree of closeness of measurements of a quantity to that quantity's actual value.

Antenna Height: The vertical offset (height above) of a GNSS antenna's reference point vertically above the point of interest.

ArcGIS: a geographic information system (GIS) for working with maps and geographic information used for: creating and using maps; compiling geographic data; analyzing mapped information; sharing and discovering geographic information; using maps and geographic information and managing geographic information in a database.

ArcPad: mobile field mapping and data collection software designed for GIS. It includes capabilities for capturing, editing, and displaying geographic information; integrates directly with ArcGIS.

Azimuth: In land navigation, usually denoted alpha, α, and defined as the horizontal angle measured clockwise from a north base line or meridian.

Bearing: In land navigation, the angle between a line connecting the user and another object, it may be expressed as an azimuth angle but more commonly as an acute angle (0°-90°) relative to one of the quadrants of the compass: NE, SE, SW and NW.

COM (Communication port): the original name of the serial port interface on IBM PC-compatible computers. It may refer not only to physical ports, but also to virtual ports.

Compass: a navigational instrument that shows directions in a frame of reference (north, south, east, and west) that is stationary relative to the surface of the Earth.

DOP (Dilution of Precision) : a term used to specify the additional effect of geometry on

measurement precision

Geoid: The equipotential surface of the Earth's gravity field which best fits, in a least squares sense, global mean sea level.

GDOP (Geometric Dilution of Precision); a term used in satellite navigation to specify the additional effect of satellite geometry on positional measurement precision.
$GDOP^2 = PDOP^2 + TDOP^2$

TDOP (Temporal Dilution of Precision); a term used to specify the additional effect of satellite geometry on time measurement precision; a component of GDOP.

PDOP (Positional Dilution of Precision); a term used to specify the additional effect of satellite geometry on 3-D positional measurement precision; a component of GDOP. $PDOP^2 = HDOP^2 + VDOP^2$

VDOP (Vertical Dilution of Precision); a term used to specify the additional effect of satellite geometry on vertical measurement precision; a component of PDOP.

HDOP (Horizontal Dilution of Precision); a term used to specify the additional effect of satellite geometry on horizontal measurement precision; a component of GDOP. $HDOP^2 = NDOP^2 + EDOP^2$

NDOP (Northing Dilution of Precision); a term used to specify the additional effect of satellite geometry on northing or latitude measurement precision; a component of HDOP.

EDOP (Easting Dilution of Precision); a term used to specify the additional effect of satellite geometry on easting or longitude measurement precision; a component of HDOP.

GLONASS: (Russian: ГЛОНАСС) a satellite navigation system operated by the Russian *Aerospace Defence Forces*; similar in function to GPS.

*GNSS(*global navigation satellite system); a system of satellites that provide autonomous geo-spatial positioning with global coverage that allows electronic receivers to determine their location (longitude, latitude, and altitude) to high precision (within a few metres or tens of feet) using time signals transmitted along a line of sight by radio from satellites.

*GPS (*Global Positioning System); a satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites, maintained by the United States government.

H.I. (Height of Instrument); the elevation of the line of sight of an optical survey instrument. Sometimes used in reference to a GNSS antenna to indicate its relative height above the point of

interest, more correctly call *antenna height*.

LASER Rangefinder: a rangefinder which uses a LASER beam to determine the distance to an object.

LASER (Light Amplification by Stimulated Emission of Radiation); a device that emits light through that process. LASERs differ from other sources of light because they emit light coherently that allows a LASER beam to stay narrow over long distances. LASERs only emit a single color of light.

NMEA 0183: a combined electrical and data specification for communication between marine electronics such as echo sounder, sonars, anemometer, gyrocompass, autopilot, GPS receivers and many other types of instruments by the National Marine Electronics Association that defines how data are transmitted in a "sentence" from one "talker" to multiple "listeners" at a time.

Precision: positional consistency; the degree to which repeated measurements under unchanged conditions show the same results

SIM card: "Subscriber Identification Module"; an integrated circuit that stores the international mobile subscriber identity (IMSI) and the related key used to identify and authenticate subscribers on mobile telephony devices. A SIM circuit is embedded into a removable plastic card and can be transferred between different mobile devices.

Signal to Noise Ratio (SNR)

TerraSync™: Software for field GIS data collection and maintenance with a GNSS handheld computer and LASER rangefinder, for the collection of feature and position data for GIS update and maintenance.

Specific Techniques to Ensure Accuracy and Precision using TerraSync

Terra Sync is a Trimble product intimately integrated with the GeoXH system and works in a fairly straightforward manner. A flowchart of its operations follows.

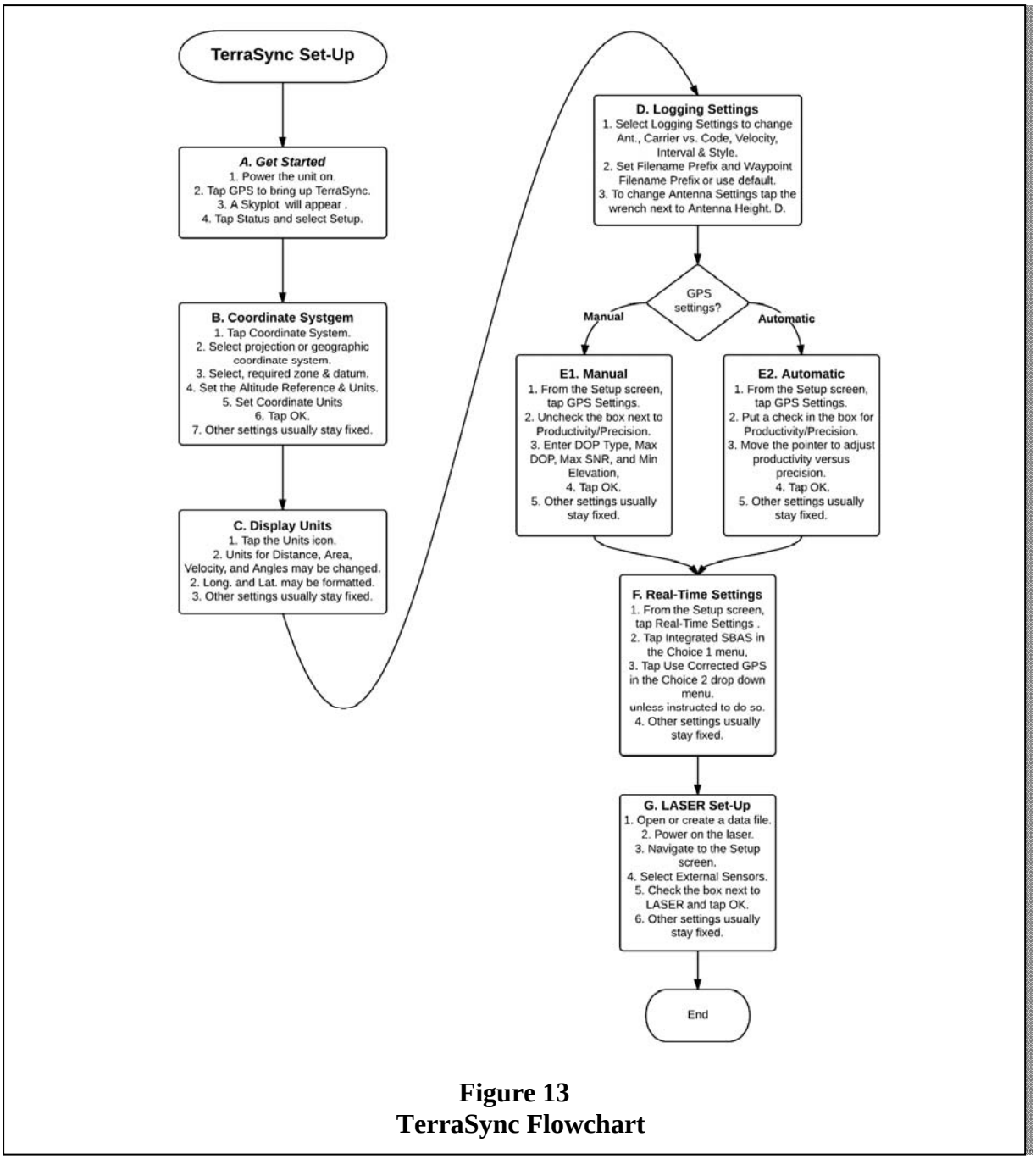


Figure 13
TerraSync Flowchart

A more complete SOP for TerraSync is the primary substance of the SOCP.

Specific Techniques to Ensure Accuracy and Precision using ArcPad

ArcPad is not the recommened field interface for use with the GeoXH in the SOCP. However, the following contains a brief overview of its use that may be helpful to any who wish to explore using ArcPad in the field.

ArcPad is a product of ESRI and an add-on extension to the GeoXH. Because of that slightly more explicit instructions follow. Given the correct data dictionary, either product will perform well. It is possible that the ArcPad will have a feel that is more comfortable for one familiar with ESRI GIS.

Configure ArcPad

Figure 14
GeoXH home page

Launch ArcPad

To do this, click the Windows icon on the bottom left of the screen, and scroll down to ArcPad, and hit the icon once.

Figure 15
Select ArcPad on Windows page

It will take about 5 to 10 seconds to fully launch.

Figure 16
ArcPad splash screen

Choose Project

Once ArcPad loads, you will be prompted to select from four choices. Choose to “Choose map to open.”

Figure 17
ArcPad start screen

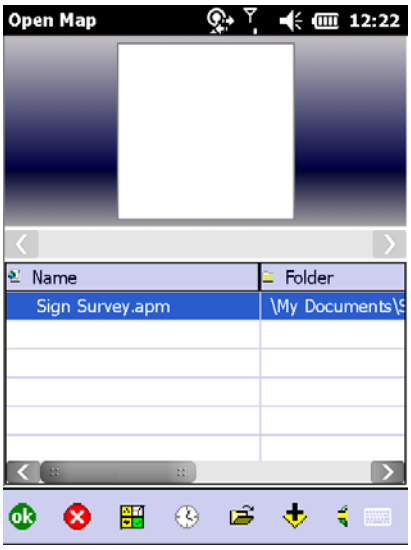


Figure 18
Available maps

The next screen lists available maps loaded from the GIS. Choose the appropriate map and hit OK.

Figure 19
ArcPad survey screen

GPS Correct

The unit may complain with error beeps until it begins receiving valid positions. To initiate the GPS Correct function within ArcPad click on the Trimble logo and again in the menu bar. This opens Trimble Positions. The screen that appears next will be whichever was last open. The illustration shows the Skyplot screen. It illustrates satellites in-use as if seen from overhead.

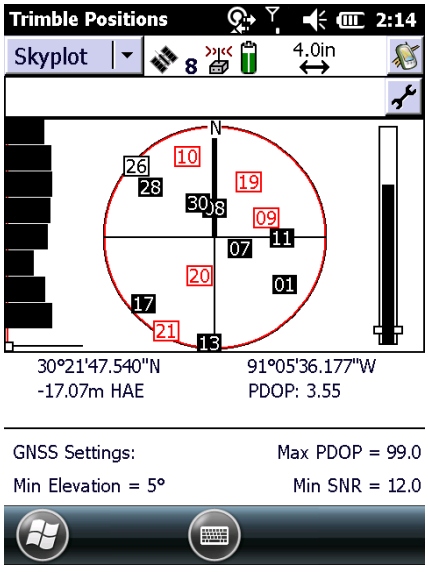


Figure 20
Trimble Positions Skyplot

From the drop-down menu, choose Setup.

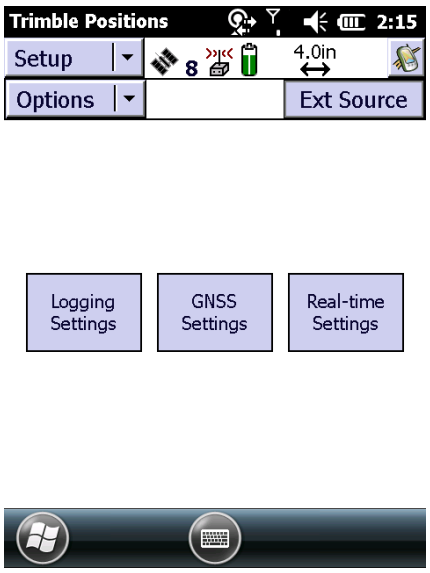


Figure 21
Trimble Positions Settings screen

Choose Logging Settings

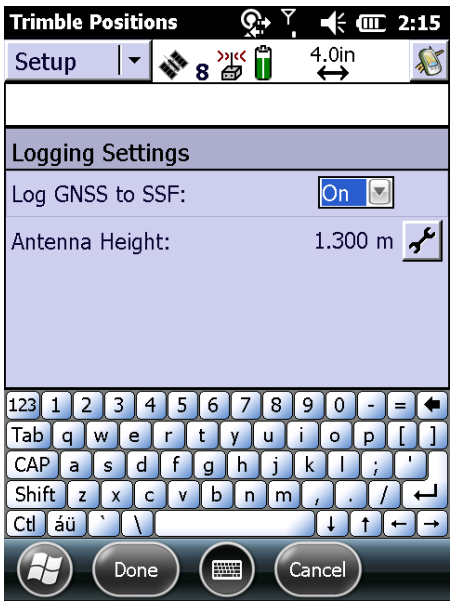


Figure 22
Trimble Positons logging settings

Turn on Lot GNSS to SSF unless instructed otherwise. Set the antenna height appropriately for the operation. A nominally good choice for someone 5'7" to 6'1" holding the receiver between waist and breast height is 4.25 ft. It is usually a comfortable position with the elbow bent just

about 90° with the forearm pressed against the body for support. Someone of a different height or with a different technique or if the receiver antenna is mounted differently will, of course, input a different, correct height. Click Done when finished.

Choose GNSS Settings

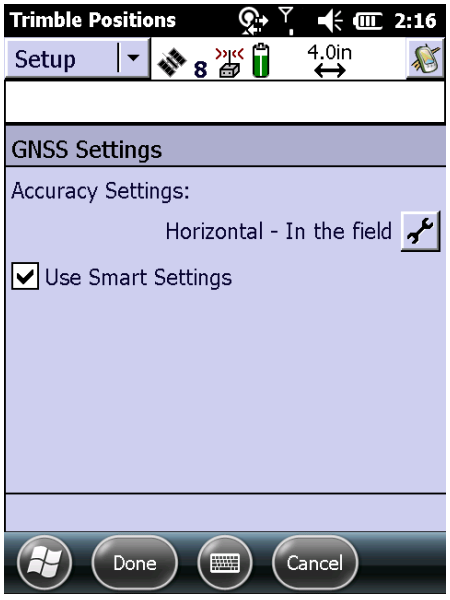


Figure 23
Trimble positions GNSS settings

These settings will probably remain the same for most operations. Use Smart Settings and determine accuracy setting by Horizontal- In the field. Click Done when finished.

Choose Real-time Settings

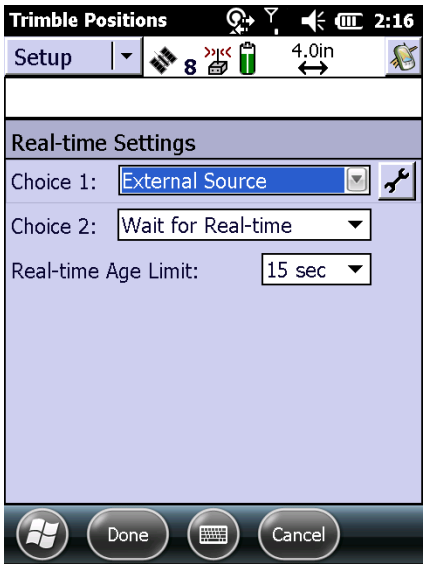


Figure 24
Trimble Positions real-time settings

The settings should be as shown in almost all cases. Use External Source (LSU C4G RTN). Wait for the Real-time corrections to consider positons useful. If the external corrections are missing for more than 15 sec., cease using them until connection is re-established. Click Done when finished.

If necessary (unusual), under options choose Connect to External Source. Under Setup choose Skyplot because this is a convenient, known place to which to return. Then click on the ArcPad logo  near the upper right corner of the screen.

Field data capture with ArcPad

Data capture

To set up data capture data on the GPS, hit the down arrow under the GPS button  on the top tool bar and click on GPS Preferences. The icon is available to us as long as we are in the FOLDER tab.

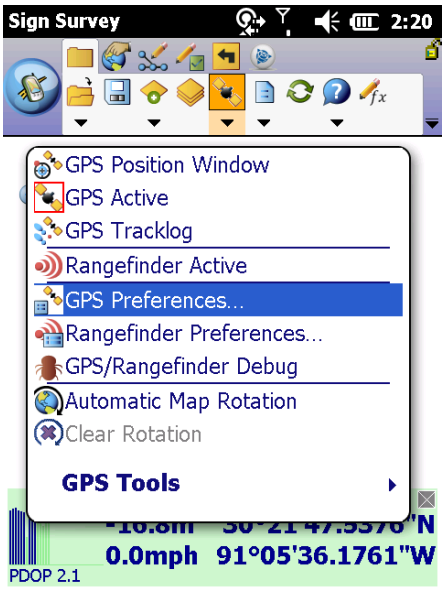


Figure 25
ArcPad survey preferences

The first tab to setup is the GPS with ArcPad 10. It will automatically tell us if this is the first time using the unit, that our GPS is not set and then it will automatically scan to find our receiver. As long as we are using ArcPad with GPSCorrect, our Protocol will be Positions ArcPad extension, Com 3: GNSS Serial Port and 9600 Baud.

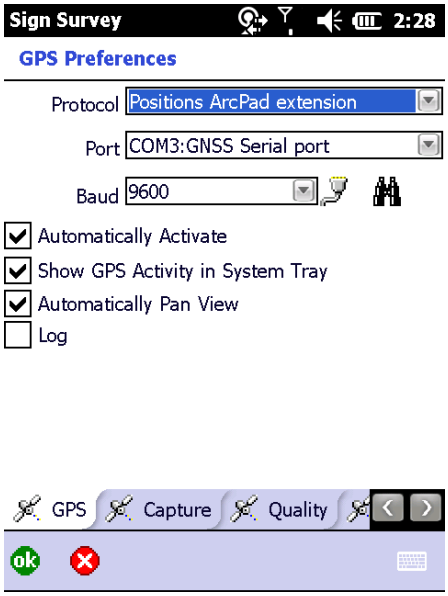


Figure 26
ArcPad GPS preferences

Next, click on the Capture tab; this is where we will set our averaging: for training,, please set to 10 for Points, 5 for Vertices, Streaming 1 sec intervals and Distance to 3 ft..

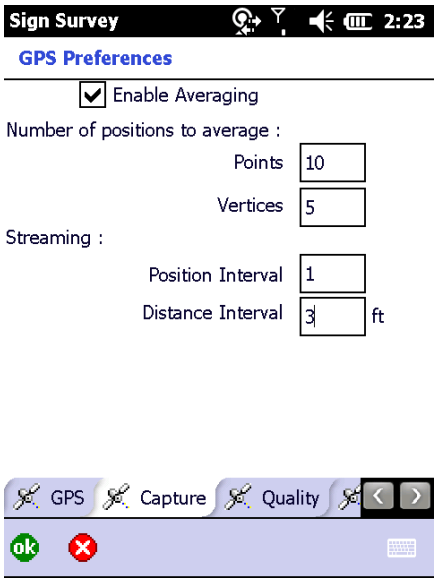


Figure 27
ArcPad capture preferences

Next, click on the Quality tab; leave these settings as No Warnings.

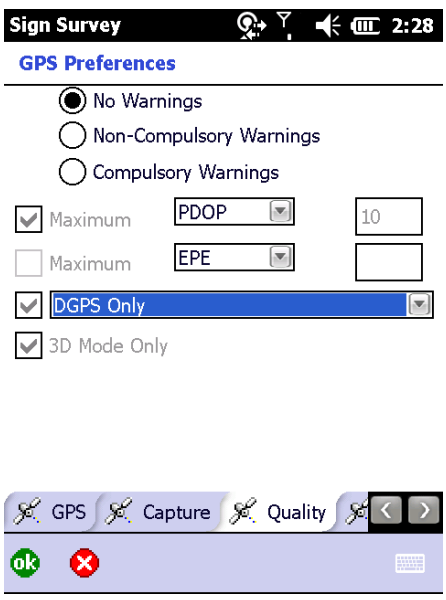


Figure 28
ArcPad quality preferences

Next, click on GPS Height. Set the antenna height to the height of your instrument; we will use 4.25ft.

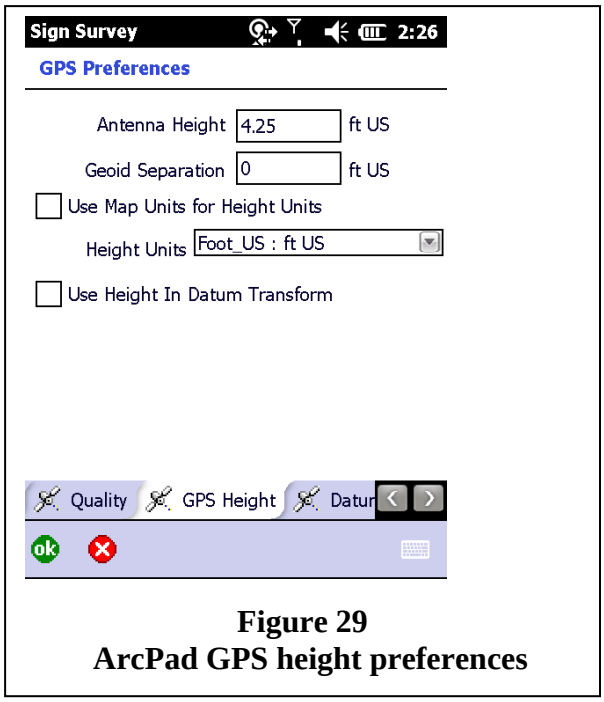


Figure 29
ArcPad GPS height preferences

Next, click on the Datum tab; we will leave this set to NAD_83_NSRS2007.

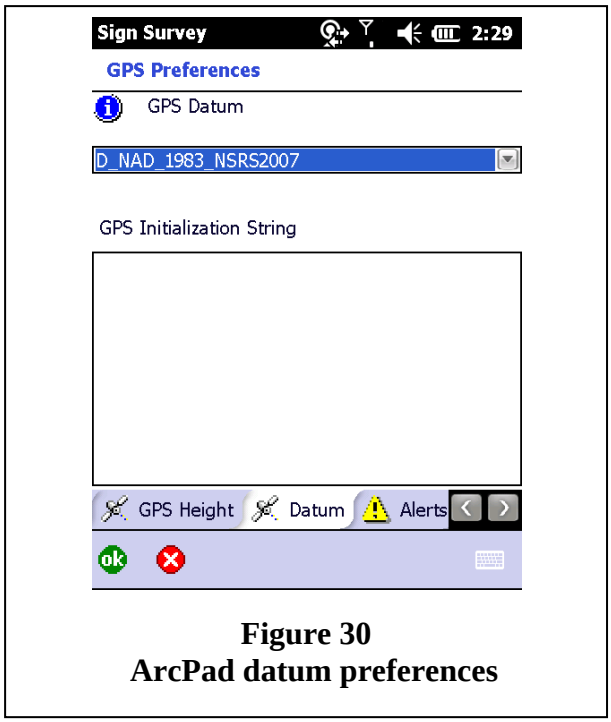


Figure 30
ArcPad datum preferences

Next, click on Alerts, which is more about personal preferences. Probably uncheck the visual alerts but choose which audible alerts to keep hearing when GNSS is lost or Carrier or when Approaching a Navigation Destination.

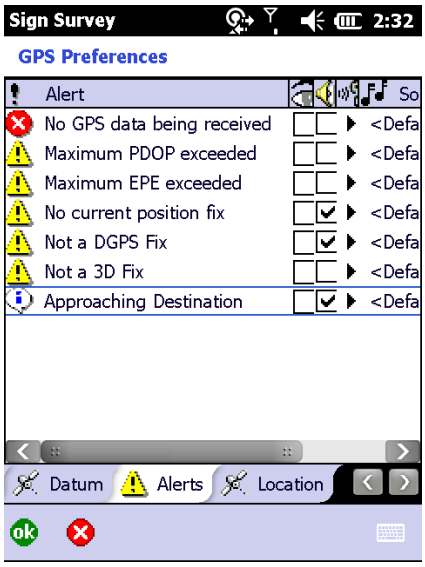


Figure 31
ArcPad alerts preferences

Now on to data collection.

Getting Ready for Data Collection

Feature types will usually be created in the office. If you have additional data you would like to record, then simply hit the Add Layers button  found under the file folder button  on the upper menu and choose a layer you would like to capture by placing a check mark in the box. [Note: Not usually recommended because feature types will usually be created in and managed by the office.]

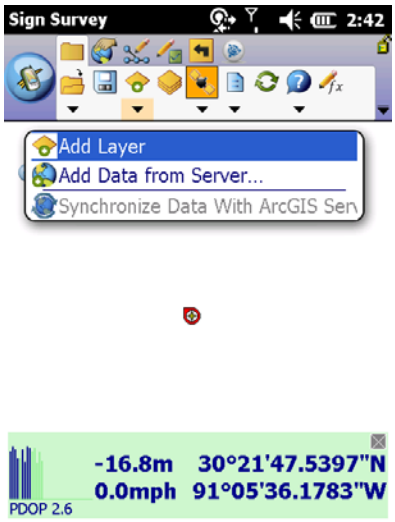


Figure 32
Adding a layer

Only one feature type at a time may be captured/edited. Only one can be marked as editable at a time.

To choose which feature to capture/edit hit the layers button and place a check mark next to the one to work with.

Figure 33
ArcPad feature choice

With the QuickCapture option on ArcPad may choose which feature to capture by clicking on its matching symbol.

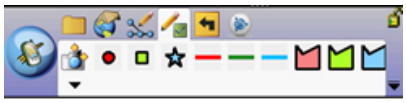


Figure 34
ArcPad quick capture option

To capture a feature, simply click on the corresponding icon.

Capturing a Features with GPS Positons

Click on the data capture button on the top toolbar.  When GNSS is Active we will be able to capture positions with GNSS.

Capturing a Point Feature

Click on the GPS Point button.  Then choose point from the dropdown list to capture a point feature. Percentages will start to climb at the top left by intervals of 10%; once it has reached 100%, we have achieved an averaged GPS Position. We can enter our attribute information as we are recording or when we are finished averaging. Some users have a tendency to move a bit while they enter data so it is important to stand still as we record our position; otherwise, we will create a large standard deviation that will affect our accuracy. Once we have captured our GPS positions and entered our attribute information, we can hit the OK button to save.

Capturing a Line Feature via Continuous Recording

To capture a continuous line like roads or paths we need to first select to record a Polyline feature in the GPS Collection tab.

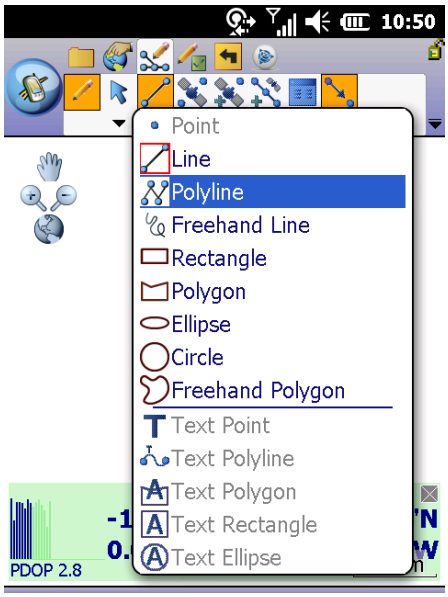


Figure 35
ArcPad GPS collection tab

Next, choose the Continuous line GPS icon  . When we set up our GPS Preferences earlier we set the setting to record a streaming line if both 1 second AND 3 ft. have transpired. Therefore, the line will only start to appear on the screen after the criteria have been met. Once you hit the Continuous GPS line button, start moving as your position trail is starting to calculate. When the line is complete, hit the green right arrow button at the bottom of the screen to advance to the attributes fields. Enter comments and hit OK when done.

Capturing a Line in Vertices mode

To capture vertices along a line instead of a continuous line hit the GPS Vertices button  . This will allow one to capture corners and, generally, much more precise data by averaging positions at the vertices rather than taking many one second shots along the path. The Vertex screen will come up with a count of 1 out of 10 readings. GPS Preferences are set to record vertices with 10 positions to average to give one better position. Once the readings have completed, hit the OK button and simply move to next spot to capture the next vertex; hit the Vertices button again and repeat until finished with the line feature. Hit the green area key  at the bottom of the screen and this will advance to the attributes page.

Capturing Area Features

Capturing Area features is much like the same of collecting a polyline. First, change the feature type to a Polygon and then record via continuous or by vertices.

Offsets

There will be times in the field when one cannot physically occupy the feature so an offset will be necessary. To capture an offset, collect a point at the antenna's position and enter attributes then activate the Offset button  . Once this is activated, click on the GPS point button  and the offset screen will be shown.

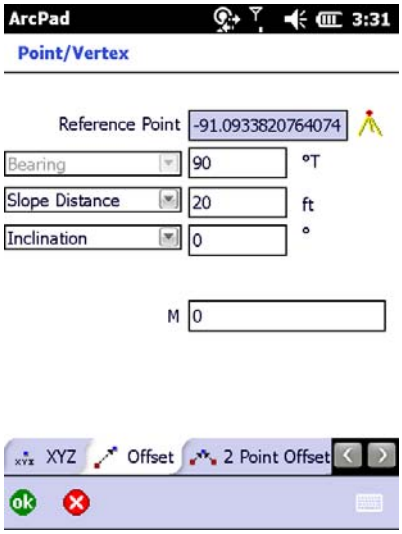


Figure 36
ArcPad offset tab

Hit OK when done.

Navigation

Navigating is fairly straightforward with ArcPad on the GeoHX, simply select the feature to navigate to by either selecting on the Map or by using the Find  tool. Choosing from the Map, select your GO TO option and make sure it is highlighted. Click on the map of the feature you would like to navigate to and the feature's label will change to the word Mark. You then will follow your compass heading. Click on the GPS Status bar at the bottom of the screen and then click on the Compass tab. The compass tab will have a red button at the top for where you need to travel and a distance and ETA.

Figure 37
ArcPad compass

Once you have arrived at the destination clear Nav target by clicking the clear selected feature button 

To navigate by using the Find  feature, simply click on the Find button, select the feature type and sort by attributes or search by all, and then select the feature by clicking on it one time. Hit the GoTo button on the right hand side, then follow the compass heading. Click on the GPS Status bar at the bottom of the screen and then click on the compass tab, which will have a red button at the top for direction and a distance and ETA. Once arrived at the destination, clear Nav target by clicking the clear selected feature button 

Editing

Edit a feature by clicking on a feature on the map and then click on the Feature Properties button 

TruPulse 360R Laser Rangefinder

The TruPulse Quick Reference Guide is a well-written booklet that covers the use of the device well. There is no need to attempt to replicate it redundantly here. Instead the document is included with this one and included by reference. There is a brief overview of its use within the SOCP.

APPENDIX B

CORS Adjustment and The New C4G Network

The Geocentric Coordinate System is a right-handed, orthogonal Cartesian system with its origin at the center of the earth. The direct Helmert transformation from latitude (ϕ), longitude (λ), and ellipsoid height (h) is:

$$X = (\nu + h)\cos\phi\cos\lambda \qquad (1)$$

$$Y = (\nu + h)\cos\phi\sin\lambda \qquad (2)$$

$$Z = \left[\left(\nu(1-e^2\right) + h\right]\sin\phi \text{ . (Helmert, 1880)} \qquad (3)$$

where:

a = semi-major axis of the ellipsoid,

b = semi-minor axis of the ellipsoid,

e = first eccentricity where:

$$e = \sqrt{2f - f^2} \text{ exactly,} \qquad (4)$$

f = flattening where:

$$f = \frac{a-b}{a}\text{, and} \qquad (5)$$

$e' = \varepsilon =$ second eccentricity where:

$$e' = \varepsilon = \sqrt{\frac{a^2-b^2}{b^2}} = \sqrt{\frac{e^2}{(1-e^2)}}\,.$$

The inverse transformation for ϕ is performed iteratively with an initial estimate, t_1:

$$t_1 = e^2 \cdot Z\,, \qquad (6)$$

$$\sin\phi_1 = \frac{Z + t_1}{\sqrt{X^2 + Y^2 + (Z + t_1)^2}}\,, \qquad (7)$$

$$t_{1+n} = \nu_1 e^2 \sin\phi_1\,, \qquad (8)$$

and t_{1+n} is substituted into the above equation until the solution converges, usually in 3-4 iterations.

$$\sin\lambda = \frac{Y}{\sqrt{X^2+Y^2}} \text{ when } |X| \geq |Y| \text{ ,} \qquad (9)$$

$$\cos\lambda = \frac{X}{\sqrt{X^2+Y^2}} \text{ when } |X| < |Y| \text{ ,} \qquad (10)$$

$$h = \left[\sqrt{X^2+Y^2+(Z+t_\phi)^2}\right] - \nu_\phi \text{ ,} \qquad (11)$$

$$\nu_\phi = \frac{\mathrm{a}}{\sqrt{1-\mathrm{e}^2\sin^2\phi}} \text{ , and} \qquad (12)$$

$$t_\phi = \nu \cdot e^2 \sin\phi \text{ .} \qquad (13)$$

A non-iterative inverse solution exists for ellipsoid heights within 100 km of the surface of the ellipsoid, but computational accuracy for ϕ degrades at greater heights.

$$\tan\phi = \frac{Z+\varepsilon\cdot\mathrm{b}\cdot\sin^3 u}{p-e^2\cdot\mathrm{a}\cdot\cos^3 u} \text{ ,} \qquad (14)$$

where:

$$p = \sqrt{X^2+Y^2} \text{ , and} \qquad (15)$$

$$\tan u = \left(\frac{Z}{p}\right)\left(\frac{\mathrm{a}}{\mathrm{b}}\right) \text{ .} \qquad \text{(Bowring, 1976)} \qquad (16)$$

Further developments for non-iterative solutions with higher accuracies at greater heights include: (Gonzalez-Vega & Polo-Blanko, 2009), (Turner, 2009), (Kotsakis, 2008), (Featherstone & Claessens, 2006), (Vermeille, 2002 & 2003), (Fukushima, 1999), and (Borkowski, 1987).

The mathematical model used to compute the relationship between two different datums may be expressed as the Bursa-Wolf Seven Parameter transformation:

$$\begin{bmatrix} f_1 \\ f_2 \\ f_3 \end{bmatrix} = \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_i - \begin{bmatrix} \Delta X \\ \Delta Y \\ \Delta Z \end{bmatrix} - \begin{bmatrix} 1 & \omega & -\psi \\ -\omega & 1 & \varepsilon \\ \psi & -\varepsilon & 1 \end{bmatrix}_i \begin{bmatrix} U \\ V \\ W \end{bmatrix}_i - \Delta s \begin{bmatrix} U \\ V \\ W \end{bmatrix}_i = 0. \qquad (17)$$

where, *"i"* denotes any point common to both the systems. The three angles *(ω,ψ,ε)* correspond to the small Euler type rotations Z, Y, and X axes respectively - taken positive in the counter clockwise mode, when viewed from the end of the respective axes (at the "initial" point) towards the origin. It may be worthwhile to mention here that the station coordinates in both the systems *(U_i,V_i,W_i and X_i, Y_i, Z_i)* are treated as observations in the above model.

The above equation written in matrix notation can then be modified into the following observation equation:

$$\mathrm{BV} + \mathrm{AX} + \mathrm{W} = 0, \qquad (18)$$

where:

$$B = \begin{bmatrix} \frac{\partial f_1}{\partial X} & \frac{\partial f_1}{\partial Y} & \frac{\partial f_1}{\partial Z} & \frac{\partial f_1}{\partial U} & \frac{\partial f_1}{\partial V} & \frac{\partial f_1}{\partial W} \\ \frac{\partial f_2}{\partial X} & \frac{\partial f_2}{\partial Y} & \frac{\partial f_2}{\partial Z} & \frac{\partial f_2}{\partial U} & \frac{\partial f_2}{\partial V} & \frac{\partial f_2}{\partial W} \\ \frac{\partial f_3}{\partial X} & \frac{\partial f_3}{\partial Y} & \frac{\partial f_3}{\partial Z} & \frac{\partial f_3}{\partial U} & \frac{\partial f_3}{\partial V} & \frac{\partial f_3}{\partial W} \end{bmatrix}_i$$

$$= \begin{bmatrix} 1 & 0 & 0 & -1 & 0 & 0 \\ 0 & 1 & 0 & 0 & -1 & 0 \\ 0 & 0 & 1 & 0 & 0 & -1 \end{bmatrix},$$

$$A = \begin{bmatrix} \frac{\partial f_1}{\partial \Delta X} & \frac{\partial f_1}{\partial \Delta Y} & \frac{\partial f_1}{\partial \Delta Z} & \frac{\partial f_1}{\partial \Delta U} & \frac{\partial f_1}{\partial \Delta V} & \frac{\partial f_1}{\partial \Delta W} \\ \frac{\partial f_2}{\partial \Delta X} & \frac{\partial f_2}{\partial \Delta Y} & \frac{\partial f_2}{\partial \Delta Z} & \frac{\partial f_2}{\partial \Delta U} & \frac{\partial f_2}{\partial \Delta V} & \frac{\partial f_2}{\partial \Delta W} \\ \frac{\partial f_3}{\partial \Delta X} & \frac{\partial f_3}{\partial \Delta Y} & \frac{\partial f_3}{\partial \Delta Z} & \frac{\partial f_3}{\partial \Delta U} & \frac{\partial f_3}{\partial \Delta V} & \frac{\partial f_3}{\partial \Delta W} \end{bmatrix}_i$$

$$= \begin{bmatrix} -1 & 0 & 0 & -U & -V & W & 0 \\ 0 & -1 & 0 & -V & U & 0 & -W \\ 0 & 0 & -1 & -W & 0 & -U & V \end{bmatrix}_I,$$

$$W = \begin{bmatrix} X - U \\ Y - V \\ Z - W \end{bmatrix}_i,$$

while V and X represent the residuals to the observations and corrections to the parameter estimated, respectively. Hence, collecting all the matrices as above, point-wise in the systems, the observation equation becomes:

$$\begin{bmatrix} 1 & 0 & 0 & -1 & 0 & 0 \\ 0 & 1 & 0 & 0 & -1 & 0 \\ 0 & 0 & 1 & 0 & 0 & -1 \end{bmatrix} \begin{bmatrix} V_X \\ V_Y \\ V_Z \\ V_U \\ V_V \\ V_W \end{bmatrix}_i + \begin{bmatrix} -1 & 0 & 0 & -U & -V & W & 0 \\ 0 & -1 & 0 & -V & U & 0 & -W \\ 0 & 0 & -1 & -W & 0 & -U & V \end{bmatrix}_i \begin{bmatrix} \Delta X \\ \Delta Y \\ \Delta Z \\ \Delta s \\ \omega \\ \psi \\ \varepsilon \end{bmatrix} + \begin{bmatrix} X-U \\ Y-V \\ Z-W \end{bmatrix}_i = 0 \qquad (19)$$

Defining the geodetic reference systems on the assumption that the Laplace condition has been enforced throughout the network (which implies that the axes of the reference ellipsoid are parallel to the conventional earth-fixed axes), many experiments have been made in recent times to determine the seven transformation parameters in relating the different geodetic systems to each other using an observation equation of the above type.

However, in the above general transformation, if the geodetic reference systems are properly oriented through the Laplace condition, the three rotations arising due to the improper relative orientation of the systems are generally never more than a few seconds of arc, while translations may amount up to 200 to 700 meters when transforming between a classical datum and a modern inertial satellite datum. Also, due to the presence of high correlations between the rotations, the scale factor and the translations, satisfactory independent estimates for these parameters are difficult to obtain from a combined general solution using equation (19).

THE INDEPENDENT DETERMINATIONS OF ROTATION AND SCALE PARAMETERS

Determination of Rotations

Mathematical Model

The mathematical model used is as follows:

$$\begin{aligned} T_{ik}^{(1)} - T_{ik}^{(2)} \quad &+\omega \quad +\psi \sin T_{ik}^{(1)} \quad \tan \delta_{ik}^{(1)} \quad -\varepsilon \cos T_{ik}^{(1)} \quad \tan \delta_{ik}^{(1)} \quad = 0 \\ \delta_{ik}^{(1)} - \delta_{ik}^{(2)} \quad &\qquad +\psi \cos T_{ik}^{(1)} \qquad\qquad +\varepsilon \sin T_{ik}^{(1)} \qquad\qquad = 0 \end{aligned} \qquad (20)$$

where, T_{ik} and δ_{ik} are defined as the geodetic hour angle and declination of the (i - k)th direction of the observed point at kth station and the observer at ith station. The indexes (1) and (2) denote the two systems with the transformation proceeding from system #1 to system #2.

If A_{ik}, B_{ik}, C_{ik} are taken to denote the direction cosines of the (i - k)th line of length R_{ik}, then for the first (UVW) system one gets:

$$
\begin{aligned}
A_{ik} &= \frac{U_k - U_i}{R_{ik}} = \frac{\Delta U_{ik}}{R_{ik}}, \\
B_{ik} &= \frac{V_k - V_i}{R_{ik}} = \frac{\Delta V_{ik}}{R_{ik}}, \\
C_{ik} &= \frac{W_k - W_i}{R_{ik}} = \frac{\Delta W_{ik}}{R_{ik}},
\end{aligned}
\qquad (21)
$$

and

$$
\begin{aligned}
T_{ik} &= -\arctan\frac{B_{ik}}{A_{ik}}, \\
\delta_{ik} &= \arctan\frac{C_{ik}}{\sqrt{A_{ik}^2 + B_{ik}^2}}.
\end{aligned}
\qquad (22)
$$

In the above relations (18) through (20) the elements of translation do not enter the picture. A similar set of relations as per (19) and (20) can be established for the second (XYZ) system.

Observation Equations

The mathematical model (18) then, for each (i - k)th line, yields the following generalized form of observation equations:

$$
\begin{bmatrix} -1 & 0 & 1 & 0 \\ 0 & -1 & 0 & 1 \end{bmatrix}
\begin{bmatrix} V_T \\ V_\delta \end{bmatrix}
+ \begin{bmatrix} 1 & \sin T_{ik}^{(1)} \tan \delta_{ik}^{(1)} & -\cos T_{ik}^{(1)} \tan \delta_{ik}^{(1)} \\ 0 & \cos T_{ik}^{(1)} & \sin T_{ik}^{(1)} \end{bmatrix}_{ik}
\begin{bmatrix} \omega \\ \psi \\ \varepsilon \end{bmatrix}
+ \begin{bmatrix} T_{ik}^{(1)} - & T_{ik}^{(2)} \\ \delta_{ik}^{(1)} - & \delta_{ik}^{(2)} \end{bmatrix} = 0 \qquad (23)
$$

Using the conventional weight matrix P for the coordinates of points included in the transformation, and the principle of least squares by making V'PV as minimum, the equation (23) is then solved for correction vector $(\omega, \psi, \varepsilon)$ and for the variance-covariance matrix $\left(\Sigma_{\omega\psi\varepsilon}\right)$ of the three parameters.

Weights

Using the variance-covariance matrices ΣX and ΣU in respect of ith and kth points for the XYZ and UVW systems, the variance-covariance matrices $\Sigma_{T\delta}$ for the two systems of coordinates can be computed through the propagation of errors. Two distinct cases would arise here. Firstly, when in addition to correlation between X,Y,Z – coordinates of any point, the correlation between the coordinates of one point to others is also considered. In such a case, the necessary relation will be:

$$
\left[\Sigma_{T\delta}^{(1)}\right]_{2,2} = G \begin{bmatrix} \Sigma U_1 & \Sigma U_{ik} \\ \Sigma U_{ik} & \Sigma U_k \end{bmatrix} G' \qquad (24)
$$

Where:

$$G = \begin{bmatrix} \frac{\partial T_{ik}^{(1)}}{\partial U_1} & \frac{\partial T_{ik}^{(1)}}{\partial V_1} & \frac{\partial T_{ik}^{(1)}}{\partial W_1} & \frac{\partial T_{ik}^{(1)}}{\partial U_k} & \frac{\partial T_{ik}^{(1)}}{\partial V_k} & \frac{\partial T_{ik}^{(1)}}{\partial W_k} \\ \frac{\partial \delta_{ik}^{(1)}}{\partial U_1} & \frac{\partial \delta_{ik}^{(1)}}{\partial V_1} & \frac{\partial \delta_{ik}^{(1)}}{\partial W_1} & \frac{\partial \delta_{ik}^{(1)}}{\partial U_k} & \frac{\partial \delta_{ik}^{(1)}}{\partial V_k} & \frac{\partial \delta_{ik}^{(1)}}{\partial W_k} \end{bmatrix},$$

and

$$\begin{aligned}
\frac{\partial T_{ik}}{\partial U_1} &= \frac{\partial T_{ik}}{\partial U_K} = -\frac{\Delta V_{ik}}{\Delta U_{ik}^2 + \Delta V_{ik}^2}, \\
\frac{\partial T_{ik}}{\partial V_1} &= \frac{\partial T_{ik}}{\partial V_K} = -\frac{\Delta U_{ik}}{\Delta U_{ik}^2 + \Delta V_{ik}^2}, \\
\frac{\partial T_{ik}}{\partial W_1} &= \frac{\partial T_{ik}}{\partial W_K} = 0, \\
\frac{\partial T_{ik}}{\partial U_1} &= \frac{\partial \delta_{ik}}{\partial U_K} = \frac{\Delta U_{ik}\Delta W_{ik}}{R_{ik}^{2(1)}\sqrt{\Delta U_{ik}^2 + \Delta V_{ik}^2}}, \\
\frac{\partial T_{ik}}{\partial V_1} &= \frac{\partial \delta_{ik}}{\partial V_K} = \frac{\Delta V_{ik}\Delta W_{ik}}{R_{ik}^{2(1)}\sqrt{\Delta U_{ik}^2 + \Delta V_{ik}^2}}, \\
\frac{\partial \delta_{ik}}{\partial W_1} &= -\frac{\partial \delta_{ik}}{\partial W_k} = -\frac{\sqrt{\Delta U_{ik}^2 + \Delta V_{ik}^2}}{R_{ik}^{2(1)}}, \\
R_{ik}^{2(1)} &= \Delta U_{ik}^2 + \Delta V_{ik}^2 + \Delta W_{ik}^2 .
\end{aligned}$$

Secondly, ignoring the correlations between the coordinates of different points within a system, equation (24) can be modified as under:

$$\left[\Sigma_{T\delta}^{(1)}\right]_{2,2} = G\begin{bmatrix} \Sigma U_1 & 0 \\ 0 & \Sigma U_k \end{bmatrix} G' \qquad (25)$$

In the equations (24) and (25), ΣU_i and ΣU_k correspond to i^{th} and k^{th} point of the first system and can be either full (3×3) matrices with covariances between the three components of a point, or may contain variances for (U, V, W) in a diagonal form only. However, in the case of covariances (ΣU_{ik}) between the points being included, the matrix in equation (24) would be a full (6×6).

Obtaining similarly $\Sigma_{T\delta}^{(2)}$, the combined variance-covariance matrix, to be used with equation (23), is given by:

$$P_{4,4} = \begin{bmatrix} \Sigma_{T\delta}^{(2)} & \vdots & 0 \\ \cdots & \cdots & \cdots \\ 0 & \vdots & \Sigma_{T\delta}^{(1)} \end{bmatrix} \qquad (26)$$

It may be noted here that the matrix P is always in 2×2 banded diagonal form.

Determination of Scale Factor

Mathematical Model

The scale factor between the systems #1 and #2 would be given as follows:

$$\Delta s_{ik} = \frac{R_{ik}^{(2)}}{R_{ik}^{(1)}} - 1 \qquad (27)$$

where:

$$R_{ik}^{(2)} = \sqrt{\left(\Delta X_{ik}^2 + \quad \Delta Y_{ik}^2 + \quad \Delta Z_{ik}^2\right)}$$
$$R_{ik}^{(1)} = \sqrt{\left(\Delta U_{ik}^2 + \quad \Delta V_{ik}^2 + \quad \Delta W_{ik}^2\right)}.$$

Weights

Using the variance-covariance matrices ΣX and ΣU for the coordinates of i_T^{th} and k_T^{th} points in the two systems included in the transformation a variance $\sigma_{\Delta s}^2$ is established for the scale factor through error propagation. Two cases similar to equations (24) and (25) would arise according to the case when full variance-covariance matrix between different points within the system is considered or not.

The matrix G for the scale factor determination is:

$$G = \left[\frac{\partial \Delta s}{\partial U_1}\frac{\partial \Delta s}{\partial V_1}\frac{\partial \Delta s}{\partial W_1}\frac{\partial \Delta s}{\partial U_k}\frac{\partial \Delta s}{\partial V_k}\frac{\partial \Delta s}{\partial W_k}\frac{\partial \Delta s}{\partial X_1}\frac{\partial \Delta s}{\partial Y_1}\frac{\partial \Delta s}{\partial Z_1}\frac{\partial \Delta s}{\partial X_k}\frac{\partial \Delta s}{\partial Y_k}\frac{\partial \Delta s}{\partial Z_k}\right],$$

where:

$$\frac{\partial \Delta s}{\partial U_i} = -\frac{\partial \Delta s}{\partial U_k} = \frac{\Delta U_{ik} \cdot R_{ik}^2}{\sqrt{\left[R_{ik}^1\right]^3}},$$

$$\frac{\partial \Delta s}{\partial V_i} = -\frac{\partial \Delta s}{\partial V_k} = \frac{\Delta V_{ik} \cdot R_{ik}^2}{\sqrt{\left[R_{ik}^1\right]^3}},$$

$$\frac{\partial \Delta s}{\partial W_i} = -\frac{\partial \Delta s}{\partial W_k} = \frac{\Delta W_{ik} \cdot R_{ik}^2}{\sqrt{\left[R_{ik}^1\right]^3}},$$

$$\frac{\partial \Delta s}{\partial X_i} = -\frac{\partial \Delta s}{\partial X_k} = \frac{\Delta X_{ik}}{R_{ik}^{(1)} \cdot R_{ik}^{(2)}},$$

$$\frac{\partial \Delta s}{\partial Y_i} = -\frac{\partial \Delta s}{\partial Y_k} = \frac{\Delta Y_{ik}}{R_{ik}^{(1)} \cdot R_{ik}^{(2)}},$$

$$\frac{\partial \Delta s}{\partial Z_i} = -\frac{\partial \Delta s}{\partial Z_k} = \frac{\Delta Z_{ik}}{R_{ik}^{(1)} \cdot R_{ik}^{(2)}}.$$

Hence,

$$\sigma_{\Delta s_{ik}}^2 = G \underset{12}{\begin{bmatrix} \Sigma U_1 & \Sigma U_{ik} & & 0 & \\ \Sigma U_{ik} & \Sigma U_k & & & \\ & & \Sigma X_1 & \Sigma X_{ik} & \\ & 0 & \Sigma X_{ik} & \Sigma X_k & \end{bmatrix}_{12}} G' \qquad (28)$$

Where the full (12×12) matrix would become a (3×3) banded diagonal matrix in case ΣU_{ik} and ΣX_{ik} are zero, *i.e.*, covariances are not considered. The complete (12×12) matrix would assume a diagonal pattern when only variances are used for station coordinates.

Using the value of Δs_{ik} and $\sigma_{\Delta s_{ik}}^2$ from equations (27) and (28), the value for the weighted mean and its variance for the transformation under investigation is established as given below:

$$\Delta s = \frac{\left[w_{ik} \cdot \Delta s_{ik}\right]}{\left[w_{ik}\right]} \qquad (29)$$

$$\sigma_{\Delta s_{ik}}^2 = \frac{\left[w_{ik} \cdot \left(\Delta s_{ik} - \Delta s_k\right)^2\right]}{\left[w_{ik}\right](n-1)} \qquad \mathbf{(30)}$$

where:

$w_{ik} = 1 / \sigma_{\Delta s_{ik}}^2$ and $\left[w_{ik}\right]$ denotes the sum of all such weights.

n = Total number of scale factor values used in the sample.

INPUT DATA FOR LOUISIANA:

NAD 83(CORS96) Geodetic coordinates for CORS Antenna Reference Point (ARP) [GRS80 ellipsoid]

SITE	EPOCH	Latitude	Longitude	Ellip. Ht. meters
1LSU	2002.00	30 24 26.70936 N	91 10 48.91529 W	-5.179
1NSU	2002.00	31 45 2.86182 N	93 5 51.34331 W	29.345
1ULM	2002.00	32 31 44.50133 N	92 4 33.23460 W	17.282
BVHS	2002.00	29 20 12.48967 N	89 24 23.01085 W	-14.217
COVG	2002.00	30 28 33.26965 N	90 5 43.92326 W	-4.561
DSTR	2002.00	29 57 52.39573 N	90 22 56.00715 W	-18.567
GRIS	2002.00	29 15 55.88303 N	89 57 26.26266 W	-15.601
HAMM	2002.00	30 30 47.05159 N	90 28 3.42873 W	7.266
HOUM	2002.00	29 35 32.10988 N	90 43 24.98886 W	-11.315
LESV	2002.00	31 8 32.87752 N	93 16 8.24336 W	76.965
LMCN	2002.00	29 15 17.90440 N	90 39 40.65331 W	-14.694
LSUA	2002.00	31 10 43.57792 N	92 24 44.33576 W	6.030
LWES	2002.00	29 54 1.29547 N	90 20 57.83389 W	-15.720
MCNE	2002.00	30 10 50.02272 N	93 13 3.84352 W	-8.712
NOLA	2002.00	29 56 3.73286 N	90 7 12.64688 W	-0.110
OAKH	2002.00	30 48 55.80618 N	92 39 25.10353 W	21.539
SHRV	2002.00	32 25 39.65172 N	93 42 16.66420 W	38.006
SIHS	2002.00	31 50 36.15836 N	91 39 19.56144 W	7.064
TALL	2002.00	32 24 1.19684 N	91 10 58.81220 W	7.418

NAD 83(2011) Geod. CORS Pos. Ant. Ref. Point (ARP) [GRS80 Ellip.]

SITE	EPOCH	Latitude	Longitude	Ellip. Ht.
				meters
1LSU	2010.00	30 24 26.70946 N	91 10 48.91474 W	-5.211
1NSU	2010.00	31 45 2.86222 N	93 5 51.34294 W	29.340
1ULM	2010.00	32 31 44.50137 N	92 4 33.23408 W	17.264
BVHS	2010.00	29 20 12.48974 N	89 24 23.01021 W	-14.248
COVG	2010.00	30 28 33.26972 N	90 5 43.92269 W	-4.563
DSTR	2010.00	29 57 52.39568 N	90 22 56.00655 W	-18.580
GRIS	2010.00	29 15 55.88300 N	89 57 26.26226 W	-15.632
HAMM	2010.00	30 30 47.05150 N	90 28 3.42841 W	7.264
HOUM	2010.00	29 35 32.10964 N	90 43 24.98847 W	-11.333
LESV	2010.00	31 8 32.87762 N	93 16 8.24289 W	76.975
LMCN	2010.00	29 15 17.90427 N	90 39 40.65211 W	-14.743
LSUA	2010.00	31 10 43.57804 N	92 24 44.33510 W	6.026
LWES	2010.00	29 54 1.29535 N	90 20 57.83368 W	-15.710
MCNE	2010.00	30 10 50.02264 N	93 13 3.84329 W	-8.700
NOLA	2010.00	29 56 3.73272 N	90 7 12.64630 W	-0.116
OAKH	2010.00	30 48 55.80614 N	92 39 25.10297 W	21.553
SHRV	2010.00	32 25 39.65182 N	93 42 16.66366 W	38.004
SIHS	2010.00	31 50 36.15835 N	91 39 19.56088 W	7.068
TALL	2010.00	32 24 1.19646 N	91 10 58.81156 W	7.410

Bursa-Wolf/Moledensky Seven-Parameter Datum Shifts

Project Title: **From GULFNet to C4GNet**

from Datum1: NAD83(CORS96) geodetic -packed dms
to Datum2: NAD83(2011) geodetic -packed dms

Number of Points: 19 determine transform

Bursa-Wolf Model
7-Parameter Transformation -- Rotate/Translate/Scale

Constrained Solutions for: Nothing
Covariance Input is: Variances Only
Multiplying Factor for 1st System Variances = 1.00

Geocentric Coordinates for NAD83(CORS96)/ NAD83(2011) Systems
Station Designation

1LSU U V W = -113402.186 -5504362.839 3209404.379
X Y Z = -113402.171 -5504362.811 3209404.365

1NSU U V W = -293348.821 -5420743.803 3336980.984
X Y Z = -293348.811 -5420743.793 3336980.991

1ULM U V W = -194981.387 -5379223.398 3410046.986
X Y Z = -194981.373 -5379223.383 3410046.977

BVHS U V W = 57650.866 -5564333.008 3106491.038
X Y Z = 57650.883 -5564332.980 3106491.024

COVG U V W = -9173.433 -5501676.859 3215950.683
X Y Z = -9173.418 -5501676.856 3215950.683

DSTR U V W = -36892.110 -5530081.058 3166961.046
X Y Z = -36892.094 -5530081.048 3166961.039

GRIS U V W = 4150.421 -5568495.489 3099600.509
X Y Z = 4150.432 -5568495.462 3099600.493

HAMM U V W = -44884.481 -5499420.934 3219506.601
X Y Z = -44884.472 -5499420.933 3219506.597

HOUM U V W = -70099.910 -5550263.858 3131145.118
X Y Z = -70099.899 -5550263.846 3131145.103

LESV U V W = -311568.833 -5455014.482 3279462.408
X Y Z = -311568.821 -5455014.490 3279462.416

LMCN U V W = -64275.284 -5568698.434 3098580.830
X Y Z = -64275.251 -5568698.394 3098580.802

Geocentric Coordinates for NAD83(CORS96)/ NAD83(2011) Systems

Station Designation

LSUA U V W = -229887.780 -5456921.291 3282870.248
X Y Z = -229887.762 -5456921.286 3282870.249

LWES U V W = -33745.477 -5533654.434 3160795.617
X Y Z = -33745.472 -5533654.444 3160795.619

MCNE U V W = -309740.331 -5509514.007 3187687.921
X Y Z = -309740.326 -5509514.019 3187687.925

NOLA U V W = -11603.305 -5531878.357 3164071.105
X Y Z = -11603.289 -5531878.354 3164071.098

OAKH U V W = -254149.244 -5476622.601 3248354.319
X Y Z = -254149.230 -5476622.614 3248354.325

SHRV U V W = -348186.712 -5377548.138 3400576.993
X Y Z = -348186.697 -5377548.135 3400576.995

SIHS U V W = -156670.832 -5420983.794 3345694.401
X Y Z = -156670.817 -5420983.798 3345694.403

TALL U V W = -111289.495 -5389259.492 3398000.311
X Y Z = -111289.479 -5389259.492 3398000.297

Variance-Covariance Matrix for NAD83(CORS96) / NAD83(2011) Systems

1LSU	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
1NSU	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
1ULM	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
BVHS	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
COVG	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
DSTR	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
GRIS	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
HAMM	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
HOUM	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
LESV	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
LMCN	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
LSUA	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
LWES	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
MCNE	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
NOLA	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
OAKH	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
SHRV	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
SIHS	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02
TALL	U V W =	1.000000E-02 1.000000E-02 1.000000E-02
	X Y Z =	1.000000E-02 1.000000E-02 1.000000E-02

NAD83(CORS96) -to- NAD83(2011) Title: From GULFNet to C4GNet

Bursa-Wolf Model

Solution for 3 Translation, 1 Scale and 3 Rotation Parameters

(Using Variances Only)

DX	DY	DZ	Scale-1	Omega_z	Psi_y	Epsilon_x
Meters	Meters	Meters	(x10^6)	Seconds	Seconds	Seconds
-0.36	0.12	0.08	0.01	-0.01	-0.01	0.00
Stddev:±0.16	±0.11	±0.15	±0.01	±0.00	±0.00	±0.01

Variance - Covariance Matrix

0.246E-01	0.816E-02	0.145E-01	0.235E-10	0.328E-08	0.202E-08	-0.262E-08
0.816E-02	0.117E-01	0.810E-02	0.966E-09	0.106E-08	0.685E-09	-0.203E-08
0.145E-01	0.810E-02	0.215E-01	-0.570E-09	0.193E-08	0.125E-08	-0.355E-08
0.235E-10	0.966E-09	-0.570E-09	0.176E-15	0.668E-29	0.436E-29	-0.113E-28
0.328E-08	0.106E-08	0.193E-08	0.926E-29	0.484E-15	0.193E-15	-0.347E-15
0.202E-08	0.685E-09	0.125E-08	0.608E-29	0.193E-15	0.297E-15	-0.220E-15
-0.262E-08	-0.203E-08	-0.355E-08	-0.197E-28	-0.347E-15	-0.220E-15	0.642E-15

Coefficients of Correlation

0.100E+01	0.481E+00	0.633E+00	0.113E-01	0.952E+00	0.748E+00	-0.659E+00
0.481E+00	0.100E+01	0.510E+00	0.672E+00	0.444E+00	0.367E+00	-0.740E+00
0.633E+00	0.510E+00	0.100E+01	-0.293E+00	0.599E+00	0.493E+00	-0.956E+00
0.113E-01	0.672E+00	-0.293E+00	0.100E+01	0.229E-13	0.190E-13	-0.337E-13
0.952E+00	0.444E+00	0.599E+00	0.229E-13	0.100E+01	0.509E+00	-0.623E+00
0.748E+00	0.367E+00	0.493E+00	0.190E-13	0.509E+00	0.100E+01	-0.503E+00
-0.659E+00	-0.740E+00	-0.956E+00	-0.337E-13	-0.623E+00	-0.503E+00	0.100E+01

Note: Axes point towards Mean Greenwich (X), East (Y) and the CIO (Z).
The Rotations are about Z, Y and X Axes, respectively.

Geocentric Residuals V (Meters)

	V1 = NAD83(CORS96)			V2 = NAD83(2011)			V1 - V2		
				DX	DY	DZ			
1LSU	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.02	-0.01
1NSU	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.01	0.01
1ULM	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.01	-0.01
BVHS	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.01	0.00
COVG	0.0	0.0	0.0	0.0	0.0	0.0	0.00	-0.01	0.01
DSTR	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00
GRIS	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.01	0.00
HAMM	0.0	0.0	0.0	0.0	0.0	0.0	-0.01	-0.01	0.00
HOUM	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	-0.01
LESV	0.0	0.0	0.0	0.0	0.0	0.0	0.00	-0.01	0.01
LMCN	0.0	0.0	0.0	0.0	0.0	0.0	0.02	0.03	-0.02
LSUA	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00
LWES	0.0	0.0	0.0	0.0	0.0	0.0	-0.01	-0.02	0.01
MCNE	0.0	0.0	0.0	0.0	0.0	0.0	-0.01	-0.01	0.00
NOLA	0.0	0.0	0.0	0.0	0.0	0.0	0.00	-0.01	0.00
OAKH	0.0	0.0	0.0	0.0	0.0	0.0	0.00	-0.01	0.01
SHRV	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.01	0.00
SIHS	0.0	0.0	0.0	0.0	0.0	0.0	0.00	-0.01	0.00
TALL	0.0	0.0	0.0	0.0	0.0	0.0	0.00	-0.01	-0.01

Geodetic Residuals V (Arc Seconds & Meters)

	V1 = NAD83(CORS96)			V1 - V2		
	V2 = NAD83(2011)			DLAT	DLON	DHT
1LSU	0.000	0.000	-0.01			
	0.000	0.000	0.01	0.000	0.000	-0.02
1NSU	0.000	0.000	0.00			
	0.000	0.000	0.00	0.000	0.000	-0.01
1ULM	0.000	0.000	-0.01			
	0.000	0.000	0.01	0.000	0.000	-0.02
BVHS	0.000	0.000	0.00			
	0.000	0.000	0.00	0.000	0.000	-0.01
COVG	0.000	0.000	0.01			
	0.000	0.000	-0.01	0.000	0.000	0.01
DSTR	0.000	0.000	0.00			
	0.000	0.000	0.00	0.000	0.000	0.00
GRIS	0.000	0.000	-0.01			
	0.000	0.000	0.01	0.000	0.000	-0.01
HAMM	0.000	0.000	0.01			
	0.000	0.000	-0.01	0.000	0.000	0.01
HOUM	0.000	0.000	0.00			
	0.000	0.000	0.00	0.000	0.000	0.00
LESV	0.000	0.000	0.00			
	0.000	0.000	0.00	0.000	0.000	0.01
LMCN	0.000	0.000	-0.02			
	0.000	0.000	0.02	0.000	0.001	-0.03
LSUA	0.000	0.000	0.00			
	0.000	0.000	0.00	0.000	0.000	0.00
LWES	0.000	0.000	0.01			
	0.000	0.000	-0.01	0.000	0.000	0.03
MCNE	0.000	0.000	0.01			
	0.000	0.000	-0.01	0.000	0.000	0.01
NOLA	0.000	0.000	0.01			
	0.000	0.000	-0.01	0.000	0.000	0.01
OAKH	0.000	0.000	0.01			
	0.000	0.000	-0.01	0.000	0.000	0.02
SHRV	0.000	0.000	0.00			
	0.000	0.000	0.00	0.000	0.000	-0.01
SIHS	0.000	0.000	0.00			
	0.000	0.000	0.00	0.000	0.000	0.01
TALL	0.000	0.000	0.00			
	0.000	0.000	0.00	0.000	0.000	0.00

Geodetic Residuals V (Meters)

	V1 = NAD83(CORS96 V2 = NAD83(2011)	V1 - V2 DLAT	DLON	DHT
1LSU	0.00 0.00 -0.01			
	0.00 0.00 0.01	0.00	0.00	-0.02
1NSU	0.01 0.00 0.00			
	-0.01 0.00 0.00	0.01	0.00	-0.01
1ULM	0.00 0.00 -0.01			
	0.00 0.00 0.01	0.00	0.00	-0.02
BVHS	0.00 0.00 0.00			
	0.00 0.00 0.00	0.01	0.00	-0.01
COVG	0.00 0.00 0.01			
	0.00 0.00 -0.01	0.00	0.00	0.01
DSTR	0.00 0.00 0.00			
	0.00 0.00 0.00	0.00	0.00	0.00
GRIS	0.00 0.00 -0.01			
	0.00 0.00 0.01	0.00	0.00	-0.01
HAMM	0.00 0.00 0.01			
	0.00 0.00 -0.01	0.00	-0.01	0.01
HOUM	0.00 0.00 0.00			
	0.00 0.00 0.00	-0.01	0.00	0.00
LESV	0.00 0.00 0.00			
	0.00 0.00 0.00	0.00	0.00	0.01
LMCN	0.00 0.01 -0.02			
	0.00 -0.01 0.02	0.00	0.02	-0.03
LSUA	0.00 0.00 0.00			
	0.00 0.00 0.00	0.00	0.00	0.00
LWES	0.00 0.00 0.01			
	0.00 0.00 -0.01	0.00	-0.01	0.03
MCNE	0.00 0.00 0.01			
	0.00 0.00 -0.01	0.00	-0.01	0.01
NOLA	0.00 0.00 0.01			
	0.00 0.00 -0.01	0.00	0.00	0.01
OAKH	0.00 0.00 0.01			
	0.00 0.00 -0.01	0.00	0.00	0.02
SHRV	0.00 0.00 0.00			
	0.00 0.00 0.00	0.00	0.00	-0.01
SIHS	0.00 0.00 0.00			
	0.00 0.00 0.00	0.00	0.00	0.01
TALL	-0.01 0.00 0.00			
	0.01 0.00 0.00	-0.01	0.00	0.00

Normal Termination

APPENDIX C

Control Survey Listing MVRM Test Site - LSU

Test Site at LSU

Date & Time 5/6/2014 – 2/21/2014

Coordinate System U.S. State Plane 1983 **Zone** Louisiana South 1702

Project Datum (NAD 83) **Vertical Datum** (NAVD 88) **Geoid Model** GEOID12A

Coordinate Unit U.S. Survey Foot **Distance Unit** U.S. Survey Foot **Height Unit** U.S. Survey Foot

Figure 38
MVRM Control – Test Site at LSU

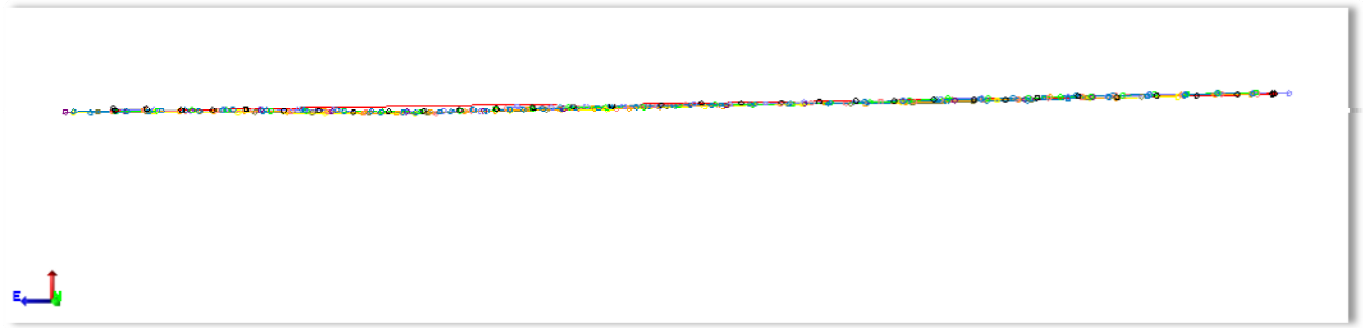
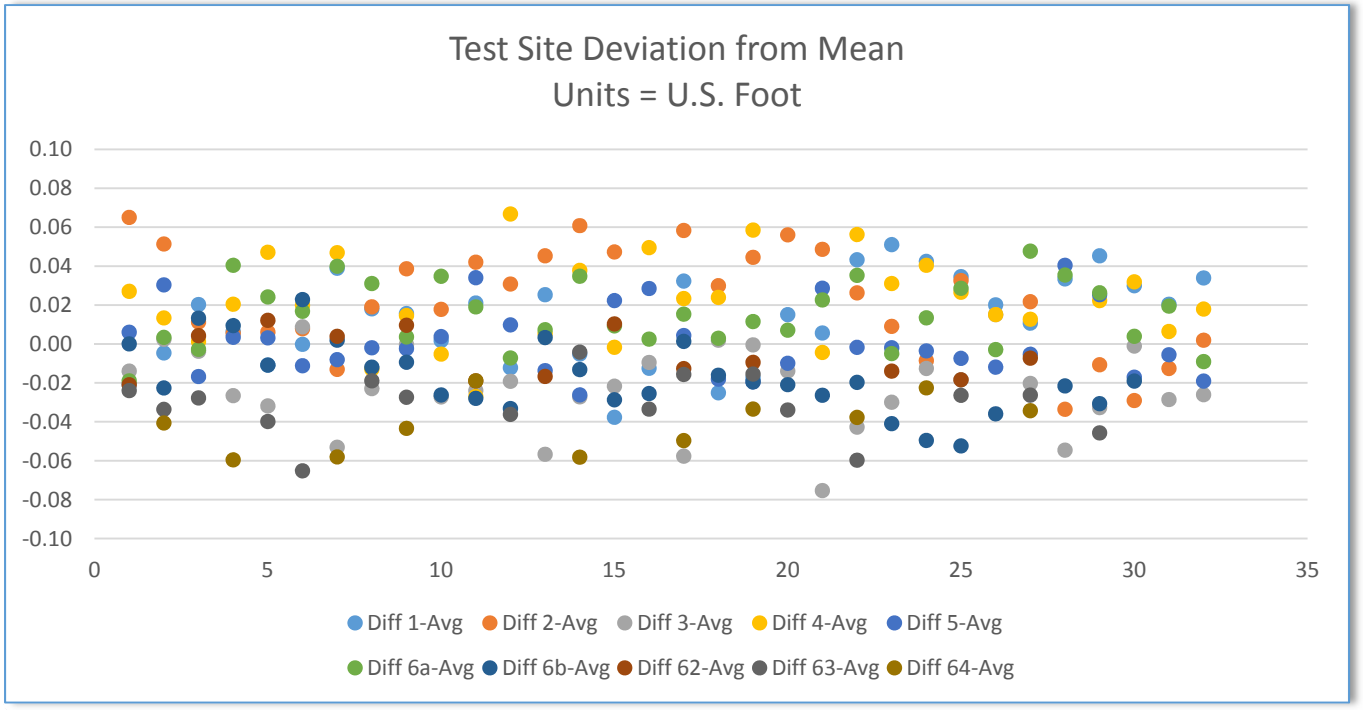


Figure 39
MVRM control – test site profile 10 X vertical

Table 11
Deviation of measurements at test site



Point ID	Northing	Easting	Elevation	H Prc	V Prc	RMS
6201	586918.631	3527416.402	16.089	0.090	0.109	0.019
6202	586440.141	3532355.492	15.969	0.051	0.066	0.017
62001	586918.815	3527416.413	16.103	0.054	0.066	0.007
62002	586917.675	3527427.891	16.114	0.054	0.065	0.007
62003	586916.642	3527439.077	16.115	0.055	0.066	0.007
62004	586915.449	3527450.787	16.172	0.055	0.067	0.007

62005	586914.516	3527461.487	16.146	0.072	0.088	0.009
62006	586913.380	3527471.911	16.177	0.063	0.077	0.008
62007	586912.425	3527482.637	16.159	0.064	0.078	0.008
62008	586911.286	3527493.334	16.174	0.073	0.089	0.009
62009	586910.278	3527504.503	16.131	0.057	0.069	0.007
62010	586909.346	3527515.681	16.163	0.065	0.080	0.008
62011	586908.173	3527526.947	16.167	0.065	0.079	0.008
62012	586906.852	3527538.521	16.202	0.057	0.069	0.007
62013	586905.801	3527550.284	16.183	0.075	0.092	0.009
62014	586904.484	3527562.021	16.194	0.067	0.081	0.008
62015	586903.396	3527574.359	16.215	0.058	0.070	0.007
62016	586902.297	3527586.074	16.181	0.141	0.084	0.007
62017	586901.210	3527598.436	16.206	0.156	0.093	0.008
62018	586899.849	3527610.809	16.183	0.153	0.091	0.008
62019	586898.733	3527622.720	16.172	0.169	0.101	0.009
62020	586897.522	3527634.943	16.160	0.173	0.103	0.009
62021	586896.412	3527646.780	16.152	0.230	0.137	0.012
62022	586895.313	3527658.719	16.214	0.158	0.094	0.008
62023	586894.089	3527670.699	16.194	0.082	0.100	0.010
62024	586892.795	3527682.959	16.194	0.097	0.119	0.012
62025	586891.565	3527695.154	16.159	0.094	0.115	0.012
62026	586890.466	3527707.609	16.140	0.088	0.107	0.011
62027	586889.213	3527719.701	16.146	0.090	0.110	0.011
62028	586888.067	3527732.200	16.161	0.104	0.128	0.013
62029	586886.728	3527745.969	16.162	0.074	0.102	0.011
62030	586885.489	3527758.457	16.191	0.076	0.105	0.011
62031	586884.376	3527771.027	16.180	0.072	0.099	0.011
62032	586883.311	3527783.608	16.180	0.077	0.094	0.010
62033	586882.116	3527796.111	16.191	0.085	0.104	0.011
62034	586880.849	3527808.804	16.181	0.100	0.122	0.012
62035	586879.581	3527821.673	16.232	0.094	0.115	0.012
62036	586878.738	3527831.707	16.277	0.101	0.124	0.013
62037	586877.315	3527844.634	16.199	0.068	0.084	0.008
62038	586875.952	3527857.884	16.206	0.081	0.099	0.010
62039	586874.628	3527870.680	16.257	0.070	0.086	0.009
62040	586873.497	3527883.447	16.238	0.078	0.096	0.010
62041	586872.341	3527896.081	16.186	0.061	0.074	0.008

62042	586871.168	3527908.481	16.234	0.061	0.075	0.008
62043	586870.141	3527921.225	16.204	0.062	0.076	0.008
62044	586868.766	3527933.803	16.281	0.082	0.102	0.009
62045	586867.609	3527946.836	16.243	0.071	0.087	0.009
62046	586866.246	3527959.390	16.225	0.080	0.098	0.010
62047	586864.847	3527972.316	16.196	0.080	0.098	0.010
62048	586863.705	3527985.280	16.179	0.062	0.076	0.008
62049	586862.463	3527998.146	16.217	0.063	0.077	0.008
62050	586861.170	3528010.575	16.198	0.072	0.088	0.009
62051	586859.894	3528023.473	16.201	0.079	0.096	0.010
62052	586858.749	3528036.298	16.218	0.079	0.097	0.010
62053	586857.402	3528049.481	16.212	0.080	0.098	0.010
62054	586856.067	3528062.255	16.198	0.071	0.087	0.009
62055	586854.922	3528074.669	16.213	0.063	0.077	0.008
62056	586853.858	3528087.101	16.212	0.067	0.079	0.006
62057	586852.500	3528099.591	16.232	0.092	0.100	0.009
62058	586851.263	3528112.320	16.200	0.164	0.098	0.008
62059	586850.312	3528125.394	16.233	0.178	0.106	0.009
62060	586849.069	3528135.487	16.229	0.143	0.085	0.007
62061	586848.018	3528146.389	16.174	0.139	0.085	0.008
62062	586846.871	3528157.155	16.150	0.194	0.116	0.010
62063	586845.846	3528169.692	16.148	0.160	0.096	0.008
62064	586844.398	3528182.627	16.147	0.117	0.070	0.006
62065	586843.181	3528195.755	16.144	0.087	0.095	0.009
62066	586841.885	3528208.503	16.136	0.088	0.096	0.009
62067	586840.605	3528221.463	16.192	0.087	0.107	0.011
62068	586839.202	3528234.341	16.172	0.078	0.095	0.010
62069	586838.016	3528247.277	16.167	0.085	0.104	0.011
62070	586836.750	3528260.420	16.192	0.076	0.093	0.010
62071	586835.480	3528273.310	16.156	0.088	0.108	0.011
62072	586834.116	3528286.459	16.170	0.091	0.112	0.011
62073	586832.976	3528299.648	16.155	0.069	0.084	0.009
62074	586831.859	3528312.839	16.185	0.113	0.070	0.006
62075	586830.854	3528322.795	16.195	0.140	0.086	0.008
62076	586829.940	3528332.777	16.162	0.128	0.078	0.007
62077	586828.687	3528345.786	16.234	0.135	0.083	0.008

62078	586827.534	3528358.727	16.254	0.180	0.111	0.010
62079	586826.300	3528371.815	16.181	0.068	0.084	0.009
62080	586825.062	3528384.734	16.164	0.077	0.094	0.010
62081	586823.777	3528397.777	16.194	0.109	0.067	0.006
62082	586822.471	3528410.673	16.200	0.077	0.094	0.010
62083	586821.250	3528423.889	16.219	0.068	0.083	0.008
62084	586820.224	3528437.028	16.296	0.134	0.083	0.008
62085	586818.800	3528449.951	16.351	0.144	0.089	0.008
62086	586817.316	3528462.845	16.295	0.151	0.093	0.009
62087	586816.298	3528475.970	16.378	0.177	0.109	0.010
62088	586815.103	3528488.894	16.448	0.144	0.089	0.008
62089	586813.963	3528501.206	16.510	0.086	0.105	0.011
62090	586812.490	3528514.305	16.597	0.077	0.095	0.010
62091	586811.504	3528524.324	16.593	0.086	0.105	0.011
62092	586810.552	3528534.473	16.649	0.068	0.084	0.009
62093	586809.513	3528544.741	16.739	0.086	0.106	0.011
62094	586807.800	3528561.119	16.865	0.165	0.100	0.009
62095	586806.730	3528571.223	16.917	0.133	0.081	0.007
62096	586805.758	3528581.562	17.041	0.184	0.111	0.010
62097	586804.950	3528591.676	17.145	0.192	0.116	0.010
62098	586804.001	3528601.904	17.262	0.198	0.120	0.010
62099	586802.972	3528612.391	17.355	0.183	0.113	0.011
62100	586802.035	3528622.564	17.468	0.082	0.100	0.010
62101	586800.959	3528632.822	17.601	0.073	0.090	0.009
62102	586800.026	3528642.952	17.696	0.097	0.120	0.012
62103	586799.004	3528653.537	17.879	0.100	0.123	0.013
62104	586797.590	3528667.867	18.045	0.091	0.112	0.011
62105	586796.599	3528678.396	18.170	0.092	0.113	0.012
62106	586795.526	3528689.267	18.348	0.068	0.095	0.010
62107	586794.479	3528699.673	18.468	0.068	0.084	0.009
62108	586793.372	3528710.379	18.657	0.102	0.112	0.010
62109	586792.293	3528721.378	18.840	0.108	0.118	0.011
62110	586791.339	3528732.190	18.990	0.102	0.113	0.010
62111	586790.349	3528743.146	19.157	0.089	0.098	0.009
62112	586789.244	3528753.597	19.349	0.090	0.099	0.009
62113	586788.281	3528764.074	19.554	0.096	0.118	0.012
62114	586787.231	3528774.400	19.781	0.082	0.101	0.010

62115	586786.045	3528784.694	19.990	0.088	0.108	0.011
62116	586785.131	3528795.194	20.160	0.094	0.116	0.012
62117	586784.029	3528805.576	20.341	0.107	0.149	0.016
62118	586782.595	3528819.048	20.609	0.243	0.152	0.014
62119	586781.524	3528829.445	20.782	0.226	0.142	0.013
62120	586780.638	3528839.599	21.039	0.261	0.164	0.015
62121	586779.663	3528849.612	21.224	0.291	0.183	0.017
62122	586778.473	3528862.742	21.507	0.284	0.178	0.017
62123	586777.553	3528872.976	21.710	0.128	0.157	0.016
62124	586776.509	3528883.184	21.879	0.147	0.181	0.019
62125	586775.524	3528893.459	22.022	0.142	0.175	0.018
62126	586774.568	3528903.692	22.237	0.133	0.164	0.017
62127	586773.521	3528914.012	22.432	0.154	0.189	0.019
62128	586772.652	3528924.009	22.616	0.135	0.167	0.017
62129	586771.616	3528934.170	22.791	0.138	0.170	0.017
62130	586770.583	3528944.499	22.962	0.140	0.173	0.018
62131	586769.645	3528954.653	23.093	0.144	0.178	0.018
62132	586768.480	3528967.786	23.322	0.145	0.179	0.018
62133	586767.346	3528981.015	23.553	0.157	0.194	0.020
62134	586766.324	3528991.111	23.691	0.101	0.142	0.015
62135	586765.453	3529001.315	23.845	0.085	0.119	0.013
62136	586764.360	3529014.599	23.993	0.070	0.098	0.010
62137	586763.359	3529024.787	24.154	0.075	0.105	0.011
62138	586762.217	3529034.905	24.302	0.084	0.118	0.013
62139	586760.997	3529047.468	24.502	0.071	0.092	0.008
62140	586759.809	3529057.577	24.618	0.076	0.098	0.009
62141	586758.712	3529067.863	24.719	0.079	0.103	0.009
62142	586757.913	3529078.043	24.863	0.103	0.134	0.012
62143	586756.925	3529088.450	24.994	0.109	0.121	0.011
62144	586755.897	3529099.010	25.184	0.117	0.129	0.012
62145	586754.923	3529109.255	25.325	0.087	0.107	0.011
62146	586753.857	3529119.766	25.460	0.091	0.113	0.012
62147	586752.830	3529130.179	25.602	0.082	0.101	0.010
62148	586751.761	3529140.990	25.730	0.074	0.092	0.009
62149	586750.801	3529151.716	25.826	0.073	0.090	0.009
62150	586749.778	3529162.380	25.977	0.082	0.115	0.012

62151	586748.623	3529172.693	26.083	0.066	0.093	0.010
62152	586747.564	3529183.130	26.182	0.073	0.103	0.011
62153	586746.623	3529193.148	26.275	0.059	0.083	0.009
62154	586745.646	3529203.192	26.453	0.066	0.093	0.010
62155	586744.677	3529213.533	26.510	0.066	0.093	0.010
62156	586743.764	3529223.898	26.644	0.059	0.082	0.009
62157	586742.579	3529234.142	26.677	0.058	0.082	0.009
62158	586741.570	3529244.156	26.767	0.065	0.080	0.008
62159	586740.415	3529254.496	26.890	0.076	0.094	0.010
62160	586739.462	3529264.594	26.955	0.070	0.087	0.009
62161	586738.361	3529274.851	27.018	0.077	0.095	0.010
62162	586737.251	3529285.558	27.106	0.081	0.100	0.010
62163	586736.220	3529295.946	27.162	0.080	0.098	0.010
62164	586735.050	3529306.254	27.202	0.073	0.103	0.011
62165	586733.931	3529319.545	27.313	0.060	0.085	0.009
62166	586732.534	3529332.958	27.419	0.065	0.092	0.010
62167	586731.649	3529342.928	27.439	0.075	0.092	0.010
62168	586730.767	3529353.053	27.489	0.067	0.083	0.009
62169	586729.736	3529363.120	27.576	0.075	0.092	0.010
62170	586728.788	3529373.384	27.610	0.088	0.109	0.011
62171	586728.099	3529383.805	27.681	0.082	0.101	0.010
62172	586726.861	3529394.152	27.750	0.093	0.115	0.012
62173	586725.930	3529404.858	27.763	0.077	0.095	0.010
62174	586725.029	3529415.204	27.827	0.075	0.106	0.011
62175	586724.029	3529425.694	27.829	0.068	0.095	0.010
62176	586722.970	3529436.290	27.887	0.086	0.122	0.013
62177	586722.022	3529446.992	27.957	0.099	0.139	0.015
62178	586720.882	3529457.628	27.997	0.074	0.105	0.011
62179	586719.758	3529468.234	28.020	0.082	0.116	0.012
62180	586718.829	3529479.246	28.100	0.083	0.118	0.013
62181	586717.568	3529489.810	28.138	0.079	0.111	0.012
62182	586716.571	3529500.227	28.151	0.074	0.105	0.011
62183	586715.835	3529510.646	28.198	0.078	0.110	0.012
62184	586714.623	3529521.356	28.268	0.071	0.100	0.011
62185	586713.650	3529531.914	28.224	0.081	0.114	0.012
62186	586712.520	3529542.446	28.255	0.070	0.099	0.011
62187	586711.658	3529553.256	28.291	0.076	0.108	0.011

62188	586710.750	3529563.792	28.236	0.077	0.102	0.009
62189	586709.741	3529574.340	28.226	0.085	0.112	0.010
62190	586708.375	3529587.976	28.259	0.066	0.087	0.008
62191	586707.289	3529598.317	28.293	0.073	0.096	0.009
62192	586706.381	3529608.790	28.317	0.083	0.110	0.010
62193	586705.201	3529619.182	28.357	0.071	0.101	0.011
62194	586704.233	3529629.290	28.380	0.071	0.101	0.011
62195	586703.158	3529639.528	28.299	0.058	0.082	0.009
62196	586701.876	3529652.401	28.297	0.057	0.080	0.009
62197	586700.843	3529662.429	28.243	0.064	0.091	0.010
62198	586699.624	3529672.762	28.247	0.064	0.091	0.010
62199	586698.655	3529683.096	28.183	0.064	0.091	0.010
62200	586697.727	3529693.302	28.176	0.071	0.101	0.011
62201	586696.299	3529709.803	28.095	0.072	0.101	0.011
62202	586695.162	3529722.678	28.109	0.072	0.102	0.011
62203	586693.805	3529735.552	28.041	0.064	0.079	0.008
62204	586692.520	3529748.662	28.016	0.081	0.100	0.010
62205	586691.551	3529758.863	27.996	0.082	0.101	0.010
62206	586690.448	3529769.187	27.922	0.073	0.090	0.009
62207	586689.391	3529779.398	27.891	0.065	0.080	0.008
62208	586687.814	3529796.064	27.776	0.071	0.101	0.011
62209	586686.809	3529806.026	27.806	0.064	0.091	0.010
62210	586685.854	3529816.236	27.742	0.071	0.101	0.011
62211	586684.910	3529826.668	27.646	0.079	0.104	0.009
62212	586684.029	3529837.523	27.660	0.070	0.093	0.008
62213	586682.838	3529848.695	27.535	0.063	0.089	0.009
62214	586681.798	3529859.906	27.486	0.070	0.100	0.011
62215	586680.866	3529870.607	27.406	0.056	0.079	0.008
62216	586679.734	3529881.710	27.403	0.071	0.100	0.011
62217	586678.796	3529892.387	27.288	0.063	0.090	0.010
62218	586677.801	3529902.857	27.227	0.063	0.090	0.010
62219	586676.470	3529917.304	27.065	0.056	0.080	0.008
62220	586675.397	3529927.718	26.993	0.071	0.100	0.011
62221	586674.459	3529938.138	26.941	0.059	0.079	0.007
62222	586672.858	3529951.992	26.843	0.063	0.090	0.010
62223	586671.848	3529962.323	26.785	0.071	0.100	0.011

62224	586670.817	3529972.582	26.654	0.067	0.075	0.007
62225	586669.622	3529983.111	26.616	0.058	0.082	0.009
62226	586668.643	3529993.663	26.500	0.056	0.079	0.008
62227	586667.185	3530007.891	26.301	0.077	0.103	0.009
62228	586666.274	3530018.373	26.257	0.060	0.079	0.007
62229	586665.373	3530028.819	26.069	0.079	0.105	0.009
62230	586664.404	3530039.119	25.988	0.061	0.081	0.007
62231	586663.564	3530049.881	25.842	0.062	0.082	0.007
62232	586662.555	3530060.521	25.806	0.082	0.092	0.008
62233	586661.586	3530071.286	25.608	0.072	0.089	0.009
62234	586660.576	3530081.719	25.501	0.063	0.090	0.010
62235	586659.373	3530092.440	25.324	0.056	0.080	0.008
62236	586658.206	3530103.345	25.215	0.080	0.098	0.010
62237	586657.091	3530114.442	25.048	0.080	0.099	0.010
62238	586655.973	3530125.337	24.934	0.072	0.089	0.009
62239	586654.876	3530136.668	24.754	0.081	0.100	0.010
62240	586653.743	3530147.566	24.606	0.073	0.090	0.009
62241	586652.815	3530158.398	24.495	0.065	0.080	0.008
62242	586651.854	3530169.506	24.301	0.073	0.091	0.009
62243	586650.847	3530180.287	24.170	0.065	0.080	0.008
62244	586649.778	3530190.936	23.962	0.065	0.081	0.008
62245	586648.870	3530201.595	23.871	0.082	0.102	0.011
62246	586647.846	3530212.027	23.734	0.083	0.102	0.011
62247	586646.863	3530222.385	23.582	0.074	0.092	0.010
62248	586645.747	3530232.624	23.410	0.074	0.092	0.010
62249	586644.749	3530242.984	23.230	0.057	0.080	0.009
62250	586643.474	3530255.332	23.076	0.079	0.100	0.011
62251	586642.503	3530265.562	22.915	0.071	0.090	0.010
62252	586641.596	3530276.117	22.741	0.080	0.101	0.011
62253	586640.480	3530286.403	22.544	0.133	0.089	0.009
62254	586639.619	3530296.664	22.385	0.121	0.081	0.008
62255	586638.551	3530307.119	22.211	0.108	0.072	0.007
62256	586637.501	3530317.518	21.995	0.112	0.075	0.007
62257	586636.490	3530327.896	21.819	0.115	0.077	0.008
62258	586635.469	3530338.188	21.633	0.074	0.092	0.010
62259	586634.470	3530348.454	21.412	0.068	0.097	0.010
62260	586633.698	3530358.618	21.223	0.066	0.081	0.009

62261	586632.122	3530372.657	20.935	0.082	0.101	0.011
62262	586631.097	3530383.008	20.721	0.073	0.090	0.009
62263	586629.922	3530396.939	20.520	0.065	0.080	0.008
62264	586628.768	3530407.359	20.274	0.065	0.080	0.008
62265	586627.692	3530417.841	20.044	0.064	0.091	0.010
62266	586626.846	3530428.119	19.886	0.071	0.101	0.011
62267	586625.738	3530438.704	19.703	0.078	0.105	0.009
62268	586624.531	3530449.029	19.535	0.069	0.077	0.007
62269	586623.553	3530459.576	19.304	0.080	0.107	0.009
62270	586622.609	3530470.209	19.098	0.062	0.083	0.007
62271	586621.506	3530480.498	18.954	0.062	0.084	0.007
62272	586620.507	3530490.940	18.822	0.094	0.106	0.009
62273	586619.546	3530500.915	18.625	0.064	0.078	0.008
62274	586618.667	3530510.913	18.483	0.081	0.100	0.010
62275	586617.683	3530521.036	18.343	0.073	0.090	0.009
62276	586616.727	3530531.704	18.157	0.065	0.080	0.008
62277	586615.861	3530541.835	17.964	0.065	0.080	0.008
62278	586614.873	3530551.974	17.859	0.071	0.101	0.011
62279	586613.917	3530562.228	17.750	0.071	0.101	0.011
62280	586612.746	3530572.649	17.623	0.057	0.081	0.009
62281	586611.790	3530582.958	17.466	0.071	0.101	0.011
62282	586610.773	3530593.230	17.330	0.064	0.091	0.010
62283	586609.677	3530604.176	17.189	0.071	0.101	0.011
62284	586608.715	3530614.949	17.070	0.057	0.081	0.009
62285	586607.680	3530625.398	16.964	0.057	0.081	0.009
62286	586606.671	3530635.889	16.869	0.073	0.089	0.009
62287	586605.621	3530646.378	16.847	0.065	0.080	0.008
62288	586604.227	3530660.522	16.709	0.069	0.078	0.007
62289	586603.147	3530671.042	16.609	0.093	0.105	0.009
62290	586602.047	3530681.688	16.482	0.094	0.106	0.009
62291	586601.036	3530692.412	16.426	0.095	0.107	0.009
62292	586599.462	3530706.400	16.361	0.072	0.097	0.008
62293	586598.610	3530716.521	16.305	0.094	0.106	0.009
62294	586597.898	3530727.205	16.294	0.081	0.100	0.011
62295	586596.736	3530737.829	16.229	0.073	0.090	0.009
62296	586595.848	3530748.614	16.209	0.082	0.101	0.011

62297	586594.768	3530759.422	16.226	0.065	0.080	0.008
62298	586593.549	3530769.942	16.174	0.082	0.101	0.011
62299	586592.447	3530780.516	16.164	0.066	0.081	0.009
62300	586591.528	3530791.095	16.163	0.128	0.088	0.009
62301	586590.408	3530801.924	16.118	0.117	0.080	0.008
62302	586589.551	3530812.935	16.103	0.121	0.083	0.008
62303	586588.261	3530824.157	16.109	0.108	0.074	0.007
62304	586587.151	3530835.153	16.091	0.111	0.076	0.008
62305	586585.851	3530846.229	16.129	0.130	0.089	0.009
62306	586584.890	3530857.079	16.130	0.119	0.079	0.007
62307	586583.853	3530867.889	16.093	0.084	0.095	0.008
62308	586583.165	3530878.452	16.118	0.105	0.070	0.006
62309	586582.108	3530889.221	16.082	0.086	0.097	0.008
62310	586581.082	3530899.953	16.070	0.075	0.085	0.007
62311	586579.861	3530910.577	16.087	0.063	0.085	0.007
62312	586578.902	3530921.618	16.096	0.057	0.081	0.009
62313	586577.834	3530932.695	16.112	0.071	0.101	0.011
62314	586576.610	3530943.741	16.117	0.057	0.081	0.009
62315	586575.356	3530954.547	16.107	0.072	0.102	0.011
62316	586574.267	3530965.678	16.097	0.065	0.092	0.010
62317	586573.485	3530976.571	16.186	0.082	0.101	0.011
62318	586572.464	3530987.326	16.154	0.113	0.078	0.008
62319	586571.579	3530998.256	16.184	0.118	0.081	0.008
62320	586570.654	3531009.423	16.194	0.105	0.073	0.007
62321	586569.680	3531020.556	16.162	0.124	0.086	0.009
62322	586568.567	3531031.648	16.176	0.127	0.088	0.009
62323	586567.628	3531042.545	16.159	0.114	0.078	0.008
62324	586566.410	3531053.474	16.144	0.147	0.102	0.010
62325	586565.202	3531064.298	16.167	0.149	0.103	0.010
62326	586564.267	3531075.074	16.184	0.135	0.093	0.009
62327	586563.356	3531085.701	16.160	0.121	0.083	0.008
62328	586562.188	3531096.341	16.127	0.138	0.095	0.010
62329	586561.152	3531107.100	16.203	0.123	0.085	0.009
62330	586560.128	3531117.551	16.116	0.075	0.094	0.010
62331	586558.999	3531128.194	16.161	0.129	0.089	0.009
62332	586558.054	3531138.928	16.082	0.124	0.083	0.007
62333	586557.073	3531149.675	16.095	0.110	0.074	0.006

62334	586555.968	3531160.570	16.077	0.152	0.102	0.009
62335	586554.725	3531171.184	16.064	0.118	0.079	0.007
62336	586553.651	3531182.145	16.026	0.159	0.107	0.009
62337	586552.470	3531192.823	16.052	0.098	0.112	0.010
62338	586551.413	3531203.799	16.060	0.072	0.102	0.011
62339	586550.243	3531214.857	16.052	0.065	0.092	0.010
62340	586549.144	3531225.900	16.104	0.057	0.081	0.009
62341	586547.954	3531236.831	16.090	0.072	0.102	0.011
62342	586546.956	3531248.067	16.089	0.072	0.102	0.011
62343	586546.036	3531259.228	16.085	0.072	0.102	0.011
62344	586544.933	3531270.276	16.102	0.058	0.082	0.009
62345	586543.773	3531281.595	16.081	0.066	0.093	0.010
62346	586542.730	3531292.803	16.082	0.060	0.081	0.007
62347	586541.677	3531304.436	16.133	0.079	0.108	0.009
62348	586540.449	3531315.836	16.115	0.080	0.109	0.009
62349	586539.528	3531327.436	16.103	0.072	0.097	0.008
62350	586538.476	3531338.823	16.145	0.082	0.111	0.010
62351	586537.454	3531349.791	16.129	0.064	0.086	0.007
62352	586536.549	3531360.977	16.122	0.073	0.104	0.011
62353	586535.369	3531371.900	16.162	0.073	0.104	0.011
62354	586534.314	3531383.139	16.141	0.081	0.102	0.011
62355	586533.137	3531394.272	16.162	0.073	0.092	0.010
62356	586532.056	3531405.515	16.146	0.082	0.103	0.011
62357	586530.832	3531417.009	16.146	0.113	0.079	0.008
62358	586529.713	3531428.593	16.116	0.117	0.082	0.008
62359	586528.735	3531439.856	16.141	0.105	0.073	0.007
62360	586527.633	3531451.261	16.133	0.123	0.086	0.009
62361	586526.480	3531462.591	16.124	0.126	0.088	0.009
62362	586525.457	3531473.928	16.134	0.128	0.090	0.009
62363	586524.321	3531485.170	16.101	0.087	0.106	0.011
62364	586523.318	3531496.384	16.104	0.087	0.106	0.011
62365	586522.203	3531507.703	16.072	0.070	0.086	0.009
62366	586521.010	3531518.845	16.052	0.074	0.084	0.007
62367	586519.661	3531530.072	16.081	0.075	0.085	0.007
62368	586518.688	3531540.907	16.075	0.081	0.110	0.010
62369	586517.672	3531551.627	16.081	0.083	0.095	0.008

62370	586516.522	3531562.588	16.104	0.086	0.098	0.008
62371	586515.530	3531573.055	16.067	0.075	0.086	0.007
62372	586514.643	3531583.564	16.088	0.087	0.099	0.009
62373	586513.386	3531594.225	16.105	0.077	0.088	0.008
62374	586512.474	3531605.483	16.057	0.078	0.088	0.008
62375	586511.397	3531616.179	16.022	0.075	0.102	0.009
62376	586510.503	3531626.627	16.001	0.085	0.116	0.010
62377	586509.497	3531637.333	16.056	0.067	0.091	0.008
62378	586508.474	3531647.697	16.066	0.076	0.093	0.010
62379	586507.372	3531658.483	16.027	0.099	0.070	0.007
62380	586506.282	3531669.121	16.050	0.133	0.094	0.010
62381	586505.463	3531680.128	16.046	0.060	0.085	0.009
62382	586504.560	3531690.811	16.055	0.060	0.085	0.009
62383	586503.614	3531701.572	16.073	0.060	0.085	0.009
62384	586502.485	3531712.564	16.050	0.082	0.104	0.011
62385	586501.434	3531723.747	16.043	0.127	0.090	0.009
62386	586500.338	3531734.884	16.048	0.131	0.093	0.009
62387	586499.375	3531745.914	16.055	0.134	0.095	0.010
62388	586498.228	3531756.893	16.110	0.137	0.097	0.010
62389	586496.946	3531768.022	16.071	0.140	0.099	0.010
62390	586495.907	3531778.928	16.043	0.127	0.090	0.009
62391	586494.890	3531789.789	16.074	0.129	0.092	0.009
62392	586493.589	3531801.295	16.017	0.116	0.082	0.008
62393	586492.691	3531812.590	16.029	0.148	0.105	0.011
62394	586491.559	3531824.126	16.072	0.134	0.095	0.010
62395	586490.579	3531834.895	16.093	0.150	0.107	0.011
62396	586489.525	3531845.548	16.081	0.151	0.108	0.011
62397	586488.452	3531856.131	16.069	0.083	0.105	0.011
62398	586487.533	3531866.918	16.084	0.067	0.085	0.009
62399	586486.017	3531881.213	16.073	0.139	0.097	0.008
62400	586484.980	3531892.119	16.085	0.090	0.117	0.010
62401	586483.969	3531903.046	16.129	0.107	0.139	0.012
62402	586482.917	3531913.725	16.109	0.151	0.105	0.009
62403	586481.895	3531924.583	16.127	0.138	0.096	0.008
62404	586480.822	3531935.350	16.095	0.162	0.113	0.010
62405	586479.276	3531949.833	16.123	0.132	0.094	0.010
62406	586477.812	3531964.680	16.142	0.130	0.093	0.010

62407	586476.410	3531979.456	16.087	0.145	0.104	0.011
62408	586475.387	3531990.455	16.113	0.146	0.105	0.011
62409	586474.334	3532001.226	16.118	0.076	0.092	0.010
62410	586473.335	3532012.261	16.145	0.072	0.088	0.010
62411	586472.156	3532023.490	16.123	0.089	0.109	0.012
62412	586471.072	3532034.602	16.058	0.089	0.109	0.012
62413	586469.955	3532045.876	16.086	0.082	0.100	0.011
62414	586468.986	3532057.157	16.039	0.068	0.096	0.010
62415	586467.951	3532068.158	16.034	0.068	0.096	0.010
62416	586466.664	3532079.072	16.050	0.061	0.086	0.009
62417	586465.484	3532092.051	16.047	0.067	0.084	0.009
62418	586464.107	3532104.481	16.083	0.112	0.080	0.008
62419	586463.207	3532114.446	16.120	0.131	0.094	0.010
62420	586462.169	3532125.619	16.076	0.120	0.087	0.009
62421	586461.220	3532136.969	16.101	0.080	0.097	0.011
62422	586459.886	3532149.497	16.069	0.116	0.084	0.009
62423	586458.591	3532162.483	16.052	0.105	0.076	0.008
62424	586457.445	3532175.782	16.065	0.068	0.085	0.009
62425	586456.449	3532185.882	16.102	0.128	0.093	0.010
62426	586455.314	3532196.595	16.077	0.084	0.106	0.011
62427	586454.315	3532207.335	16.055	0.075	0.106	0.011
62428	586453.135	3532218.110	16.058	0.068	0.083	0.009
62429	586452.024	3532229.205	16.087	0.086	0.104	0.011
62430	586450.930	3532240.276	16.108	0.086	0.105	0.011
62431	586449.779	3532251.196	16.086	0.078	0.095	0.010
62432	586448.832	3532262.215	16.074	0.087	0.106	0.011
62433	586447.769	3532273.540	16.055	0.079	0.096	0.010
62434	586446.665	3532284.708	16.072	0.061	0.085	0.009
62435	586445.553	3532295.795	16.085	0.061	0.085	0.009
62436	586444.612	3532306.681	16.056	0.068	0.095	0.010
62437	586443.519	3532317.771	16.047	0.075	0.106	0.011
62438	586442.475	3532328.729	16.024	0.075	0.106	0.011
62439	586441.477	3532339.346	16.043	0.068	0.096	0.010
62440	586440.378	3532349.608	16.048	0.061	0.085	0.009
62441	586439.088	3532360.903	16.001	0.061	0.086	0.009

APPENDIX D

Control Survey Listing MVRM Calibration Site - Dist. 02

East bound I-10 bridge at Lake Pontchartrain

Date & Time 5/18/2014 7:05 AM

Coordinate System U.S. State Plane 1983 **Zone** Louisiana South 1702

Project Datum (NAD 83) **Vertical Datum** (NAVD 88) **Geoid Model** GEOID12A

Coordinate Unit U.S. Survey Foot **Distance Unit** U.S. Survey Foot **Height Unit** U.S. Survey Foot

Figure 40
MVRM Control – 02 East bound I-10 bridge at Lake Pontchartrain

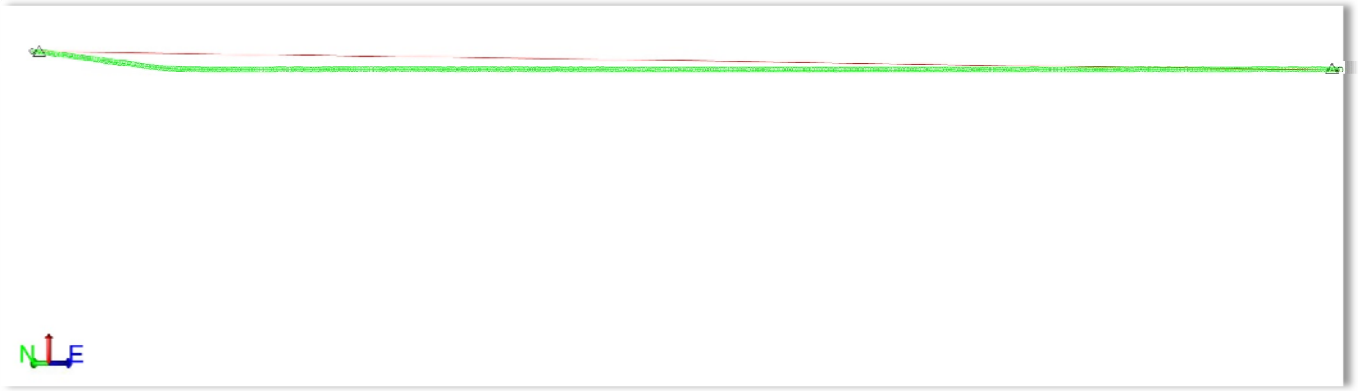


Figure 41
MVRM Control – 02 Profile 10 X vertical

Point ID	Northing	Easting	Elevation	H Prc	V Prc	RMS
0201	574331.44	3575259.24	26.11	0.06	0.06	0.01
0202	570965.92	3579658.05	18.25	0.05	0.06	0.01
02001	574331.62	3575259.10	26.09	0.13	0.15	0.02
02002	574325.03	3575267.27	26.02	0.12	0.14	0.02
02003	574317.92	3575276.89	25.89	0.13	0.15	0.02
02004	574310.53	3575286.25	25.73	0.12	0.14	0.02
02005	574302.88	3575296.44	25.57	0.11	0.13	0.02
02006	574295.07	3575306.69	25.38	0.12	0.14	0.02
02007	574287.05	3575317.22	25.27	0.13	0.15	0.02
02008	574279.20	3575327.27	25.07	0.13	0.15	0.02
02009	574272.77	3575335.43	24.94	0.11	0.13	0.02
02010	574266.21	3575343.79	24.84	0.12	0.14	0.02
02011	574258.75	3575354.43	24.63	0.12	0.14	0.02
02012	574250.87	3575364.84	24.44	0.12	0.14	0.02
02013	574244.65	3575372.79	24.34	0.12	0.13	0.02
02014	574236.47	3575383.31	24.16	0.12	0.13	0.02
02015	574228.32	3575393.92	24.03	0.12	0.14	0.02
02016	574222.03	3575402.09	23.80	0.12	0.14	0.02
02017	574215.92	3575410.45	23.68	0.12	0.13	0.02
02018	574209.28	3575418.89	23.53	0.13	0.15	0.02
02019	574203.11	3575427.25	23.38	0.13	0.15	0.02
02020	574196.58	3575435.42	23.22	0.12	0.14	0.02
02021	574190.17	3575443.91	23.09	0.13	0.15	0.02
02022	574184.16	3575451.94	22.97	0.13	0.15	0.02
02023	574175.59	3575463.28	22.77	0.13	0.15	0.02
02024	574168.87	3575471.97	22.63	0.13	0.14	0.02
02025	574162.22	3575480.42	22.51	0.13	0.15	0.02
02026	574154.72	3575490.21	22.41	0.12	0.14	0.02
02027	574147.90	3575498.86	22.17	0.12	0.14	0.02
02028	574140.78	3575508.07	22.03	0.12	0.14	0.02
02029	574134.38	3575516.21	21.87	0.13	0.14	0.02
02030	574127.33	3575525.33	21.71	0.12	0.14	0.02
02031	574120.84	3575533.83	21.58	0.13	0.15	0.02
02032	574112.84	3575544.30	21.42	0.12	0.14	0.02
02033	574106.51	3575552.51	21.28	0.13	0.15	0.02
02034	574100.10	3575561.27	21.11	0.12	0.14	0.02

02035	574093.67	3575569.69	21.00	0.13	0.15	0.02
02036	574087.14	3575578.45	20.83	0.12	0.14	0.02
02037	574080.19	3575587.09	20.71	0.12	0.14	0.02
02038	574073.38	3575595.64	20.52	0.12	0.14	0.02
02039	574064.12	3575607.55	20.34	0.13	0.15	0.02
02040	574056.77	3575616.89	20.15	0.13	0.15	0.02
02041	574050.09	3575625.86	19.98	0.12	0.14	0.02
02042	574043.12	3575634.89	19.81	0.12	0.14	0.02
02043	574033.60	3575647.35	19.67	0.12	0.14	0.02
02044	574026.29	3575656.79	19.54	0.13	0.15	0.02
02045	574019.28	3575665.66	19.48	0.16	0.16	0.02
02046	574012.34	3575674.79	19.35	0.13	0.16	0.02
02047	574005.75	3575683.55	19.23	0.13	0.15	0.02
02048	573998.74	3575692.66	19.09	0.13	0.15	0.02
02049	573991.93	3575701.77	19.02	0.13	0.15	0.02
02050	573985.22	3575710.74	18.93	0.13	0.16	0.02
02051	573978.60	3575719.39	18.83	0.13	0.16	0.02
02052	573971.77	3575728.28	18.78	0.12	0.14	0.02
02053	573965.36	3575736.55	18.73	0.13	0.15	0.02
02054	573958.30	3575745.68	18.67	0.14	0.16	0.02
02055	573951.24	3575755.08	18.60	0.14	0.16	0.02
02056	573944.37	3575764.45	18.60	0.13	0.16	0.02
02057	573937.31	3575773.58	18.54	0.13	0.15	0.02
02058	573930.44	3575782.59	18.47	0.14	0.16	0.02
02059	573922.87	3575792.17	18.45	0.13	0.15	0.02
02060	573916.30	3575801.25	18.43	0.13	0.15	0.02
02061	573909.17	3575810.39	18.41	0.14	0.16	0.02
02062	573902.17	3575819.38	18.39	0.14	0.16	0.02
02063	573895.35	3575828.47	18.35	0.13	0.15	0.02
02064	573888.28	3575837.64	18.36	0.13	0.15	0.02
02065	573881.28	3575847.03	18.34	0.13	0.15	0.02
02066	573874.22	3575856.21	18.32	0.13	0.16	0.02
02067	573866.98	3575865.43	18.31	0.13	0.15	0.02
02068	573859.85	3575874.74	18.33	0.13	0.15	0.02
02069	573852.70	3575883.96	18.32	0.14	0.16	0.02
02070	573845.46	3575893.35	18.32	0.14	0.16	0.02

02071	573838.43	3575902.76	18.31	0.13	0.15	0.02
02072	573831.33	3575912.31	18.30	0.13	0.15	0.02
02073	573824.23	3575921.42	18.31	0.13	0.15	0.02
02074	573817.10	3575930.62	18.31	0.12	0.14	0.02
02075	573810.28	3575939.70	18.33	0.14	0.16	0.02
02076	573803.17	3575949.17	18.29	0.14	0.16	0.02
02077	573795.57	3575958.80	18.30	0.14	0.16	0.02
02078	573788.09	3575968.43	18.32	0.12	0.14	0.02
02079	573780.71	3575977.87	18.29	0.14	0.16	0.02
02080	573773.51	3575987.54	18.31	0.13	0.15	0.02
02081	573766.34	3575997.02	18.32	0.12	0.15	0.02
02082	573759.12	3576006.38	18.33	0.14	0.16	0.02
02083	573751.93	3576015.68	18.32	0.12	0.14	0.02
02084	573742.47	3576028.20	18.36	0.14	0.16	0.02
02085	573733.11	3576040.41	18.33	0.14	0.16	0.02
02086	573723.84	3576052.55	18.31	0.13	0.15	0.02
02087	573716.81	3576061.78	18.36	0.14	0.16	0.02
02088	573709.64	3576071.44	18.36	0.12	0.14	0.02
02089	573702.68	3576079.97	18.38	0.14	0.16	0.02
02090	573695.37	3576089.44	18.39	0.13	0.16	0.02
02091	573687.88	3576099.18	18.40	0.12	0.14	0.02
02092	573680.23	3576109.23	18.39	0.13	0.16	0.02
02093	573670.43	3576122.16	18.37	0.13	0.15	0.02
02094	573663.14	3576131.78	18.36	0.13	0.15	0.02
02095	573656.16	3576141.28	18.40	0.13	0.15	0.02
02096	573649.01	3576150.62	18.41	0.12	0.14	0.02
02097	573641.58	3576160.44	18.38	0.12	0.14	0.02
02098	573634.18	3576170.01	18.36	0.12	0.14	0.02
02099	573626.50	3576179.85	18.36	0.12	0.14	0.01
02100	573619.19	3576189.27	18.37	0.13	0.16	0.01
02101	573611.72	3576198.59	18.36	0.14	0.17	0.02
02102	573603.48	3576209.29	18.36	0.13	0.16	0.01
02103	573596.50	3576218.62	18.33	0.13	0.16	0.01
02104	573589.48	3576227.76	18.37	0.13	0.15	0.01
02105	573582.13	3576237.17	18.38	0.13	0.15	0.01
02106	573575.46	3576246.44	18.37	0.14	0.16	0.01
02107	573568.57	3576255.56	18.38	0.13	0.15	0.01

02108	573561.45	3576264.96	18.36	0.13	0.15	0.01
02109	573554.38	3576273.85	18.39	0.14	0.16	0.01
02110	573547.42	3576282.74	18.38	0.14	0.16	0.01
02111	573540.48	3576291.77	18.41	0.13	0.15	0.01
02112	573534.00	3576300.58	18.41	0.14	0.17	0.01
02113	573527.03	3576309.75	18.38	0.14	0.17	0.01
02114	573520.13	3576318.99	18.39	0.14	0.17	0.01
02115	573512.94	3576328.57	18.40	0.15	0.18	0.02
02116	573505.80	3576337.90	18.39	0.15	0.18	0.02
02117	573498.56	3576347.14	18.42	0.14	0.17	0.01
02118	573491.30	3576356.61	18.42	0.16	0.24	0.01
02119	573482.19	3576368.61	18.44	0.13	0.16	0.01
02120	573475.24	3576377.98	18.40	0.14	0.17	0.02
02121	573468.31	3576387.10	18.43	0.14	0.17	0.02
02122	573458.79	3576399.39	18.40	0.14	0.17	0.02
02123	573448.70	3576411.97	18.40	0.14	0.17	0.02
02124	573441.66	3576421.38	18.43	0.14	0.17	0.02
02125	573434.45	3576431.00	18.39	0.13	0.16	0.01
02126	573427.22	3576440.48	18.35	0.12	0.14	0.01
02127	573419.79	3576449.94	18.39	0.12	0.14	0.01
02128	573412.41	3576459.70	18.41	0.14	0.17	0.02
02129	573404.99	3576469.33	18.38	0.13	0.16	0.01
02130	573397.67	3576478.86	18.42	0.14	0.17	0.02
02131	573390.42	3576488.32	18.42	0.14	0.16	0.01
02132	573382.86	3576497.54	18.37	0.13	0.15	0.01
02133	573375.64	3576507.22	18.43	0.15	0.17	0.02
02134	573368.32	3576517.04	18.42	0.14	0.16	0.01
02135	573360.82	3576526.70	18.43	0.13	0.15	0.01
02136	573353.65	3576536.67	18.37	0.13	0.15	0.01
02137	573346.39	3576546.13	18.42	0.15	0.18	0.02
02138	573339.35	3576555.53	18.43	0.14	0.16	0.01
02139	573332.18	3576565.34	18.41	0.14	0.16	0.01
02140	573324.78	3576574.64	18.41	0.14	0.17	0.01
02141	573317.50	3576584.16	18.44	0.14	0.16	0.01
02142	573310.04	3576593.44	18.44	0.15	0.18	0.02
02143	573302.86	3576602.81	18.40	0.14	0.16	0.01

02144	573295.79	3576612.25	18.38	0.15	0.17	0.02
02145	573288.57	3576621.64	18.40	0.13	0.15	0.01
02146	573281.19	3576631.05	18.37	0.15	0.18	0.02
02147	573274.09	3576640.30	18.37	0.15	0.18	0.02
02148	573266.92	3576649.39	18.37	0.15	0.18	0.02
02149	573260.03	3576658.82	18.39	0.13	0.15	0.01
02150	573253.25	3576667.91	18.43	0.13	0.15	0.01
02151	573245.95	3576677.33	18.39	0.14	0.17	0.01
02152	573238.81	3576687.07	18.37	0.13	0.15	0.01
02153	573231.54	3576696.38	18.37	0.13	0.15	0.01
02154	573224.27	3576706.05	18.38	0.14	0.16	0.01
02155	573217.04	3576715.39	18.43	0.14	0.16	0.01
02156	573209.77	3576724.78	18.36	0.15	0.18	0.02
02157	573202.68	3576734.08	18.39	0.15	0.18	0.02
02158	573195.74	3576743.24	18.38	0.14	0.17	0.01
02159	573188.97	3576752.20	18.38	0.14	0.17	0.01
02160	573181.92	3576761.36	18.37	0.14	0.17	0.01
02161	573174.33	3576770.62	18.40	0.15	0.18	0.02
02162	573166.92	3576780.29	18.39	0.14	0.16	0.01
02163	573159.68	3576789.89	18.38	0.13	0.15	0.01
02164	573152.23	3576799.35	18.41	0.13	0.15	0.01
02165	573144.83	3576808.97	18.40	0.15	0.18	0.02
02166	573137.26	3576818.73	18.41	0.15	0.18	0.02
02167	573129.77	3576828.69	18.35	0.15	0.18	0.02
02168	573122.43	3576838.15	18.42	0.15	0.18	0.02
02169	573115.10	3576847.90	18.37	0.15	0.18	0.02
02170	573107.74	3576856.96	18.41	0.14	0.17	0.01
02171	573100.54	3576866.36	18.35	0.15	0.18	0.02
02172	573093.25	3576876.07	18.40	0.15	0.18	0.02
02173	573085.95	3576885.42	18.41	0.15	0.18	0.02
02174	573078.54	3576895.01	18.38	0.15	0.17	0.02
02175	573071.38	3576904.38	18.40	0.14	0.16	0.01
02176	573064.17	3576913.74	18.35	0.14	0.16	0.01
02177	573057.52	3576922.09	18.38	0.13	0.15	0.01
02178	573050.02	3576932.56	18.35	0.13	0.16	0.01
02179	573043.66	3576941.21	18.37	0.14	0.17	0.02
02180	573037.28	3576949.87	18.35	0.13	0.15	0.01

02181	573030.64	3576958.42	18.39	0.12	0.14	0.01
02182	573023.99	3576967.25	18.34	0.12	0.14	0.01
02183	573017.05	3576976.06	18.36	0.13	0.15	0.01
02184	573010.15	3576985.38	18.35	0.12	0.14	0.01
02185	573003.32	3576994.55	18.35	0.13	0.15	0.01
02186	572996.32	3577003.81	18.33	0.12	0.14	0.01
02187	572989.09	3577012.80	18.38	0.14	0.16	0.01
02188	572981.96	3577022.18	18.39	0.13	0.15	0.01
02189	572975.09	3577031.42	18.38	0.12	0.14	0.01
02190	572967.94	3577040.55	18.37	0.14	0.16	0.01
02191	572960.41	3577050.05	18.36	0.14	0.16	0.01
02192	572953.32	3577059.41	18.36	0.13	0.16	0.01
02193	572946.31	3577068.62	18.38	0.14	0.17	0.02
02194	572939.41	3577077.59	18.37	0.14	0.16	0.01
02195	572932.52	3577086.53	18.35	0.13	0.15	0.01
02196	572925.30	3577095.94	18.33	0.14	0.17	0.02
02197	572918.44	3577105.21	18.38	0.12	0.14	0.01
02198	572911.75	3577114.16	18.33	0.12	0.14	0.01
02199	572905.05	3577123.12	18.36	0.14	0.17	0.02
02200	572898.31	3577131.78	18.33	0.12	0.14	0.01
02201	572891.52	3577141.06	18.34	0.14	0.17	0.02
02202	572884.96	3577150.10	18.34	0.13	0.16	0.01
02203	572878.22	3577159.01	18.37	0.15	0.17	0.02
02204	572871.54	3577167.57	18.34	0.14	0.16	0.01
02205	572864.76	3577176.37	18.38	0.15	0.17	0.02
02206	572857.98	3577185.19	18.36	0.15	0.17	0.02
02207	572851.08	3577194.02	18.34	0.15	0.17	0.02
02208	572843.98	3577203.10	18.32	0.13	0.15	0.01
02209	572837.01	3577212.02	18.34	0.13	0.15	0.01
02210	572830.18	3577220.98	18.33	0.14	0.16	0.01
02211	572823.31	3577229.79	18.31	0.12	0.15	0.01
02212	572816.68	3577238.55	18.27	0.12	0.15	0.01
02213	572810.00	3577247.51	18.31	0.13	0.15	0.01
02214	572803.27	3577256.02	18.24	0.14	0.16	0.01
02215	572796.36	3577265.08	18.27	0.14	0.16	0.01
02216	572789.47	3577273.97	18.25	0.14	0.16	0.01

02217	572782.25	3577283.13	18.32	0.14	0.16	0.01
02218	572774.80	3577292.62	18.28	0.14	0.16	0.01
02219	572767.64	3577301.88	18.27	0.15	0.17	0.02
02220	572760.50	3577311.01	18.30	0.15	0.17	0.02
02221	572753.14	3577320.35	18.24	0.14	0.16	0.01
02222	572746.38	3577329.59	18.27	0.12	0.14	0.01
02223	572739.17	3577339.06	18.28	0.12	0.15	0.01
02224	572732.81	3577347.42	18.28	0.12	0.14	0.01
02225	572726.40	3577356.12	18.32	0.14	0.17	0.02
02226	572719.82	3577364.79	18.32	0.13	0.15	0.01
02227	572713.51	3577373.02	18.29	0.13	0.15	0.01
02228	572707.14	3577381.48	18.27	0.13	0.15	0.01
02229	572700.52	3577390.09	18.27	0.15	0.17	0.02
02230	572693.86	3577398.93	18.25	0.15	0.17	0.02
02231	572687.63	3577407.29	18.29	0.12	0.15	0.01
02232	572680.97	3577415.73	18.31	0.12	0.15	0.01
02233	572674.44	3577425.03	18.27	0.12	0.14	0.01
02234	572667.71	3577433.97	18.29	0.13	0.15	0.01
02235	572660.60	3577443.09	18.27	0.12	0.14	0.01
02236	572653.66	3577452.27	18.27	0.12	0.15	0.01
02237	572646.87	3577461.23	18.28	0.12	0.15	0.01
02238	572640.30	3577470.04	18.26	0.14	0.16	0.01
02239	572633.43	3577478.70	18.26	0.13	0.15	0.01
02240	572626.58	3577487.33	18.31	0.14	0.16	0.01
02241	572619.64	3577496.31	18.32	0.15	0.17	0.02
02242	572612.62	3577505.41	18.32	0.13	0.15	0.01
02243	572605.90	3577514.20	18.29	0.13	0.15	0.01
02244	572599.22	3577522.71	18.27	0.15	0.18	0.02
02245	572592.26	3577531.14	18.27	0.13	0.15	0.01
02246	572585.83	3577539.51	18.30	0.13	0.15	0.01
02247	572579.17	3577548.23	18.25	0.13	0.15	0.01
02248	572572.52	3577557.20	18.25	0.15	0.18	0.02
02249	572565.30	3577566.47	18.22	0.15	0.18	0.02
02250	572558.18	3577575.71	18.21	0.13	0.15	0.01
02251	572551.22	3577584.53	18.23	0.14	0.17	0.02
02252	572543.96	3577593.57	18.24	0.13	0.15	0.01
02253	572534.49	3577605.63	18.22	0.14	0.17	0.02

02254	572527.32	3577614.77	18.23	0.14	0.17	0.02
02255	572520.50	3577624.01	18.25	0.13	0.15	0.01
02256	572511.38	3577635.94	18.24	0.13	0.15	0.01
02257	572504.81	3577644.79	18.27	0.14	0.16	0.01
02258	572497.83	3577653.97	18.28	0.13	0.15	0.01
02259	572490.95	3577663.50	18.25	0.14	0.16	0.01
02260	572483.87	3577673.04	18.29	0.15	0.17	0.02
02261	572476.66	3577682.63	18.25	0.15	0.18	0.02
02262	572469.77	3577691.83	18.26	0.14	0.16	0.01
02263	572462.63	3577700.93	18.27	0.15	0.17	0.02
02264	572455.61	3577710.04	18.27	0.13	0.15	0.01
02265	572448.74	3577718.82	18.30	0.13	0.15	0.01
02266	572442.19	3577727.41	18.30	0.13	0.15	0.01
02267	572435.74	3577735.69	18.27	0.15	0.17	0.02
02268	572427.99	3577745.88	18.27	0.14	0.16	0.01
02269	572420.65	3577755.07	18.24	0.15	0.17	0.02
02270	572414.30	3577763.20	18.24	0.15	0.17	0.02
02271	572407.95	3577771.83	18.22	0.13	0.15	0.01
02272	572401.45	3577780.56	18.26	0.13	0.15	0.01
02273	572394.71	3577789.09	18.25	0.15	0.17	0.02
02274	572387.76	3577797.73	18.28	0.14	0.16	0.01
02275	572380.83	3577806.88	18.23	0.15	0.17	0.02
02276	572374.05	3577815.77	18.23	0.13	0.15	0.01
02277	572367.32	3577824.91	18.23	0.15	0.17	0.02
02278	572360.36	3577833.96	18.27	0.15	0.17	0.02
02279	572353.41	3577843.37	18.24	0.14	0.16	0.01
02280	572346.72	3577852.37	18.25	0.13	0.15	0.01
02281	572339.75	3577861.86	18.23	0.14	0.16	0.01
02282	572332.75	3577871.14	18.19	0.14	0.17	0.02
02283	572325.80	3577880.55	18.23	0.13	0.15	0.01
02284	572318.91	3577889.76	18.25	0.13	0.15	0.01
02285	572312.14	3577898.35	18.22	0.13	0.15	0.01
02286	572305.60	3577907.25	18.24	0.15	0.17	0.02
02287	572298.44	3577916.23	18.25	0.12	0.14	0.01
02288	572291.56	3577925.43	18.27	0.14	0.16	0.02
02289	572284.42	3577934.65	18.25	0.12	0.14	0.01

02290	572277.32	3577943.94	18.28	0.14	0.16	0.02
02291	572270.26	3577953.05	18.26	0.14	0.16	0.01
02292	572262.86	3577962.43	18.20	0.14	0.16	0.02
02293	572255.73	3577972.05	18.23	0.13	0.15	0.01
02294	572248.56	3577981.50	18.24	0.13	0.15	0.01
02295	572241.34	3577990.60	18.23	0.12	0.14	0.01
02296	572234.25	3577999.63	18.27	0.14	0.17	0.02
02297	572227.14	3578008.60	18.24	0.13	0.15	0.01
02298	572220.25	3578017.69	18.21	0.13	0.15	0.01
02299	572213.44	3578026.62	18.23	0.14	0.16	0.02
02300	572206.59	3578035.69	18.25	0.13	0.15	0.01
02301	572199.63	3578044.60	18.24	0.13	0.15	0.01
02302	572192.41	3578053.95	18.25	0.12	0.14	0.01
02303	572185.79	3578062.82	18.26	0.11	0.13	0.01
02304	572179.63	3578070.95	18.21	0.10	0.12	0.01
02305	572172.95	3578079.59	18.22	0.11	0.13	0.01
02306	572165.88	3578088.47	18.24	0.12	0.14	0.01
02307	572158.88	3578097.30	18.21	0.12	0.14	0.01
02308	572152.19	3578106.19	18.25	0.12	0.14	0.01
02309	572145.40	3578114.98	18.23	0.10	0.11	0.01
02310	572138.63	3578123.82	18.25	0.12	0.14	0.01
02311	572131.82	3578132.86	18.25	0.10	0.12	0.01
02312	572125.29	3578141.69	18.26	0.10	0.12	0.01
02313	572115.79	3578153.67	18.22	0.11	0.13	0.01
02314	572108.58	3578162.83	18.23	0.10	0.11	0.01
02315	572101.34	3578172.07	18.24	0.11	0.13	0.01
02316	572094.18	3578181.26	18.22	0.12	0.14	0.01
02317	572087.10	3578190.29	18.23	0.11	0.13	0.01
02318	572080.10	3578200.19	18.24	0.10	0.11	0.01
02319	572072.95	3578210.40	18.21	0.11	0.12	0.01
02320	572065.47	3578220.16	18.24	0.12	0.13	0.01
02321	572058.39	3578229.67	18.26	0.11	0.12	0.01
02322	572050.99	3578239.15	18.25	0.12	0.14	0.01
02323	572044.04	3578248.35	18.27	0.10	0.12	0.01
02324	572036.96	3578257.48	18.28	0.11	0.13	0.01
02325	572029.81	3578267.04	18.32	0.10	0.12	0.01
02326	572022.56	3578276.93	18.27	0.12	0.13	0.01

02327	572015.28	3578286.46	18.26	0.11	0.12	0.01
02328	572008.03	3578296.17	18.27	0.11	0.12	0.01
02329	572000.79	3578305.30	18.27	0.11	0.13	0.01
02330	571993.44	3578314.74	18.26	0.11	0.13	0.01
02331	571985.93	3578324.35	18.30	0.11	0.13	0.01
02332	571978.62	3578333.73	18.31	0.12	0.14	0.01
02333	571971.36	3578343.16	18.31	0.12	0.14	0.01
02334	571964.32	3578352.75	18.29	0.10	0.12	0.01
02335	571957.23	3578362.17	18.29	0.12	0.14	0.01
02336	571949.63	3578371.84	18.26	0.12	0.14	0.01
02337	571942.14	3578381.52	18.25	0.12	0.14	0.01
02338	571934.74	3578391.11	18.28	0.12	0.14	0.01
02339	571927.34	3578400.32	18.26	0.12	0.14	0.01
02340	571920.12	3578409.73	18.32	0.12	0.14	0.01
02341	571912.96	3578419.28	18.30	0.11	0.13	0.01
02342	571905.76	3578428.62	18.27	0.11	0.12	0.01
02343	571898.59	3578437.73	18.31	0.11	0.12	0.01
02344	571891.74	3578446.60	18.31	0.13	0.15	0.01
02345	571884.73	3578456.10	18.32	0.12	0.13	0.01
02346	571878.00	3578465.16	18.34	0.13	0.15	0.01
02347	571870.85	3578474.43	18.31	0.12	0.13	0.01
02348	571861.45	3578486.75	18.33	0.11	0.13	0.01
02349	571851.92	3578499.12	18.34	0.11	0.13	0.01
02350	571844.79	3578508.55	18.34	0.14	0.16	0.01
02351	571837.75	3578517.89	18.36	0.11	0.13	0.01
02352	571830.50	3578527.17	18.33	0.11	0.13	0.01
02353	571823.54	3578536.00	18.29	0.13	0.15	0.01
02354	571816.59	3578545.34	18.28	0.13	0.15	0.01
02355	571809.18	3578554.77	18.31	0.12	0.13	0.01
02356	571801.85	3578564.15	18.28	0.11	0.13	0.01
02357	571794.62	3578573.58	18.28	0.12	0.13	0.01
02358	571787.55	3578582.81	18.33	0.12	0.14	0.01
02359	571779.97	3578592.09	18.31	0.12	0.14	0.01
02360	571772.56	3578601.85	18.36	0.13	0.15	0.01
02361	571765.51	3578611.66	18.36	0.13	0.15	0.01
02362	571758.62	3578621.35	18.39	0.12	0.14	0.01

02363	571751.51	3578630.77	18.40	0.12	0.13	0.01
02364	571744.33	3578640.50	18.38	0.12	0.14	0.01
02365	571736.99	3578650.11	18.34	0.13	0.15	0.01
02366	571729.51	3578659.84	18.36	0.13	0.15	0.01
02367	571722.04	3578669.29	18.34	0.13	0.15	0.01
02368	571715.97	3578677.29	18.30	0.11	0.13	0.01
02369	571705.84	3578690.98	18.29	0.13	0.15	0.01
02370	571696.87	3578702.43	18.30	0.12	0.14	0.01
02371	571687.88	3578714.19	18.29	0.12	0.13	0.01
02372	571678.96	3578725.76	18.34	0.13	0.15	0.01
02373	571669.73	3578738.01	18.33	0.13	0.14	0.01
02374	571662.56	3578747.44	18.36	0.13	0.15	0.01
02375	571655.43	3578756.62	18.31	0.15	0.17	0.02
02376	571646.03	3578768.78	18.32	0.14	0.16	0.02
02377	571639.05	3578777.98	18.32	0.14	0.16	0.02
02378	571632.21	3578787.12	18.27	0.14	0.16	0.02
02379	571625.33	3578796.31	18.30	0.13	0.15	0.01
02380	571618.28	3578805.69	18.29	0.13	0.15	0.01
02381	571611.11	3578815.14	18.30	0.13	0.15	0.01
02382	571604.00	3578824.35	18.32	0.15	0.17	0.02
02383	571597.23	3578833.55	18.34	0.15	0.17	0.02
02384	571589.95	3578842.94	18.31	0.14	0.15	0.01
02385	571582.90	3578852.24	18.33	0.12	0.14	0.01
02386	571575.76	3578861.33	18.34	0.15	0.17	0.02
02387	571568.60	3578870.52	18.31	0.14	0.16	0.02
02388	571561.36	3578879.80	18.36	0.15	0.17	0.02
02389	571554.37	3578889.31	18.37	0.14	0.16	0.01
02390	571547.33	3578898.29	18.35	0.12	0.14	0.01
02391	571540.35	3578907.43	18.32	0.12	0.14	0.01
02392	571533.29	3578916.36	18.37	0.13	0.15	0.01
02393	571525.98	3578925.50	18.40	0.14	0.21	0.01
02394	571519.66	3578934.11	18.27	0.15	0.23	0.01
02395	571512.92	3578942.91	18.31	0.18	0.27	0.01
02396	571506.07	3578951.78	18.30	0.17	0.26	0.01
02397	571498.96	3578960.93	18.27	0.20	0.30	0.01
02398	571491.98	3578969.92	18.38	0.18	0.27	0.01
02399	571485.10	3578978.98	18.40	0.14	0.16	0.02

02400	571478.17	3578988.08	18.39	0.13	0.15	0.01
02401	571470.95	3578997.66	18.39	0.15	0.16	0.02
02402	571463.83	3579007.02	18.35	0.15	0.17	0.02
02403	571456.61	3579016.35	18.40	0.15	0.17	0.02
02404	571449.21	3579025.63	18.37	0.13	0.14	0.01
02405	571442.32	3579034.82	18.38	0.12	0.14	0.01
02406	571435.13	3579043.92	18.40	0.12	0.14	0.01
02407	571427.82	3579053.17	18.37	0.14	0.16	0.02
02408	571420.31	3579063.00	18.36	0.13	0.15	0.01
02409	571413.34	3579072.46	18.35	0.13	0.15	0.01
02410	571406.18	3579081.89	18.38	0.14	0.16	0.02
02411	571400.29	3579090.18	18.33	0.14	0.16	0.02
02412	571392.16	3579100.52	18.34	0.13	0.14	0.01
02413	571385.96	3579108.65	18.36	0.14	0.15	0.02
02414	571379.68	3579117.19	18.32	0.12	0.13	0.01
02415	571370.67	3579128.66	18.31	0.12	0.13	0.01
02416	571361.86	3579140.33	18.39	0.13	0.14	0.01
02417	571352.70	3579152.32	18.34	0.14	0.15	0.02
02418	571345.77	3579161.39	18.32	0.14	0.16	0.02
02419	571338.80	3579170.30	18.33	0.13	0.15	0.01
02420	571331.97	3579178.76	18.31	0.13	0.15	0.01
02421	571325.33	3579187.45	18.35	0.13	0.15	0.01
02422	571318.96	3579195.85	18.38	0.14	0.16	0.02
02423	571312.44	3579204.78	18.35	0.13	0.15	0.01
02424	571305.45	3579213.95	18.36	0.14	0.16	0.02
02425	571298.47	3579223.27	18.36	0.14	0.15	0.02
02426	571291.30	3579232.60	18.32	0.12	0.13	0.01
02427	571283.88	3579242.12	18.37	0.14	0.16	0.02
02428	571276.52	3579251.81	18.34	0.14	0.16	0.02
02429	571268.89	3579261.36	18.37	0.12	0.13	0.01
02430	571261.75	3579270.89	18.37	0.14	0.16	0.02
02431	571254.53	3579280.37	18.32	0.12	0.13	0.01
02432	571247.46	3579289.48	18.35	0.14	0.15	0.02
02433	571240.50	3579298.60	18.35	0.13	0.14	0.01
02434	571233.22	3579308.13	18.35	0.12	0.13	0.01
02435	571225.95	3579317.53	18.34	0.11	0.13	0.01

02436	571218.52	3579327.07	18.36	0.13	0.15	0.01
02437	571211.43	3579336.25	18.32	0.12	0.14	0.01
02438	571204.21	3579345.71	18.36	0.12	0.14	0.01
02439	571196.75	3579355.58	18.36	0.13	0.15	0.01
02440	571189.47	3579365.36	18.38	0.13	0.15	0.01
02441	571182.06	3579374.87	18.42	0.11	0.13	0.01
02442	571174.47	3579384.73	18.42	0.13	0.16	0.01
02443	571167.54	3579394.03	18.49	0.12	0.15	0.01
02444	571160.47	3579403.41	18.45	0.11	0.16	0.01
02445	571153.58	3579412.61	18.43	0.12	0.17	0.01
02446	571146.79	3579421.48	18.38	0.12	0.18	0.01
02447	571140.09	3579430.11	18.40	0.16	0.24	0.01
02448	571133.51	3579438.79	18.40	0.13	0.14	0.01
02449	571126.59	3579447.66	18.39	0.14	0.15	0.01
02450	571119.33	3579456.86	18.37	0.13	0.14	0.01
02451	571110.12	3579468.80	18.35	0.13	0.14	0.01
02452	571103.05	3579478.06	18.36	0.12	0.13	0.01
02453	571096.10	3579487.29	18.39	0.13	0.14	0.01
02454	571089.16	3579496.32	18.37	0.12	0.13	0.01
02455	571082.32	3579505.52	18.40	0.11	0.12	0.01
02456	571075.20	3579514.70	18.42	0.12	0.13	0.01
02457	571068.53	3579523.30	18.35	0.11	0.12	0.01
02458	571061.97	3579531.71	18.37	0.13	0.14	0.01
02459	571055.37	3579540.35	18.37	0.13	0.14	0.01
02460	571049.05	3579548.77	18.37	0.13	0.14	0.01
02461	571042.22	3579557.22	18.37	0.11	0.12	0.01
02462	571035.25	3579566.23	18.39	0.12	0.13	0.01
02463	571028.71	3579574.87	18.32	0.13	0.14	0.01
02464	571021.95	3579583.14	18.37	0.13	0.14	0.01
02465	571015.60	3579591.31	18.43	0.11	0.12	0.01
02466	571007.41	3579601.59	18.36	0.11	0.12	0.01
02467	570999.72	3579611.27	18.37	0.11	0.12	0.01
02468	570992.46	3579620.87	18.34	0.13	0.14	0.01
02469	570985.27	3579630.58	18.35	0.12	0.13	0.01
02470	570978.71	3579639.15	18.37	0.11	0.12	0.01
02471	570972.27	3579649.14	18.37	0.12	0.13	0.01
02472	570965.81	3579658.33	18.37	0.11	0.12	0.01

APPENDIX E

Control Survey Listing MVRM Calibration Site - Dist. 03

East bound 1-10 bridge east of Henderson

Date & Time 3/23/2014 9:10 AM

Coordinate System U.S. State Plane 1983 **Zone** Louisiana South 1702

Project Datum (NAD 83) **Vertical Datum** (NAVD 88) **Geoid Model** GEOID12A

Coordinate Unit U.S. Survey Foot **Distance Unit** U.S. Survey Foot **Height Unit** U.S. Survey Foot

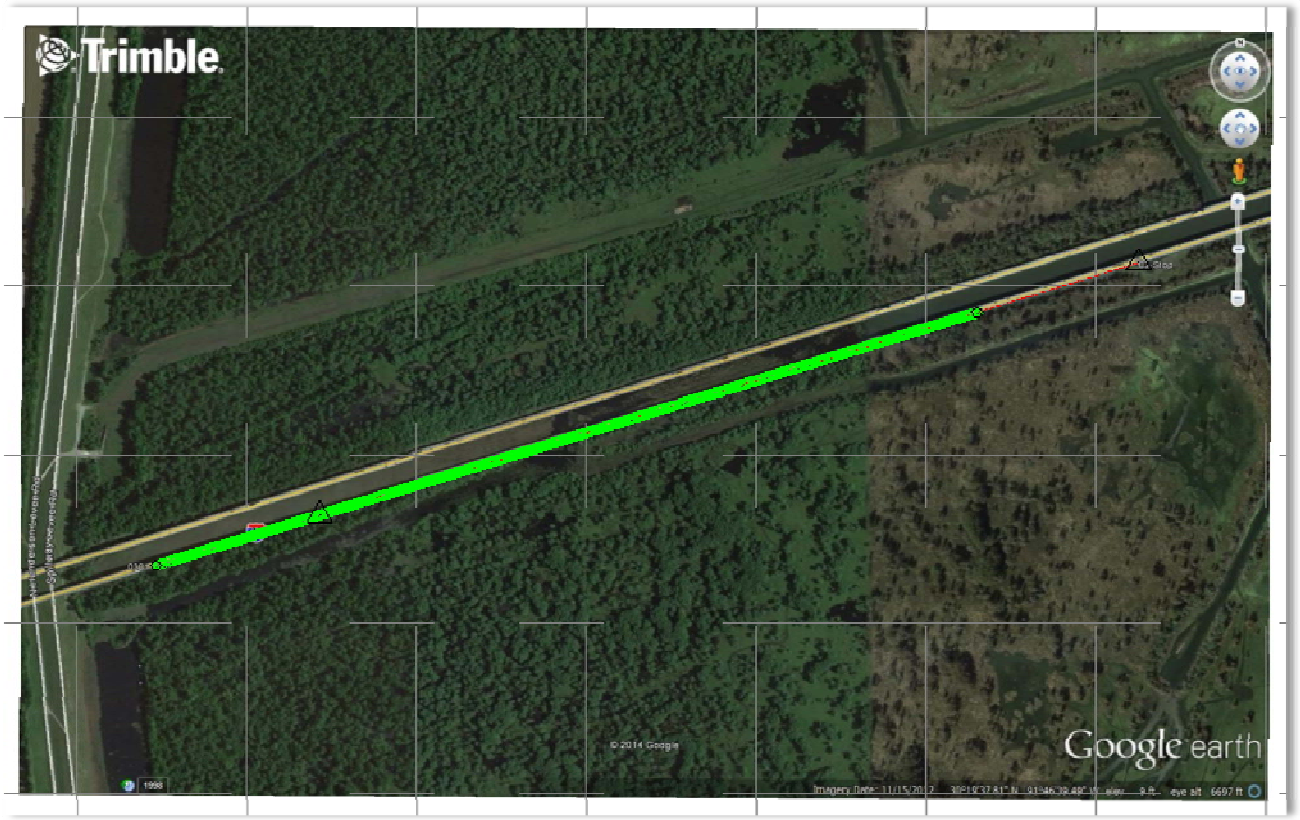


Figure 42
MVRM Control – 03 East bound 1-10 bridge east of Henderson

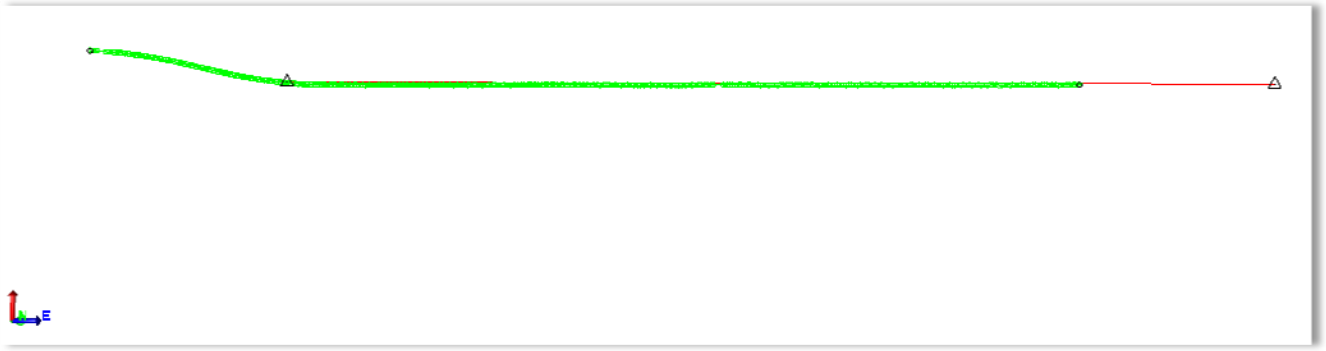


Figure 43
MVRM Control – 03 Profile 10 X vertical

Point ID	Northing	Easting	Elevation	H Prc	V Prc	RMS
0301	663806.334	3137622.421	57.128	0.100	0.133	0.012
0302	665376.976	3142695.074	38.884	0.089	0.097	0.008
03001	663806.385	3137622.257	57.215	0.097	0.139	0.010
03002	663809.450	3137632.891	57.061	0.076	0.101	0.008
03003	663813.168	3137645.341	57.053	0.086	0.113	0.009
03004	663816.782	3137657.267	57.063	0.096	0.126	0.010
03005	663831.215	3137703.900	56.572	0.111	0.147	0.012
03006	663834.880	3137716.677	56.466	0.084	0.111	0.009
03007	663838.612	3137729.082	56.414	0.082	0.108	0.009
03008	663842.473	3137741.601	56.287	0.092	0.121	0.010
03009	663845.662	3137751.251	56.225	0.079	0.104	0.009
03010	663848.829	3137760.999	56.081	0.101	0.133	0.011
03011	663851.753	3137770.765	55.969	0.082	0.108	0.009
03012	663854.823	3137780.614	55.901	0.096	0.127	0.010
03013	663858.514	3137793.285	55.692	0.110	0.145	0.012
03014	663862.307	3137805.091	55.550	0.107	0.141	0.012
03015	663866.098	3137817.631	55.422	0.105	0.138	0.011
03016	663869.377	3137827.499	55.341	0.106	0.140	0.011
03017	663872.381	3137837.157	55.187	0.115	0.152	0.012
03018	663875.409	3137847.155	55.033	0.107	0.141	0.012
03019	663878.636	3137857.021	54.911	0.102	0.135	0.011
03020	663881.568	3137866.683	54.806	0.118	0.155	0.013
03021	663885.522	3137879.320	54.601	0.098	0.129	0.011
03022	663888.375	3137889.013	54.479	0.107	0.141	0.011
03023	663892.019	3137901.383	54.216	0.089	0.117	0.010
03024	663894.930	3137911.030	54.048	0.098	0.129	0.010
03025	663898.068	3137921.008	53.885	0.089	0.117	0.010
03026	663901.218	3137930.948	53.720	0.084	0.111	0.009
03027	663905.301	3137943.895	53.531	0.110	0.144	0.012
03028	663909.344	3137956.988	53.212	0.112	0.147	0.012
03029	663912.445	3137966.790	53.077	0.088	0.116	0.009
03030	663915.520	3137976.515	52.908	0.112	0.147	0.012
03031	663918.592	3137986.472	52.638	0.119	0.157	0.013
03032	663922.565	3137999.086	52.403	0.102	0.134	0.011
03033	663926.429	3138011.687	52.194	0.109	0.143	0.012
03034	663929.404	3138021.453	51.946	0.105	0.137	0.011

03035	663932.566	3138031.112	51.829	0.098	0.129	0.010
03036	663935.725	3138041.253	51.653	0.102	0.134	0.011
03037	663938.848	3138050.843	51.388	0.092	0.121	0.010
03038	663942.646	3138063.526	51.150	0.110	0.144	0.012
03039	663945.601	3138073.456	50.916	0.125	0.164	0.013
03040	663948.840	3138083.382	50.698	0.117	0.152	0.012
03041	663951.763	3138093.167	50.520	0.120	0.156	0.013
03042	663955.072	3138103.070	50.224	0.120	0.156	0.013
03043	663958.011	3138112.952	50.021	0.119	0.156	0.013
03044	663961.022	3138122.748	49.854	0.126	0.179	0.013
03045	663963.932	3138132.445	49.555	0.134	0.175	0.014
03046	663966.903	3138142.205	49.327	0.111	0.145	0.012
03047	663970.078	3138152.215	49.155	0.139	0.181	0.015
03048	663973.137	3138162.301	48.846	0.124	0.162	0.013
03049	663976.197	3138172.214	48.610	0.133	0.173	0.014
03050	663979.489	3138182.328	48.329	0.134	0.175	0.014
03051	663982.693	3138192.334	48.130	0.123	0.161	0.013
03052	663985.770	3138202.283	47.850	0.138	0.180	0.015
03053	663988.981	3138212.330	47.666	0.137	0.179	0.015
03054	663991.995	3138222.263	47.411	0.127	0.166	0.013
03055	663995.176	3138232.434	47.171	0.120	0.156	0.013
03056	663998.414	3138242.578	46.914	0.149	0.195	0.016
03057	664001.482	3138252.513	46.661	0.132	0.171	0.014
03058	664004.460	3138262.790	46.370	0.115	0.150	0.012
03059	664007.499	3138272.371	46.197	0.132	0.172	0.014
03060	664010.476	3138282.068	45.923	0.131	0.170	0.014
03061	664013.471	3138292.481	45.687	0.111	0.145	0.012
03062	664016.644	3138302.440	45.473	0.107	0.139	0.011
03063	664019.917	3138312.517	45.249	0.124	0.176	0.012
03064	664023.000	3138322.947	45.057	0.125	0.178	0.012
03065	664026.008	3138332.831	44.779	0.127	0.166	0.013
03066	664029.201	3138342.427	44.594	0.108	0.141	0.011
03067	664032.499	3138352.751	44.402	0.122	0.159	0.013
03068	664035.778	3138363.530	44.114	0.113	0.147	0.012
03069	664039.033	3138373.872	43.909	0.127	0.165	0.013
03070	664042.357	3138384.358	43.717	0.109	0.141	0.011

03071	664045.639	3138394.782	43.485	0.116	0.150	0.012
03072	664049.028	3138405.277	43.295	0.116	0.151	0.012
03073	664052.093	3138415.373	43.061	0.124	0.161	0.013
03074	664055.162	3138425.055	42.874	0.122	0.158	0.013
03075	664058.138	3138434.909	42.705	0.112	0.145	0.012
03076	664061.028	3138444.962	42.582	0.129	0.168	0.014
03077	664064.071	3138455.191	42.383	0.118	0.153	0.012
03078	664067.157	3138465.299	42.173	0.111	0.144	0.012
03079	664070.006	3138475.162	42.104	0.125	0.178	0.012
03080	664072.982	3138485.157	41.863	0.149	0.193	0.016
03081	664076.269	3138495.760	41.781	0.150	0.194	0.016
03082	664079.728	3138506.412	41.557	0.129	0.168	0.014
03083	664083.113	3138517.293	41.462	0.148	0.192	0.016
03084	664086.519	3138527.829	41.244	0.149	0.193	0.016
03085	664090.792	3138541.895	41.073	0.147	0.191	0.015
03086	664094.026	3138552.452	40.926	0.139	0.180	0.015
03087	664097.182	3138562.971	40.763	0.130	0.168	0.014
03088	664100.652	3138573.626	40.647	0.136	0.176	0.014
03089	664103.780	3138583.918	40.559	0.136	0.176	0.014
03090	664107.042	3138594.383	40.481	0.115	0.148	0.012
03091	664110.468	3138605.059	40.277	0.138	0.179	0.014
03092	664113.805	3138615.671	40.217	0.137	0.177	0.014
03093	664117.185	3138626.376	40.152	0.111	0.144	0.012
03094	664120.414	3138636.777	40.021	0.128	0.166	0.013
03095	664123.623	3138647.290	39.894	0.116	0.151	0.012
03096	664126.860	3138657.673	39.832	0.118	0.152	0.012
03097	664130.040	3138668.040	39.707	0.129	0.166	0.013
03098	664133.164	3138677.963	39.618	0.136	0.175	0.014
03099	664136.383	3138688.225	39.513	0.141	0.183	0.015
03100	664139.523	3138698.188	39.492	0.121	0.157	0.013
03101	664142.578	3138708.231	39.409	0.140	0.181	0.015
03102	664145.721	3138718.235	39.305	0.131	0.170	0.014
03103	664148.930	3138728.255	39.292	0.116	0.149	0.012
03104	664152.209	3138738.614	39.240	0.131	0.169	0.014
03105	664155.183	3138748.836	39.090	0.123	0.158	0.013
03106	664158.280	3138759.097	39.078	0.115	0.162	0.011
03107	664161.601	3138769.657	39.039	0.124	0.160	0.013

03108	664164.833	3138780.156	39.026	0.124	0.159	0.013
03109	664168.107	3138790.905	39.021	0.122	0.157	0.013
03110	664171.398	3138801.020	39.021	0.102	0.132	0.011
03111	664174.605	3138811.183	38.956	0.100	0.129	0.010
03112	664177.677	3138821.329	38.942	0.088	0.113	0.009
03113	664180.903	3138831.499	38.895	0.094	0.121	0.010
03114	664184.165	3138841.738	38.918	0.095	0.123	0.010
03115	664187.178	3138851.795	38.909	0.114	0.147	0.012
03116	664190.342	3138861.869	38.967	0.118	0.152	0.012
03117	664193.543	3138872.238	38.949	0.112	0.144	0.012
03118	664196.580	3138882.502	38.881	0.106	0.137	0.011
03119	664199.632	3138892.557	38.927	0.101	0.130	0.010
03120	664202.918	3138902.765	38.922	0.112	0.144	0.012
03121	664205.995	3138912.986	38.954	0.110	0.141	0.011
03122	664209.059	3138923.397	38.940	0.085	0.110	0.009
03123	664212.312	3138933.817	38.928	0.098	0.125	0.010
03124	664215.429	3138944.393	38.906	0.088	0.113	0.009
03125	664218.769	3138954.878	38.931	0.084	0.108	0.009
03126	664222.201	3138965.446	38.928	0.086	0.110	0.009
03127	664225.424	3138975.821	38.950	0.109	0.139	0.011
03128	664228.497	3138986.209	38.894	0.105	0.148	0.010
03129	664231.478	3138996.371	38.928	0.105	0.134	0.011
03130	664235.845	3139010.320	38.923	0.092	0.118	0.010
03131	664239.158	3139021.179	38.901	0.106	0.135	0.011
03132	664242.543	3139032.003	38.822	0.095	0.122	0.010
03133	664245.917	3139042.352	38.858	0.081	0.103	0.008
03134	664249.022	3139052.582	38.885	0.100	0.129	0.010
03135	664252.059	3139062.817	38.798	0.090	0.115	0.009
03136	664255.388	3139073.073	38.813	0.081	0.104	0.008
03137	664258.622	3139083.307	38.783	0.102	0.130	0.011
03138	664261.852	3139093.533	38.846	0.101	0.129	0.010
03139	664265.072	3139103.853	38.877	0.076	0.097	0.008
03140	664268.186	3139114.005	38.845	0.095	0.122	0.010
03141	664271.382	3139124.076	38.879	0.083	0.106	0.009
03142	664274.430	3139134.269	38.855	0.087	0.111	0.009
03143	664277.574	3139144.686	38.883	0.106	0.136	0.011

03144	664280.968	3139155.161	38.887	0.101	0.129	0.010
03145	664284.021	3139165.299	38.910	0.091	0.117	0.009
03146	664287.333	3139175.463	38.874	0.103	0.131	0.011
03147	664290.439	3139185.769	38.926	0.080	0.102	0.008
03148	664293.609	3139196.068	38.916	0.086	0.110	0.009
03149	664296.802	3139206.175	38.927	0.109	0.139	0.011
03150	664299.757	3139216.214	38.897	0.110	0.141	0.011
03151	664302.763	3139226.547	38.866	0.113	0.144	0.012
03152	664305.950	3139236.496	38.834	0.103	0.131	0.011
03153	664309.218	3139246.627	38.861	0.099	0.126	0.010
03154	664312.336	3139256.930	38.817	0.113	0.144	0.012
03155	664315.522	3139267.050	38.806	0.107	0.136	0.011
03156	664319.322	3139279.894	38.823	0.107	0.136	0.011
03157	664322.365	3139289.782	38.783	0.115	0.147	0.012
03158	664325.777	3139300.267	38.827	0.119	0.151	0.012
03159	664328.900	3139310.265	38.863	0.125	0.159	0.013
03160	664331.967	3139320.263	38.851	0.119	0.152	0.012
03161	664335.212	3139330.431	38.880	0.138	0.175	0.014
03162	664338.388	3139340.491	38.841	0.126	0.160	0.013
03163	664341.609	3139350.685	38.823	0.130	0.165	0.013
03164	664344.934	3139361.264	38.787	0.137	0.174	0.014
03165	664348.243	3139371.701	38.844	0.136	0.173	0.014
03166	664351.423	3139381.854	38.850	0.128	0.163	0.013
03167	664354.411	3139392.185	38.862	0.120	0.153	0.012
03168	664357.891	3139402.854	38.858	0.126	0.160	0.013
03169	664361.034	3139413.479	38.865	0.109	0.139	0.011
03170	664364.214	3139424.096	38.835	0.138	0.176	0.014
03171	664367.276	3139434.591	38.848	0.137	0.174	0.014
03172	664370.637	3139444.517	38.809	0.130	0.165	0.013
03173	664373.562	3139454.660	38.824	0.143	0.181	0.015
03174	664376.709	3139464.789	38.863	0.143	0.181	0.015
03175	664379.846	3139474.813	38.877	0.132	0.167	0.013
03176	664382.881	3139485.109	38.800	0.119	0.151	0.012
03177	664386.170	3139495.486	38.883	0.143	0.182	0.015
03178	664389.483	3139505.947	38.880	0.114	0.144	0.012
03179	664392.582	3139515.989	38.865	0.120	0.152	0.012
03180	664395.868	3139526.137	38.906	0.111	0.140	0.011

03181	664398.654	3139536.181	38.913	0.133	0.168	0.014
03182	664401.795	3139546.247	38.800	0.143	0.181	0.015
03183	664405.131	3139556.827	38.814	0.127	0.160	0.013
03184	664408.688	3139568.190	38.907	0.108	0.137	0.011
03185	664412.051	3139579.181	38.790	0.093	0.117	0.009
03186	664415.576	3139590.338	38.827	0.093	0.117	0.009
03187	664418.738	3139601.379	38.843	0.103	0.131	0.010
03188	664422.191	3139612.158	38.829	0.099	0.125	0.010
03189	664425.698	3139623.151	38.850	0.105	0.132	0.011
03190	664429.130	3139633.873	38.819	0.104	0.131	0.011
03191	664432.270	3139644.653	38.795	0.099	0.125	0.010
03192	664435.416	3139655.483	38.790	0.119	0.150	0.012
03193	664438.883	3139666.145	38.838	0.099	0.125	0.010
03194	664442.140	3139676.940	38.820	0.119	0.150	0.012
03195	664445.508	3139687.933	38.843	0.140	0.177	0.014
03196	664449.062	3139698.763	38.875	0.139	0.176	0.014
03197	664452.577	3139709.327	38.856	0.140	0.176	0.014
03198	664455.749	3139720.036	38.882	0.129	0.163	0.013
03199	664460.108	3139734.177	38.789	0.142	0.179	0.014
03200	664463.569	3139744.744	38.832	0.122	0.153	0.012
03201	664466.886	3139755.158	38.802	0.135	0.170	0.014
03202	664470.064	3139765.546	38.916	0.146	0.184	0.015
03203	664473.160	3139775.487	38.799	0.138	0.174	0.014
03204	664476.338	3139785.897	38.880	0.129	0.162	0.013
03205	664479.426	3139796.205	38.898	0.154	0.194	0.016
03206	664482.222	3139805.949	38.832	0.147	0.185	0.015
03207	664485.381	3139816.095	38.919	0.146	0.184	0.015
03208	664488.397	3139826.107	38.861	0.121	0.169	0.011
03209	664491.610	3139836.446	38.868	0.117	0.147	0.012
03210	664494.986	3139846.691	38.925	0.135	0.169	0.014
03211	664498.143	3139856.731	38.919	0.128	0.160	0.013
03212	664501.146	3139866.907	38.917	0.138	0.173	0.014
03213	664504.253	3139877.038	38.940	0.134	0.167	0.013
03214	664507.471	3139887.080	38.881	0.115	0.144	0.012
03215	664510.523	3139897.324	38.889	0.131	0.164	0.013
03216	664513.640	3139907.916	38.871	0.125	0.156	0.013

03217	664516.864	3139918.207	38.914	0.125	0.156	0.013
03218	664520.086	3139929.050	38.930	0.135	0.169	0.014
03219	664523.491	3139939.826	38.934	0.113	0.141	0.011
03220	664526.661	3139950.378	38.984	0.112	0.140	0.011
03221	664530.266	3139961.172	38.964	0.121	0.152	0.012
03222	664533.550	3139971.572	38.969	0.112	0.140	0.011
03223	664536.758	3139982.231	38.925	0.116	0.145	0.012
03224	664540.042	3139992.950	38.960	0.118	0.148	0.012
03225	664543.416	3140003.622	38.897	0.140	0.176	0.014
03226	664546.692	3140014.212	38.955	0.144	0.179	0.014
03227	664549.922	3140025.077	38.927	0.118	0.147	0.012
03228	664553.145	3140035.616	38.933	0.113	0.141	0.011
03229	664556.580	3140046.365	38.972	0.133	0.166	0.013
03230	664560.007	3140057.142	38.924	0.109	0.135	0.011
03231	664563.247	3140067.699	38.938	0.130	0.162	0.013
03232	664566.652	3140078.531	38.920	0.114	0.143	0.011
03233	664569.931	3140089.218	38.884	0.123	0.153	0.012
03234	664573.265	3140099.822	38.854	0.131	0.163	0.013
03235	664576.588	3140110.290	38.959	0.099	0.123	0.010
03236	664579.863	3140120.745	38.903	0.113	0.141	0.011
03237	664583.057	3140130.582	38.908	0.120	0.149	0.012
03238	664586.118	3140141.170	38.894	0.123	0.154	0.012
03239	664588.997	3140151.618	38.845	0.129	0.160	0.013
03240	664592.345	3140162.003	38.837	0.119	0.148	0.012
03241	664595.632	3140172.414	38.917	0.104	0.129	0.010
03242	664598.592	3140182.348	38.867	0.089	0.111	0.009
03243	664601.603	3140192.389	38.929	0.109	0.136	0.011
03244	664604.897	3140202.548	38.883	0.110	0.137	0.011
03245	664608.067	3140212.821	38.843	0.110	0.137	0.011
03246	664611.440	3140223.667	38.850	0.088	0.109	0.009
03247	664614.791	3140234.516	38.814	0.083	0.103	0.008
03248	664618.125	3140245.252	38.823	0.084	0.104	0.008
03249	664621.573	3140255.929	38.838	0.084	0.104	0.008
03250	664625.154	3140266.936	38.825	0.095	0.118	0.009
03251	664629.456	3140281.188	38.830	0.094	0.116	0.009
03252	664632.718	3140292.021	38.811	0.080	0.099	0.008
03253	664636.028	3140302.341	38.800	0.079	0.097	0.008

03254	664639.191	3140312.888	38.833	0.093	0.115	0.009
03255	664642.458	3140323.711	38.796	0.095	0.118	0.009
03256	664645.634	3140334.350	38.778	0.081	0.101	0.008
03257	664648.851	3140345.222	38.792	0.092	0.113	0.009
03258	664652.264	3140356.045	38.829	0.103	0.128	0.010
03259	664655.748	3140366.798	38.782	0.082	0.102	0.008
03260	664659.135	3140377.863	38.842	0.089	0.110	0.009
03261	664662.500	3140388.573	38.812	0.089	0.110	0.009
03262	664665.952	3140399.378	38.825	0.089	0.110	0.009
03263	664669.216	3140409.644	38.816	0.093	0.115	0.009
03264	664672.411	3140420.400	38.749	0.082	0.102	0.008
03265	664675.847	3140431.087	38.770	0.080	0.099	0.008
03266	664679.173	3140441.733	38.801	0.101	0.124	0.010
03267	664682.329	3140452.160	38.729	0.100	0.124	0.010
03268	664685.541	3140462.748	38.770	0.101	0.124	0.010
03269	664688.584	3140472.977	38.723	0.093	0.114	0.009
03270	664691.912	3140483.399	38.765	0.094	0.116	0.009
03271	664695.348	3140494.056	38.733	0.082	0.101	0.008
03272	664698.661	3140504.933	38.778	0.104	0.129	0.010
03273	664701.989	3140515.440	38.772	0.106	0.131	0.010
03274	664705.338	3140526.204	38.763	0.081	0.100	0.008
03275	664708.655	3140536.757	38.795	0.096	0.118	0.009
03276	664711.824	3140547.230	38.770	0.080	0.099	0.008
03277	664714.821	3140557.807	38.741	0.092	0.114	0.009
03278	664718.312	3140568.930	38.732	0.083	0.102	0.008
03279	664721.654	3140579.748	38.730	0.103	0.127	0.010
03280	664724.829	3140590.738	38.741	0.087	0.107	0.009
03281	664728.364	3140601.570	38.685	0.091	0.111	0.009
03282	664731.556	3140612.227	38.714	0.102	0.126	0.010
03283	664735.075	3140623.305	38.715	0.115	0.141	0.011
03284	664738.542	3140634.609	38.702	0.089	0.110	0.009
03285	664741.986	3140645.343	38.703	0.093	0.114	0.009
03286	664745.283	3140655.740	38.723	0.093	0.114	0.009
03287	664748.493	3140666.229	38.745	0.119	0.146	0.012
03288	664751.782	3140676.625	38.715	0.123	0.151	0.012
03289	664754.909	3140687.251	38.739	0.121	0.148	0.012

03290	664758.262	3140697.910	38.719	0.122	0.150	0.012
03291	664761.819	3140708.557	38.781	0.107	0.131	0.011
03292	664765.228	3140719.274	38.770	0.134	0.165	0.013
03293	664768.668	3140730.032	38.783	0.123	0.151	0.012
03294	664772.137	3140740.939	38.842	0.097	0.119	0.010
03295	664775.469	3140751.646	38.847	0.105	0.128	0.010
03296	664778.891	3140762.575	38.858	0.094	0.115	0.009
03297	664782.219	3140773.610	38.916	0.104	0.127	0.010
03298	664785.539	3140784.348	38.918	0.117	0.143	0.011
03299	664788.976	3140795.600	38.878	0.119	0.146	0.012
03300	664792.352	3140806.541	38.920	0.098	0.119	0.010
03301	664795.673	3140817.481	38.892	0.099	0.121	0.010
03302	664811.556	3140869.161	38.911	0.092	0.112	0.009
03303	664814.775	3140880.123	38.931	0.096	0.118	0.009
03304	664818.200	3140891.139	38.880	0.168	0.205	0.016
03305	664821.963	3140902.900	38.857	0.226	0.275	0.022
03306	664825.531	3140914.752	38.886	0.453	0.553	0.044
03307	664829.220	3140925.986	38.847	0.296	0.361	0.029
03308	664832.795	3140937.410	38.928	0.218	0.266	0.021
03309	664836.485	3140949.003	38.938	0.132	0.160	0.013
03310	664840.003	3140960.257	38.892	0.147	0.179	0.014
03311	664843.563	3140971.607	38.901	0.123	0.149	0.012
03312	664846.708	3140982.678	38.934	0.099	0.121	0.010
03313	664850.075	3140994.029	38.965	0.119	0.145	0.012
03314	664853.651	3141005.427	38.939	0.106	0.129	0.010
03315	664858.475	3141020.323	38.903	0.094	0.114	0.009
03316	664863.184	3141035.406	38.870	0.105	0.127	0.010
03317	664866.498	3141046.352	38.822	0.105	0.127	0.010
03318	664869.872	3141057.459	38.769	0.117	0.141	0.011
03319	664873.538	3141068.654	38.853	0.097	0.117	0.009
03320	664876.781	3141079.498	38.791	0.117	0.142	0.011
03321	664880.169	3141090.942	38.758	0.107	0.130	0.010
03322	664883.855	3141102.593	38.727	0.117	0.142	0.011
03323	664887.457	3141114.197	38.769	0.096	0.116	0.009
03324	664890.894	3141125.692	38.768	0.097	0.118	0.010
03325	664894.608	3141137.463	38.850	0.099	0.120	0.010
03326	664897.846	3141148.914	38.787	0.110	0.133	0.011

03327	664901.491	3141160.633	38.859	0.120	0.146	0.012
03328	664905.103	3141172.391	38.914	0.108	0.131	0.011
03329	664908.528	3141183.510	38.826	0.108	0.131	0.011
03330	664912.076	3141194.767	38.867	0.108	0.130	0.010
03331	664915.816	3141206.101	38.866	0.107	0.130	0.010
03332	664919.281	3141217.524	38.838	0.118	0.143	0.012
03333	664922.819	3141229.226	38.880	0.118	0.142	0.011
03334	664926.436	3141240.430	38.844	0.094	0.114	0.009
03335	664929.958	3141251.569	38.935	0.105	0.126	0.010
03336	664933.340	3141262.925	38.904	0.104	0.125	0.010
03337	664936.871	3141273.859	38.886	0.103	0.124	0.010
03338	664940.839	3141285.135	38.934	0.115	0.138	0.011
03339	664944.417	3141296.090	38.882	0.116	0.140	0.011
03340	664947.789	3141307.030	38.923	0.113	0.137	0.011
03341	664950.935	3141318.058	38.942	0.113	0.136	0.011
03342	664954.154	3141329.062	38.865	0.112	0.135	0.011
03343	664957.230	3141340.026	38.849	0.089	0.108	0.009
03344	664960.517	3141351.321	38.811	0.090	0.108	0.009
03345	664964.162	3141362.618	38.788	0.101	0.121	0.010
03346	664967.504	3141373.770	38.772	0.113	0.136	0.011
03347	664970.984	3141384.976	38.868	0.113	0.136	0.011
03348	664974.200	3141395.873	38.787	0.101	0.121	0.010
03349	664977.804	3141406.915	38.848	0.090	0.108	0.009
03350	664981.093	3141417.688	38.760	0.113	0.136	0.011
03351	664984.692	3141428.976	38.799	0.090	0.108	0.009
03352	664988.139	3141440.350	38.778	0.090	0.108	0.009
03353	664991.546	3141451.684	38.830	0.089	0.107	0.009
03354	664995.105	3141462.964	38.802	0.111	0.134	0.011
03355	664998.774	3141474.342	38.751	0.089	0.107	0.009
03356	665002.344	3141485.655	38.794	0.111	0.133	0.011
03357	665005.831	3141496.549	38.821	0.100	0.120	0.010
03358	665010.471	3141511.074	38.832	0.111	0.133	0.011
03359	665013.709	3141522.204	38.856	0.100	0.119	0.010
03360	665017.128	3141533.414	38.773	0.088	0.106	0.009
03361	665020.695	3141544.578	38.776	0.089	0.107	0.009
03362	665024.144	3141556.010	38.816	0.100	0.120	0.010

03363	665027.487	3141567.144	38.829	0.089	0.106	0.009
03364	665031.177	3141578.256	38.802	0.088	0.106	0.009
03365	665034.449	3141588.628	38.796	0.099	0.119	0.010
03366	665037.962	3141600.128	38.840	0.111	0.132	0.011
03367	665041.674	3141611.944	38.854	0.088	0.105	0.008
03368	665045.050	3141623.145	38.770	0.099	0.118	0.010
03369	665048.538	3141635.081	38.834	0.110	0.131	0.011
03370	665052.076	3141646.464	38.835	0.088	0.105	0.009
03371	665055.339	3141657.692	38.841	0.111	0.133	0.011
03372	665058.625	3141668.869	38.837	0.100	0.119	0.010
03373	665062.137	3141679.748	38.839	0.100	0.119	0.010
03374	665065.685	3141690.823	38.786	0.111	0.133	0.011
03375	665069.162	3141702.494	38.723	0.100	0.120	0.010
03376	665072.950	3141714.300	38.809	0.089	0.106	0.009
03377	665076.478	3141725.589	38.746	0.100	0.119	0.010
03378	665080.100	3141736.570	38.814	0.111	0.132	0.011
03379	665083.574	3141747.939	38.751	0.100	0.119	0.010
03380	665087.057	3141759.330	38.756	0.100	0.119	0.010
03381	665091.718	3141774.404	38.770	0.100	0.119	0.010
03382	665095.113	3141785.992	38.841	0.086	0.102	0.008
03383	665098.668	3141797.338	38.830	0.098	0.116	0.009
03384	665103.416	3141812.671	38.776	0.087	0.103	0.008
03385	665108.265	3141827.997	38.831	0.087	0.103	0.008
03386	665111.979	3141839.273	38.825	0.110	0.130	0.011
03387	665115.457	3141850.148	38.885	0.098	0.117	0.009
03388	665118.919	3141861.214	38.812	0.087	0.103	0.008
03389	665122.301	3141872.263	38.874	0.110	0.130	0.011
03390	665125.710	3141883.470	38.842	0.110	0.130	0.011
03391	665129.215	3141894.858	38.872	0.099	0.117	0.009
03392	665132.684	3141905.894	38.878	0.110	0.131	0.011
03393	665135.977	3141916.917	38.856	0.087	0.104	0.008
03394	665139.334	3141928.108	38.847	0.099	0.117	0.009
03395	665142.643	3141939.373	38.816	0.087	0.103	0.008
03396	665146.257	3141950.525	38.857	0.110	0.130	0.011
03397	665149.547	3141961.573	38.813	0.087	0.103	0.008
03398	665152.920	3141973.182	38.813	0.098	0.116	0.009
03399	665156.359	3141984.483	38.759	0.110	0.130	0.011

03400	665159.973	3141995.521	38.795	0.087	0.103	0.008
03401	665163.482	3142006.787	38.798	0.098	0.116	0.009
03402	665167.153	3142017.985	38.794	0.109	0.129	0.011
03403	665170.739	3142029.720	38.840	0.109	0.129	0.011
03404	665174.364	3142040.961	38.721	0.098	0.116	0.009
03405	665177.812	3142052.144	38.804	0.112	0.132	0.011
03406	665181.392	3142063.726	38.817	0.115	0.136	0.011
03407	665184.946	3142075.453	38.835	0.112	0.132	0.011
03408	665188.331	3142087.114	38.798	0.104	0.122	0.010
03409	665192.135	3142098.501	38.872	0.100	0.117	0.010
03410	665195.676	3142110.277	38.814	0.092	0.109	0.009
03411	665199.074	3142121.467	38.818	0.111	0.131	0.011
03412	665202.600	3142132.689	38.838	0.101	0.119	0.010
03413	665205.796	3142143.757	38.814	0.121	0.143	0.012
03414	665209.268	3142155.128	38.768	0.095	0.112	0.009
03415	665212.832	3142166.590	38.787	0.091	0.107	0.009
03416	665216.426	3142177.930	38.855	0.088	0.104	0.008
03417	665219.857	3142189.302	38.812	0.111	0.131	0.011
03418	665223.398	3142200.380	38.799	0.094	0.110	0.009
03419	665226.866	3142211.899	38.836	0.105	0.123	0.010
03420	665230.470	3142223.144	38.700	0.119	0.140	0.011
03421	665233.996	3142234.660	38.838	0.103	0.121	0.010
03422	665237.531	3142246.245	38.890	0.094	0.110	0.009
03423	665241.247	3142257.379	38.822	0.113	0.133	0.011
03424	665244.704	3142268.880	38.885	0.101	0.118	0.010
03425	665248.375	3142280.482	38.790	0.126	0.148	0.012
03426	665251.984	3142292.332	38.790	0.126	0.148	0.012
03427	665255.812	3142304.065	38.869	0.116	0.136	0.011
03428	665259.754	3142315.881	38.800	0.114	0.134	0.011
03429	665263.593	3142327.485	38.900	0.083	0.123	0.007
03430	665267.022	3142339.165	38.787	0.106	0.124	0.010
03431	665270.274	3142350.736	38.865	0.101	0.118	0.010
03432	665273.814	3142362.275	38.822	0.118	0.137	0.011
03433	665277.730	3142374.173	38.858	0.107	0.125	0.010
03434	665280.994	3142385.807	38.798	0.130	0.152	0.012
03435	665284.355	3142397.477	38.860	0.105	0.122	0.010

03436	665287.903	3142408.769	38.838	0.110	0.128	0.011
03437	665291.529	3142420.261	38.845	0.114	0.133	0.011
03438	665295.044	3142431.932	38.779	0.104	0.121	0.010
03439	665298.598	3142443.644	38.758	0.103	0.121	0.010
03440	665302.132	3142455.002	38.842	0.115	0.134	0.011
03441	665305.788	3142466.608	38.901	0.125	0.146	0.012
03442	665309.380	3142478.643	38.876	0.111	0.129	0.011
03443	665312.933	3142490.118	38.841	0.108	0.126	0.010
03444	665316.567	3142501.871	38.832	0.123	0.143	0.012
03445	665320.180	3142513.654	38.861	0.104	0.121	0.010
03446	665323.666	3142524.981	38.845	0.124	0.144	0.012
03447	665326.957	3142535.942	38.882	0.106	0.123	0.010
03448	665331.616	3142550.850	38.909	0.115	0.134	0.011
03449	665335.026	3142561.626	38.814	0.130	0.151	0.012
03450	665338.594	3142572.814	38.886	0.109	0.127	0.010
03451	665342.080	3142583.967	38.751	0.113	0.131	0.011
03452	665345.601	3142595.250	38.880	0.138	0.160	0.013
03453	665349.028	3142606.682	38.895	0.120	0.140	0.012
03454	665352.636	3142618.283	38.879	0.132	0.153	0.013
03455	665356.151	3142629.964	38.912	0.132	0.153	0.013
03456	665359.775	3142641.542	38.965	0.130	0.151	0.012
03457	665363.363	3142653.139	38.806	0.138	0.160	0.013
03458	665366.835	3142664.394	38.984	0.110	0.127	0.011
03459	665370.428	3142675.517	38.879	0.106	0.123	0.010
03460	665373.677	3142686.494	38.891	0.109	0.126	0.010
03461	665376.728	3142696.199	38.963	0.120	0.139	0.011

APPENDIX F

Control Survey Listing MVRM Calibration Site - Dist. 04

North bound I-49 bridge and ramp, north of LA 3132 Inner Loop Expressway

Date & Time 3/30/2014 1:08 PM

Coordinate System U.S. State Plane 1983 **Zone** Louisiana North 1701

Project Datum (NAD 83) **Vertical Datum** (NAVD 88) **Geoid Model** GEOID12A

Coordinate Unit U.S. Survey Foot **Distance Unit** U.S. Survey Foot **Height Unit** U.S. Survey Foot

Figure 44
MVRM Control – 04 North bound I-49 bridge & ramp, north of LA 3132 Inner Loop Exp.

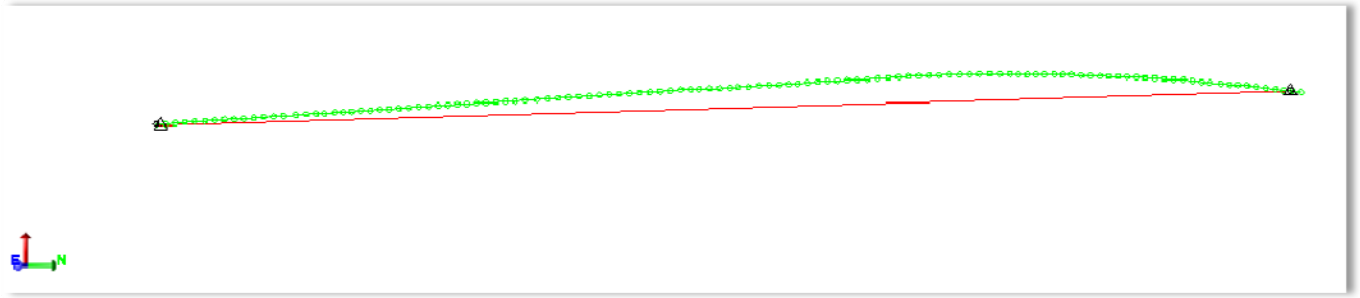


Figure 45
MVRM Control – 04 Profile 10 X vertical

Point ID	Northing	Easting	Elevation	H Prc	V Prc	RMS
0401	704899.90	2893904.22	241.62	0.07	0.10	0.01
0402	706272.10	2893522.52	245.83	0.06	0.08	0.01
040001	704899.83	2893904.30	241.53	0.23	0.32	0.03
040002	704911.06	2893900.17	241.58	0.22	0.30	0.03
040003	704922.29	2893896.41	241.68	0.21	0.33	0.02
040004	704933.82	2893892.68	241.79	0.22	0.30	0.03
040005	704945.68	2893888.55	241.92	0.21	0.30	0.03
040006	704958.09	2893884.40	241.96	0.21	0.29	0.03
040007	704969.33	2893880.65	242.07	0.18	0.26	0.02
040008	704981.04	2893876.56	242.15	0.20	0.28	0.03
040009	704992.44	2893872.60	242.18	0.18	0.25	0.02
040010	705004.17	2893868.76	242.25	0.18	0.25	0.02
040011	705016.05	2893864.69	242.34	0.18	0.25	0.02
040012	705027.63	2893860.76	242.47	0.18	0.26	0.02
040013	705039.61	2893856.68	242.54	0.16	0.23	0.02
040014	705051.08	2893852.67	242.59	0.16	0.23	0.02
040015	705066.16	2893847.63	242.70	0.18	0.25	0.02
040016	705078.21	2893843.54	242.81	0.16	0.22	0.02
040017	705090.34	2893839.53	242.89	0.17	0.24	0.02
040018	705100.26	2893835.94	242.91	0.16	0.23	0.02
040019	705112.32	2893831.90	243.04	0.15	0.21	0.02
040020	705122.42	2893828.49	243.08	0.15	0.21	0.02
040021	705132.78	2893825.10	243.16	0.14	0.20	0.02
040022	705143.84	2893821.42	243.30	0.15	0.21	0.02
040023	705154.88	2893817.79	243.29	0.15	0.21	0.02
040024	705166.23	2893814.36	243.41	0.14	0.19	0.02
040025	705177.29	2893810.77	243.44	0.14	0.20	0.02
040026	705189.03	2893807.10	243.57	0.13	0.19	0.02
040027	705201.02	2893803.16	243.66	0.15	0.21	0.02
040028	705212.86	2893799.34	243.77	0.14	0.19	0.02
040029	705224.66	2893795.46	243.82	0.13	0.18	0.02
040030	705236.15	2893791.89	243.92	0.14	0.19	0.02
040031	705247.67	2893788.36	243.97	0.14	0.19	0.02
040032	705259.16	2893784.86	244.05	0.14	0.20	0.02
040033	705270.53	2893781.20	244.12	0.14	0.20	0.02
040034	705282.02	2893777.70	244.21	0.12	0.17	0.02

040035	705293.46	2893774.23	244.27	0.13	0.18	0.02
040036	705305.26	2893770.83	244.36	0.14	0.20	0.02
040037	705317.08	2893767.22	244.45	0.12	0.17	0.02
040038	705328.80	2893763.89	244.50	0.14	0.19	0.02
040039	705340.73	2893760.33	244.59	0.13	0.18	0.02
040040	705355.09	2893755.99	244.71	0.13	0.18	0.02
040041	705367.62	2893752.19	244.77	0.12	0.17	0.02
040042	705380.12	2893748.52	244.88	0.13	0.18	0.02
040043	705392.80	2893744.78	244.96	0.13	0.18	0.02
040044	705405.40	2893740.93	245.03	0.12	0.16	0.02
040045	705417.78	2893737.20	245.10	0.12	0.16	0.02
040046	705430.03	2893733.60	245.22	0.12	0.17	0.02
040047	705442.12	2893730.06	245.31	0.11	0.16	0.02
040048	705454.09	2893726.66	245.37	0.11	0.16	0.02
040049	705466.15	2893723.46	245.45	0.11	0.16	0.02
040050	705478.45	2893719.80	245.57	0.11	0.16	0.02
040051	705490.81	2893716.18	245.63	0.11	0.16	0.01
040052	705503.22	2893712.80	245.71	0.12	0.17	0.02
040053	705515.68	2893709.17	245.80	0.11	0.16	0.01
040054	705528.19	2893705.72	245.92	0.12	0.17	0.02
040055	705540.83	2893702.14	245.97	0.12	0.17	0.02
040056	705550.51	2893699.49	246.00	0.12	0.17	0.02
040057	705562.98	2893695.79	246.07	0.11	0.15	0.01
040058	705575.16	2893692.44	246.08	0.12	0.18	0.02
040059	705587.78	2893688.84	246.15	0.12	0.16	0.02
040060	705597.55	2893686.09	246.25	0.12	0.16	0.02
040061	705610.31	2893682.57	246.24	0.12	0.16	0.02
040062	705622.61	2893679.21	246.43	0.11	0.15	0.01
040063	705634.96	2893675.92	246.50	0.11	0.15	0.01
040064	705647.30	2893672.62	246.56	0.12	0.17	0.02
040065	705658.88	2893669.50	246.63	0.12	0.17	0.02
040066	705670.11	2893666.34	246.67	0.11	0.16	0.02
040067	705681.87	2893663.17	246.81	0.11	0.15	0.01
040068	705694.02	2893660.01	246.94	0.12	0.17	0.02
040069	705705.84	2893656.83	247.00	0.10	0.15	0.01
040070	705717.98	2893653.58	247.06	0.11	0.16	0.01

040071	705729.99	2893650.49	247.12	0.12	0.17	0.02
040072	705742.00	2893647.15	247.15	0.10	0.14	0.01
040073	705754.52	2893644.10	247.23	0.12	0.17	0.02
040074	705767.24	2893640.94	247.35	0.12	0.17	0.02
040075	705779.73	2893637.57	247.44	0.12	0.17	0.02
040076	705792.15	2893634.30	247.53	0.12	0.17	0.02
040077	705804.28	2893630.94	247.62	0.11	0.15	0.01
040078	705816.95	2893627.88	247.65	0.10	0.14	0.01
040079	705829.51	2893624.61	247.73	0.10	0.14	0.01
040080	705841.88	2893621.68	247.75	0.12	0.16	0.02
040081	705854.29	2893618.46	247.84	0.12	0.16	0.02
040082	705866.49	2893615.31	247.83	0.10	0.14	0.01
040083	705878.69	2893612.40	247.85	0.11	0.15	0.01
040084	705890.83	2893609.41	247.92	0.11	0.15	0.01
040085	705903.37	2893606.38	247.89	0.11	0.16	0.02
040086	705915.99	2893603.37	247.91	0.11	0.16	0.02
040087	705928.27	2893600.46	247.90	0.11	0.16	0.02
040088	705938.34	2893598.02	247.86	0.10	0.14	0.01
040089	705949.25	2893595.29	247.83	0.11	0.16	0.02
040090	705959.95	2893592.89	247.84	0.11	0.15	0.01
040091	705970.19	2893590.28	247.85	0.11	0.15	0.01
040092	705982.25	2893587.32	247.86	0.10	0.15	0.01
040093	705992.57	2893585.02	247.82	0.10	0.15	0.01
040094	706003.56	2893582.52	247.81	0.10	0.13	0.01
040095	706015.17	2893579.90	247.73	0.10	0.13	0.01
040096	706026.79	2893577.13	247.69	0.10	0.13	0.01
040097	706038.38	2893574.44	247.66	0.10	0.13	0.01
040098	706049.24	2893572.04	247.60	0.10	0.15	0.01
040099	706060.68	2893569.14	247.58	0.10	0.15	0.01
040100	706071.57	2893566.52	247.55	0.10	0.13	0.01
040101	706082.72	2893564.12	247.51	0.11	0.16	0.01
040102	706093.75	2893561.40	247.45	0.10	0.14	0.01
040103	706105.20	2893558.77	247.38	0.09	0.13	0.01
040104	706116.93	2893556.16	247.27	0.11	0.16	0.01
040105	706128.55	2893553.46	247.22	0.09	0.13	0.01
040106	706140.11	2893550.79	247.18	0.10	0.14	0.01
040107	706151.54	2893548.44	247.05	0.10	0.14	0.01

040108	706162.90	2893546.04	246.90	0.10	0.14	0.01
040109	706172.95	2893543.90	246.80	0.10	0.14	0.01
040110	706186.37	2893541.11	246.68	0.11	0.15	0.01
040111	706197.03	2893539.00	246.54	0.10	0.14	0.01
040112	706207.49	2893536.51	246.52	0.11	0.15	0.01
040113	706218.79	2893533.99	246.45	0.11	0.15	0.01
040114	706230.35	2893531.66	246.32	0.10	0.14	0.01
040115	706241.87	2893529.18	246.14	0.10	0.14	0.01
040116	706253.50	2893526.67	246.00	0.10	0.14	0.01
040117	706263.77	2893524.59	245.81	0.10	0.14	0.01
040118	706274.88	2893522.31	245.79	0.11	0.15	0.01
040119	706285.53	2893520.14	245.63	0.09	0.13	0.01

APPENDIX G

Control Survey Listing MVRM Calibration Site - Dist. 05

West bound I-20 bridge and ramp west of the Mississippi River

Date & Time 6/1/2014 1:42 AM

Coordinate System U.S. State Plane 1983 **Zone** Louisiana North 1701

Project Datum (NAD 83) **Vertical Datum** (NAVD 88) **Geoid Model** GEOID12A

Coordinate Unit U.S. Survey Foot **Distance Unit** U.S. Survey Foot **Height Unit** U.S. Survey Foot

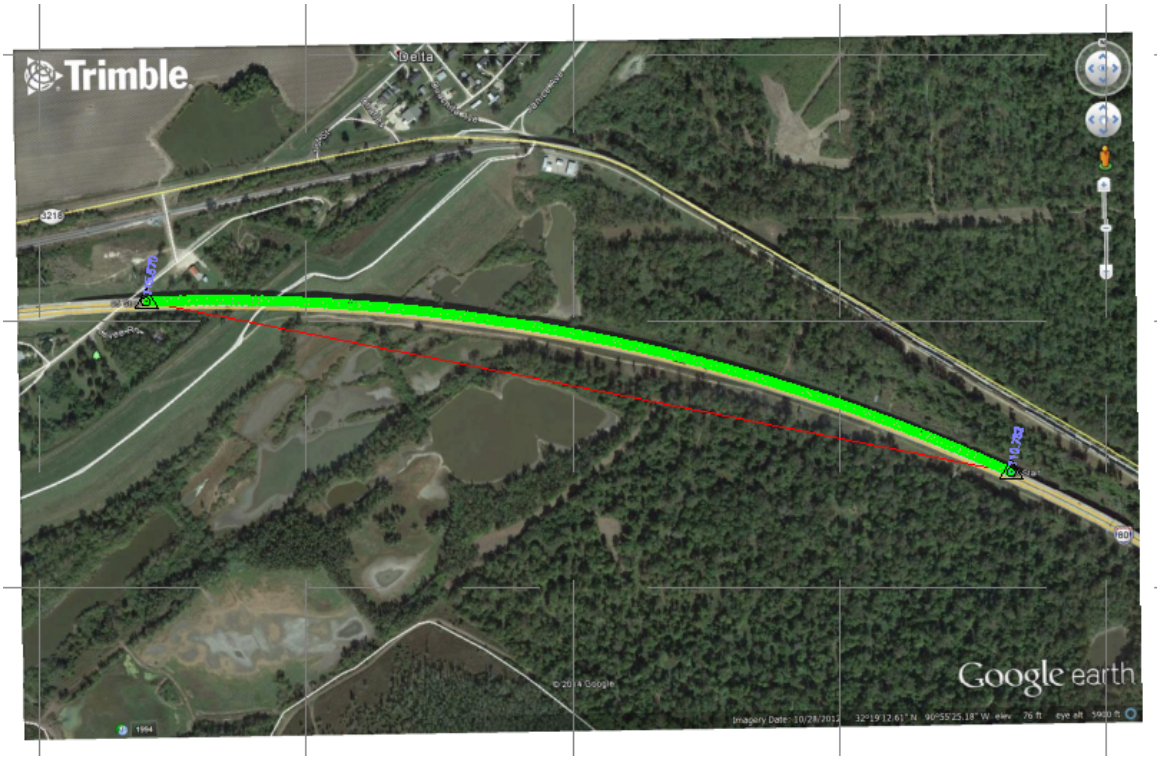


Figure 46
MVRM Control – 05 West bound I-20 bridge and ramp west of the Mississippi River

Figure 47
MVRM Control – 05 Profile 10 X vertical

Point ID	Northing	Easting	Elevation	GNSS P	GNSS P	GNSS P
0501	665143.71	3770364.78	110.782	0.073	0.085	0.011
0502	666169.62	3765172.85	115.570	0.078	0.094	0.015
05001	665143.83	3770364.54	110.777	0.054	0.063	0.007
05002	665148.66	3770353.75	110.702	0.053	0.062	0.007
05003	665153.46	3770343.00	110.626	0.062	0.073	0.008
05004	665158.38	3770332.13	110.544	0.054	0.063	0.007
05005	665164.59	3770318.01	110.534	0.050	0.065	0.005
05006	665169.78	3770306.28	110.450	0.061	0.079	0.007
05007	665175.10	3770294.51	110.439	0.062	0.080	0.007
05008	665180.36	3770282.39	110.417	0.063	0.081	0.007
05009	665184.66	3770273.16	110.351	0.057	0.065	0.007
05010	665188.71	3770263.86	110.333	0.058	0.066	0.007
05011	665192.72	3770254.56	110.269	0.062	0.073	0.008
05012	665196.91	3770245.24	110.277	0.056	0.063	0.006
05013	665200.85	3770236.03	110.288	0.057	0.064	0.007
05014	665204.93	3770226.45	110.324	0.073	0.086	0.009
05015	665209.15	3770217.01	110.275	0.058	0.069	0.007
05016	665213.23	3770207.67	110.247	0.071	0.084	0.008
05017	665218.58	3770195.44	110.272	0.083	0.097	0.010
05018	665222.55	3770186.26	110.270	0.083	0.098	0.010
05019	665226.64	3770176.86	110.270	0.076	0.090	0.010
05020	665232.01	3770164.64	110.314	0.060	0.068	0.007
05021	665235.92	3770155.43	110.241	0.080	0.090	0.009
05022	665241.19	3770143.21	110.231	0.067	0.079	0.009
05023	665246.35	3770131.09	110.279	0.059	0.069	0.008
05024	665251.59	3770119.25	110.329	0.060	0.070	0.008
05025	665256.57	3770107.40	110.334	0.074	0.081	0.008
05026	665261.78	3770095.36	110.294	0.089	0.092	0.009
05027	665265.82	3770085.87	110.277	0.065	0.072	0.007
05028	665273.71	3770066.89	110.311	0.067	0.073	0.007
05029	665277.68	3770057.52	110.295	0.061	0.072	0.008
05030	665281.64	3770048.05	110.357	0.070	0.083	0.008
05031	665285.59	3770038.81	110.353	0.068	0.069	0.007
05032	665290.83	3770026.84	110.335	0.068	0.070	0.007
05033	665296.05	3770014.57	110.299	0.069	0.071	0.007

05034	665301.07	3770002.20	110.320	0.070	0.072	0.007
05035	665305.88	3769990.48	110.306	0.078	0.085	0.008
05036	665310.78	3769978.50	110.304	0.063	0.074	0.008
05037	665315.80	3769966.32	110.277	0.079	0.094	0.010
05038	665320.82	3769954.23	110.259	0.071	0.084	0.009
05039	665325.88	3769942.18	110.282	0.072	0.085	0.009
05040	665330.79	3769930.27	110.310	0.072	0.086	0.009
05041	665335.93	3769918.35	110.293	0.063	0.075	0.008
05042	665340.72	3769906.17	110.303	0.064	0.076	0.008
05043	665345.56	3769894.34	110.276	0.064	0.077	0.008
05044	665350.22	3769882.23	110.283	0.074	0.088	0.009
05045	665355.15	3769870.24	110.287	0.083	0.099	0.010
05046	665360.10	3769858.35	110.300	0.083	0.099	0.010
05047	665364.74	3769846.47	110.317	0.066	0.078	0.008
05048	665369.65	3769834.17	110.327	0.075	0.089	0.009
05049	665373.39	3769824.85	110.265	0.066	0.078	0.008
05050	665377.08	3769815.31	110.289	0.066	0.078	0.008
05051	665380.82	3769805.74	110.250	0.066	0.078	0.008
05052	665386.88	3769790.43	110.270	0.066	0.078	0.008
05053	665391.75	3769778.11	110.263	0.081	0.096	0.011
05054	665395.55	3769768.51	110.258	0.065	0.076	0.009
05055	665399.23	3769758.88	110.230	0.065	0.076	0.009
05056	665402.89	3769749.28	110.255	0.073	0.086	0.010
05057	665406.54	3769739.79	110.280	0.081	0.096	0.011
05058	665411.42	3769727.85	110.303	0.081	0.096	0.011
05059	665414.92	3769718.31	110.275	0.081	0.096	0.011
05060	665418.53	3769708.76	110.315	0.065	0.077	0.009
05061	665423.37	3769696.42	110.281	0.073	0.087	0.010
05062	665428.20	3769684.30	110.268	0.074	0.087	0.010
05063	665432.87	3769671.93	110.245	0.082	0.097	0.011
05064	665437.52	3769659.69	110.250	0.065	0.077	0.009
05065	665441.88	3769647.38	110.260	0.074	0.087	0.010
05066	665446.31	3769634.96	110.296	0.066	0.077	0.009
05067	665449.79	3769625.52	110.220	0.074	0.088	0.009
05068	665453.34	3769616.12	110.257	0.083	0.099	0.010
05069	665456.87	3769606.68	110.254	0.074	0.088	0.009
05070	665461.26	3769594.27	110.278	0.066	0.078	0.008

05071	665464.80	3769584.77	110.241	0.084	0.100	0.010
05072	665468.37	3769575.38	110.265	0.084	0.100	0.010
05073	665472.95	3769563.05	110.287	0.084	0.101	0.010
05074	665476.32	3769553.30	110.242	0.085	0.101	0.010
05075	665479.98	3769543.61	110.254	0.085	0.101	0.010
05076	665483.41	3769534.10	110.246	0.076	0.091	0.009
05077	665486.84	3769524.71	110.279	0.085	0.102	0.010
05078	665491.43	3769512.20	110.258	0.067	0.080	0.008
05079	665495.79	3769499.83	110.242	0.085	0.102	0.010
05080	665500.10	3769487.60	110.228	0.083	0.098	0.011
05081	665504.47	3769475.34	110.255	0.075	0.088	0.010
05082	665508.97	3769463.05	110.276	0.066	0.078	0.009
05083	665513.58	3769450.73	110.257	0.083	0.098	0.011
05084	665517.03	3769440.90	110.253	0.075	0.088	0.010
05085	665520.40	3769431.07	110.273	0.065	0.078	0.008
05086	665523.81	3769421.44	110.241	0.066	0.079	0.008
05087	665527.40	3769411.75	110.220	0.075	0.090	0.009
05088	665530.82	3769402.09	110.267	0.084	0.101	0.010
05089	665535.36	3769389.49	110.234	0.066	0.079	0.008
05090	665538.84	3769379.58	110.261	0.066	0.079	0.008
05091	665542.35	3769369.85	110.239	0.066	0.079	0.008
05092	665545.50	3769360.31	110.229	0.066	0.080	0.008
05093	665548.85	3769350.58	110.237	0.076	0.090	0.009
05094	665554.40	3769334.51	110.247	0.067	0.080	0.008
05095	665557.70	3769324.75	110.232	0.085	0.102	0.010
05096	665561.08	3769314.74	110.233	0.076	0.091	0.009
05097	665564.38	3769304.48	110.180	0.085	0.102	0.010
05098	665567.81	3769294.33	110.206	0.086	0.102	0.010
05099	665571.12	3769284.43	110.217	0.068	0.081	0.008
05100	665574.49	3769274.65	110.240	0.077	0.092	0.009
05101	665577.52	3769264.95	110.213	0.077	0.092	0.009
05102	665580.85	3769255.07	110.248	0.068	0.082	0.008
05103	665584.22	3769245.60	110.168	0.076	0.090	0.010
05104	665587.52	3769235.82	110.233	0.068	0.080	0.009
05105	665590.83	3769225.84	110.243	0.066	0.080	0.008
05106	665594.27	3769215.80	110.250	0.067	0.080	0.008

05107	665597.53	3769205.82	110.243	0.076	0.089	0.010
05108	665600.76	3769195.81	110.208	0.075	0.090	0.009
05109	665603.99	3769185.79	110.205	0.084	0.101	0.010
05110	665607.28	3769176.05	110.260	0.067	0.080	0.008
05111	665610.71	3769166.09	110.247	0.085	0.102	0.010
05112	665613.90	3769156.10	110.234	0.085	0.102	0.010
05113	665617.03	3769146.15	110.225	0.076	0.091	0.009
05114	665620.20	3769136.10	110.213	0.085	0.102	0.010
05115	665623.50	3769126.24	110.221	0.068	0.081	0.008
05116	665626.80	3769116.26	110.253	0.086	0.103	0.010
05117	665629.89	3769106.29	110.191	0.068	0.080	0.009
05118	665633.05	3769096.36	110.196	0.084	0.100	0.011
05119	665636.36	3769086.20	110.213	0.068	0.080	0.009
05120	665639.49	3769076.05	110.185	0.076	0.090	0.010
05121	665642.55	3769066.32	110.190	0.085	0.102	0.010
05122	665645.72	3769056.26	110.225	0.076	0.090	0.010
05123	665648.81	3769046.23	110.197	0.084	0.100	0.011
05124	665652.05	3769035.97	110.194	0.068	0.080	0.009
05125	665655.12	3769025.84	110.253	0.084	0.100	0.011
05126	665658.37	3769015.37	110.240	0.076	0.090	0.010
05127	665661.98	3769004.88	110.243	0.076	0.090	0.010
05128	665665.23	3768994.64	110.237	0.068	0.081	0.009
05129	665668.45	3768984.30	110.277	0.085	0.102	0.010
05130	665671.64	3768974.31	110.279	0.085	0.103	0.010
05131	665674.94	3768963.87	110.211	0.068	0.081	0.009
05132	665677.93	3768953.84	110.255	0.076	0.092	0.009
05133	665680.92	3768944.25	110.243	0.085	0.103	0.010
05134	665684.02	3768934.35	110.224	0.086	0.103	0.010
05135	665687.89	3768921.45	110.270	0.086	0.103	0.010
05136	665690.94	3768911.88	110.290	0.077	0.093	0.009
05137	665694.01	3768901.89	110.259	0.077	0.093	0.009
05138	665696.81	3768891.96	110.227	0.086	0.104	0.011
05139	665699.77	3768881.99	110.258	0.086	0.104	0.011
05140	665703.04	3768871.78	110.311	0.087	0.104	0.011
05141	665706.11	3768861.40	110.236	0.087	0.104	0.011
05142	665708.93	3768851.17	110.278	0.078	0.094	0.010
05143	665711.85	3768841.12	110.242	0.088	0.106	0.011

05144	665714.77	3768831.12	110.240	0.088	0.106	0.011
05145	665717.70	3768820.89	110.276	0.089	0.107	0.011
05146	665720.53	3768810.75	110.249	0.071	0.085	0.009
05147	665723.32	3768800.40	110.275	0.071	0.085	0.009
05148	665726.13	3768790.15	110.243	0.080	0.096	0.010
05149	665729.26	3768779.47	110.253	0.080	0.096	0.010
05150	665732.23	3768769.10	110.251	0.071	0.085	0.009
05151	665735.11	3768758.65	110.224	0.089	0.107	0.011
05152	665737.91	3768748.43	110.238	0.089	0.107	0.011
05153	665740.86	3768738.39	110.228	0.080	0.096	0.010
05154	665743.69	3768728.16	110.236	0.080	0.096	0.010
05155	665746.64	3768717.97	110.249	0.080	0.096	0.010
05156	665749.53	3768707.90	110.260	0.089	0.107	0.011
05157	665752.39	3768697.73	110.248	0.071	0.086	0.009
05158	665755.08	3768687.10	110.266	0.071	0.086	0.009
05159	665758.16	3768676.79	110.228	0.080	0.097	0.010
05160	665761.03	3768666.58	110.290	0.072	0.086	0.009
05161	665763.91	3768656.54	110.222	0.080	0.097	0.010
05162	665766.79	3768646.37	110.266	0.072	0.086	0.009
05163	665769.73	3768636.32	110.283	0.089	0.108	0.011
05164	665772.56	3768626.25	110.302	0.072	0.086	0.009
05165	665775.30	3768616.20	110.273	0.089	0.108	0.011
05166	665778.07	3768606.29	110.256	0.081	0.097	0.010
05167	665780.75	3768596.26	110.280	0.081	0.097	0.010
05168	665783.44	3768586.19	110.271	0.081	0.098	0.010
05169	665785.97	3768576.40	110.270	0.090	0.109	0.011
05170	665788.89	3768566.39	110.260	0.087	0.105	0.011
05171	665791.56	3768556.43	110.231	0.088	0.110	0.010
05172	665794.29	3768546.11	110.292	0.080	0.114	0.010
05173	665801.55	3768520.17	110.257	0.090	0.108	0.011
05174	665803.98	3768510.40	110.265	0.081	0.098	0.010
05175	665807.16	3768497.70	110.276	0.073	0.088	0.009
05176	665810.10	3768486.17	110.240	0.073	0.088	0.009
05177	665811.94	3768473.68	110.225	0.073	0.089	0.009
05178	665815.97	3768464.20	110.227	0.082	0.100	0.010
05179	665819.31	3768451.32	110.220	0.083	0.100	0.010

05180	665821.79	3768440.87	110.204	0.083	0.100	0.010
05181	665824.46	3768429.35	110.224	0.093	0.112	0.011
05182	665827.23	3768418.67	110.225	0.084	0.101	0.010
05183	665830.00	3768407.50	110.264	0.084	0.102	0.010
05184	665832.94	3768395.72	110.249	0.084	0.102	0.010
05185	665836.08	3768383.44	110.249	0.084	0.102	0.010
05186	665839.09	3768371.25	110.270	0.093	0.112	0.012
05187	665842.17	3768358.85	110.244	0.093	0.113	0.012
05188	665845.35	3768346.34	110.236	0.075	0.091	0.009
05189	665848.27	3768333.86	110.238	0.076	0.091	0.009
05190	665851.29	3768321.28	110.226	0.076	0.091	0.009
05191	665854.21	3768309.03	110.221	0.093	0.113	0.012
05192	665857.24	3768297.01	110.271	0.093	0.113	0.012
05193	665860.07	3768285.34	110.239	0.076	0.092	0.009
05194	665862.90	3768274.46	110.202	0.093	0.113	0.012
05195	665865.47	3768263.91	110.224	0.076	0.092	0.009
05196	665868.13	3768252.19	110.239	0.085	0.103	0.011
05197	665870.40	3768242.18	110.274	0.077	0.093	0.009
05198	665872.95	3768230.97	110.259	0.077	0.093	0.010
05199	665875.45	3768219.53	110.274	0.094	0.114	0.012
05200	665878.08	3768209.02	110.262	0.085	0.104	0.011
05201	665880.74	3768197.66	110.253	0.085	0.104	0.011
05202	665883.61	3768185.24	110.296	0.077	0.093	0.010
05203	665886.52	3768172.72	110.202	0.094	0.114	0.012
05204	665889.33	3768160.09	110.239	0.077	0.093	0.010
05205	665892.33	3768147.20	110.220	0.085	0.104	0.011
05206	665894.53	3768137.42	110.235	0.094	0.114	0.012
05207	665897.23	3768125.02	110.271	0.094	0.114	0.012
05208	665899.90	3768112.89	110.298	0.077	0.093	0.010
05209	665902.51	3768100.61	110.212	0.094	0.114	0.012
05210	665905.35	3768087.95	110.220	0.094	0.114	0.012
05211	665907.75	3768077.96	110.248	0.094	0.114	0.012
05212	665910.02	3768068.08	110.289	0.077	0.093	0.010
05213	665912.64	3768055.07	110.262	0.094	0.114	0.012
05214	665914.95	3768044.95	110.309	0.085	0.104	0.011
05215	665917.71	3768032.79	110.268	0.094	0.114	0.012
05216	665920.34	3768020.16	110.292	0.094	0.114	0.012

05217	665922.94	3768007.49	110.274	0.077	0.093	0.010
05218	665925.71	3767994.52	110.288	0.095	0.115	0.012
05219	665927.94	3767984.71	110.249	0.077	0.093	0.010
05220	665930.73	3767971.79	110.234	0.077	0.094	0.010
05221	665933.61	3767958.22	110.224	0.077	0.094	0.010
05222	665935.71	3767948.19	110.225	0.095	0.115	0.012
05223	665938.37	3767935.01	110.241	0.077	0.094	0.010
05224	665940.44	3767924.88	110.245	0.095	0.115	0.012
05225	665942.45	3767914.61	110.192	0.086	0.104	0.011
05226	665944.49	3767904.67	110.225	0.086	0.104	0.011
05227	665947.00	3767891.96	110.240	0.086	0.104	0.011
05228	665949.54	3767879.11	110.255	0.077	0.094	0.010
05229	665951.53	3767869.03	110.213	0.086	0.104	0.011
05230	665953.75	3767858.70	110.201	0.086	0.104	0.011
05231	665955.58	3767848.79	110.219	0.077	0.094	0.010
05232	665958.45	3767835.22	110.211	0.086	0.104	0.011
05233	665960.38	3767825.22	110.224	0.095	0.115	0.012
05234	665962.42	3767814.93	110.254	0.095	0.115	0.012
05235	665964.61	3767804.36	110.208	0.077	0.094	0.010
05236	665966.59	3767794.08	110.148	0.095	0.115	0.012
05237	665968.61	3767783.71	110.251	0.095	0.115	0.012
05238	665970.60	3767773.59	110.237	0.077	0.094	0.010
05239	665973.04	3767760.47	110.217	0.077	0.094	0.010
05240	665975.01	3767750.25	110.222	0.095	0.115	0.012
05241	665977.01	3767740.01	110.213	0.077	0.094	0.010
05242	665979.02	3767729.90	110.189	0.086	0.105	0.011
05243	665981.15	3767719.57	110.220	0.077	0.094	0.010
05244	665983.24	3767709.44	110.200	0.086	0.105	0.011
05245	665985.12	3767699.18	110.215	0.086	0.105	0.011
05246	665987.09	3767688.68	110.202	0.095	0.115	0.012
05247	665989.07	3767678.19	110.169	0.078	0.095	0.010
05248	665991.05	3767667.58	110.176	0.086	0.105	0.011
05249	665992.87	3767657.12	110.197	0.086	0.105	0.011
05250	665994.62	3767646.61	110.188	0.095	0.116	0.012
05251	665996.50	3767635.89	110.170	0.086	0.105	0.011
05252	665998.26	3767625.38	110.197	0.078	0.095	0.010

05253	666000.00	3767614.89	110.189	0.095	0.116	0.012
05254	666001.74	3767604.46	110.167	0.095	0.116	0.012
05255	666003.75	3767593.95	110.136	0.086	0.105	0.011
05256	666005.64	3767583.39	110.177	0.095	0.116	0.012
05257	666007.49	3767572.96	110.181	0.095	0.116	0.012
05258	666009.32	3767562.49	110.163	0.086	0.105	0.011
05259	666011.24	3767551.84	110.214	0.086	0.105	0.011
05260	666012.95	3767541.56	110.204	0.078	0.095	0.010
05261	666014.70	3767531.01	110.206	0.086	0.105	0.011
05262	666016.42	3767520.64	110.204	0.087	0.105	0.011
05263	666018.10	3767510.15	110.144	0.086	0.105	0.011
05264	666019.93	3767499.45	110.168	0.087	0.105	0.011
05265	666021.91	3767488.88	110.225	0.078	0.095	0.010
05266	666023.61	3767478.74	110.207	0.095	0.116	0.012
05267	666025.45	3767468.45	110.252	0.086	0.105	0.011
05268	666027.12	3767458.37	110.208	0.086	0.105	0.011
05269	666029.21	3767444.80	110.200	0.078	0.095	0.010
05270	666030.91	3767434.62	110.182	0.095	0.116	0.012
05271	666032.45	3767424.31	110.227	0.086	0.105	0.011
05272	666034.06	3767414.24	110.220	0.077	0.094	0.010
05273	666035.61	3767403.76	110.205	0.095	0.116	0.012
05274	666037.28	3767392.98	110.167	0.077	0.094	0.010
05275	666039.02	3767382.05	110.149	0.086	0.105	0.011
05276	666040.66	3767371.32	110.239	0.095	0.116	0.012
05277	666042.28	3767360.82	110.238	0.095	0.116	0.012
05278	666043.85	3767350.20	110.265	0.095	0.116	0.012
05279	666045.69	3767339.57	110.324	0.095	0.116	0.012
05280	666047.30	3767329.12	110.312	0.086	0.105	0.011
05281	666048.91	3767318.31	110.343	0.086	0.105	0.011
05282	666050.66	3767308.12	110.387	0.086	0.105	0.011
05283	666052.23	3767297.84	110.462	0.086	0.105	0.011
05284	666053.74	3767287.29	110.538	0.095	0.116	0.012
05285	666055.27	3767276.72	110.589	0.078	0.095	0.010
05286	666056.88	3767266.12	110.652	0.078	0.095	0.010
05287	666058.52	3767255.25	110.697	0.095	0.116	0.012
05288	666059.92	3767245.03	110.830	0.095	0.116	0.012
05289	666061.66	3767234.52	110.929	0.086	0.105	0.011

05290	666063.25	3767223.55	111.059	0.095	0.116	0.012
05291	666064.73	3767213.09	111.108	0.078	0.095	0.010
05292	666066.06	3767202.20	111.197	0.095	0.116	0.012
05293	666067.53	3767191.69	111.337	0.095	0.116	0.012
05294	666069.02	3767181.32	111.456	0.095	0.116	0.012
05295	666070.46	3767171.08	111.588	0.078	0.095	0.010
05296	666071.89	3767160.58	111.712	0.086	0.105	0.011
05297	666073.39	3767149.79	111.860	0.095	0.116	0.012
05298	666075.23	3767135.75	112.074	0.095	0.116	0.012
05299	666076.96	3767122.91	112.271	0.086	0.105	0.011
05300	666078.35	3767112.55	112.407	0.095	0.116	0.012
05301	666079.75	3767101.97	112.581	0.095	0.116	0.012
05302	666081.03	3767091.35	112.730	0.095	0.116	0.012
05303	666082.39	3767080.67	112.949	0.078	0.095	0.010
05304	666084.29	3767066.27	113.204	0.078	0.095	0.010
05305	666086.01	3767051.85	113.504	0.078	0.095	0.010
05306	666089.22	3767026.60	113.912	0.095	0.116	0.012
05307	666090.53	3767015.82	114.143	0.078	0.095	0.010
05308	666091.77	3767005.17	114.427	0.086	0.105	0.011
05309	666093.03	3766994.55	114.666	0.078	0.095	0.010
05310	666094.28	3766983.91	114.889	0.086	0.105	0.011
05311	666095.76	3766972.95	115.142	0.095	0.116	0.012
05312	666097.15	3766962.21	115.383	0.078	0.095	0.010
05313	666098.57	3766951.87	115.640	0.087	0.106	0.011
05314	666100.15	3766937.79	116.037	0.095	0.116	0.012
05315	666101.85	3766923.80	116.347	0.087	0.106	0.011
05316	666103.46	3766909.31	116.674	0.087	0.106	0.011
05317	666104.69	3766898.63	116.995	0.087	0.106	0.011
05318	666105.94	3766887.84	117.330	0.096	0.117	0.012
05319	666107.22	3766877.03	117.613	0.095	0.116	0.012
05320	666108.50	3766866.14	117.927	0.078	0.095	0.010
05321	666109.85	3766855.21	118.231	0.078	0.095	0.010
05322	666110.91	3766844.64	118.489	0.095	0.116	0.012
05323	666112.07	3766834.16	118.784	0.087	0.106	0.011
05324	666113.16	3766823.77	119.047	0.078	0.095	0.010
05325	666114.22	3766813.37	119.352	0.087	0.106	0.011

05326	666115.26	3766803.07	119.597	0.096	0.117	0.012
05327	666116.40	3766792.68	119.839	0.087	0.106	0.011
05328	666117.42	3766782.14	120.097	0.078	0.096	0.010
05329	666118.41	3766771.66	120.368	0.096	0.117	0.012
05330	666119.69	3766761.27	120.604	0.096	0.117	0.012
05331	666120.72	3766750.75	120.846	0.096	0.117	0.012
05332	666121.74	3766740.22	121.069	0.096	0.117	0.012
05333	666122.84	3766729.56	121.279	0.078	0.096	0.010
05334	666123.80	3766718.54	121.559	0.087	0.106	0.011
05335	666124.73	3766707.58	121.861	0.096	0.117	0.012
05336	666125.76	3766696.75	122.141	0.079	0.096	0.010
05337	666126.68	3766686.14	122.402	0.087	0.106	0.011
05338	666127.58	3766675.49	122.664	0.096	0.117	0.012
05339	666128.57	3766664.82	122.943	0.096	0.117	0.012
05340	666129.64	3766654.02	123.193	0.079	0.096	0.010
05341	666130.44	3766643.46	123.377	0.079	0.096	0.010
05342	666131.36	3766632.80	123.629	0.079	0.096	0.010
05343	666132.30	3766622.13	123.805	0.096	0.117	0.012
05344	666133.39	3766611.39	124.056	0.096	0.117	0.012
05345	666134.24	3766600.81	124.255	0.079	0.096	0.010
05346	666135.23	3766589.95	124.498	0.079	0.096	0.010
05347	666136.06	3766579.02	124.705	0.087	0.107	0.011
05348	666136.94	3766568.21	124.928	0.079	0.096	0.010
05349	666137.92	3766557.27	125.102	0.079	0.096	0.010
05350	666139.01	3766546.30	125.306	0.096	0.117	0.012
05351	666139.87	3766535.35	125.514	0.079	0.096	0.010
05352	666140.76	3766524.46	125.681	0.079	0.096	0.010
05353	666141.72	3766513.70	125.858	0.079	0.096	0.010
05354	666142.60	3766503.40	126.026	0.087	0.107	0.011
05355	666143.55	3766491.52	126.185	0.096	0.117	0.012
05356	666144.28	3766480.62	126.373	0.079	0.096	0.010
05357	666145.05	3766469.79	126.515	0.086	0.104	0.011
05358	666145.87	3766458.90	126.684	0.077	0.094	0.010
05359	666146.73	3766447.83	126.838	0.077	0.094	0.010
05360	666147.53	3766436.45	127.009	0.095	0.115	0.012
05361	666148.68	3766421.68	127.181	0.086	0.105	0.011
05362	666149.70	3766406.77	127.396	0.095	0.116	0.012

05363	666151.00	3766391.57	127.555	0.086	0.106	0.011
05364	666152.06	3766377.23	127.737	0.087	0.106	0.011
05365	666152.77	3766362.67	127.911	0.095	0.116	0.012
05366	666153.71	3766348.06	128.059	0.095	0.117	0.012
05367	666154.44	3766333.75	128.194	0.096	0.117	0.012
05368	666155.14	3766322.73	128.308	0.087	0.106	0.011
05369	666155.82	3766311.81	128.439	0.096	0.117	0.012
05370	666156.56	3766300.65	128.594	0.096	0.117	0.012
05371	666157.19	3766289.32	128.673	0.079	0.096	0.010
05372	666157.85	3766278.53	128.732	0.087	0.107	0.011
05373	666158.52	3766268.02	128.784	0.096	0.117	0.012
05374	666159.19	3766257.10	128.847	0.079	0.096	0.010
05375	666159.77	3766246.48	128.885	0.088	0.107	0.011
05376	666160.19	3766235.75	128.982	0.079	0.096	0.010
05377	666160.88	3766224.90	129.008	0.079	0.096	0.010
05378	666161.47	3766213.90	129.041	0.079	0.096	0.010
05379	666162.21	3766203.02	129.113	0.096	0.117	0.012
05380	666162.94	3766192.09	129.199	0.096	0.117	0.012
05381	666163.29	3766181.06	129.241	0.088	0.107	0.011
05382	666163.92	3766163.81	129.347	0.097	0.118	0.012
05383	666164.48	3766153.39	129.426	0.080	0.097	0.010
05384	666164.97	3766142.80	129.456	0.088	0.108	0.011
05385	666165.43	3766132.67	129.492	0.088	0.108	0.011
05386	666166.06	3766121.10	129.568	0.088	0.107	0.011
05387	666166.72	3766109.04	129.621	0.150	0.102	0.010
05388	666167.27	3766096.56	129.709	0.141	0.096	0.009
05389	666167.66	3766086.34	129.709	0.163	0.111	0.011
05390	666166.20	3766074.09	129.744	0.088	0.107	0.011
05391	666168.73	3766063.23	129.744	0.079	0.097	0.010
05392	666169.01	3766050.52	129.775	0.088	0.107	0.011
05393	666169.36	3766039.99	129.767	0.088	0.107	0.011
05394	666169.95	3766029.37	129.748	0.079	0.097	0.010
05395	666170.31	3766018.77	129.746	0.088	0.107	0.011
05396	666170.95	3766005.43	129.720	0.080	0.097	0.010
05397	666171.13	3765995.25	129.720	0.088	0.107	0.011
05398	666171.44	3765981.86	129.655	0.088	0.107	0.011

05399	666171.65	3765971.80	129.619	0.088	0.107	0.011
05400	666171.90	3765961.76	129.569	0.088	0.107	0.011
05401	666172.25	3765951.48	129.539	0.088	0.107	0.011
05402	666172.39	3765941.13	129.487	0.080	0.097	0.010
05403	666172.66	3765930.55	129.404	0.088	0.107	0.011
05404	666173.04	3765920.04	129.344	0.097	0.118	0.012
05405	666173.52	3765909.25	129.239	0.088	0.107	0.011
05406	666173.91	3765898.37	129.189	0.088	0.108	0.011
05407	666174.25	3765887.71	129.072	0.088	0.107	0.011
05408	666174.62	3765876.86	129.025	0.080	0.097	0.010
05409	666174.91	3765865.83	128.954	0.080	0.097	0.010
05410	666175.21	3765854.74	128.841	0.097	0.118	0.012
05411	666175.57	3765831.75	128.546	0.080	0.097	0.010
05412	666175.70	3765820.92	128.429	0.080	0.097	0.010
05413	666175.77	3765809.90	128.328	0.115	0.080	0.008
05414	666175.82	3765799.09	128.192	0.136	0.094	0.009
05415	666176.04	3765788.17	128.101	0.139	0.096	0.009
05416	666176.11	3765777.36	127.997	0.158	0.109	0.011
05417	666176.49	3765766.82	127.957	0.161	0.111	0.011
05418	666176.70	3765756.04	127.793	0.148	0.102	0.010
05419	666176.79	3765745.22	127.689	0.096	0.118	0.012
05420	666177.02	3765734.14	127.593	0.080	0.097	0.010
05421	666177.36	3765722.83	127.448	0.080	0.097	0.010
05422	666177.27	3765711.74	127.348	0.080	0.097	0.010
05423	666177.27	3765700.41	127.253	0.080	0.097	0.010
05424	666177.37	3765689.48	127.087	0.080	0.097	0.010
05425	666177.57	3765678.51	126.942	0.080	0.097	0.010
05426	666177.74	3765667.57	126.778	0.080	0.097	0.010
05427	666177.77	3765656.44	126.590	0.088	0.107	0.011
05428	666177.75	3765645.75	126.439	0.088	0.108	0.011
05429	666177.61	3765634.77	126.304	0.088	0.108	0.011
05430	666177.55	3765623.73	126.121	0.088	0.108	0.011
05431	666177.52	3765612.70	125.925	0.080	0.097	0.010
05432	666177.47	3765601.55	125.801	0.080	0.097	0.010
05433	666177.45	3765590.73	125.660	0.088	0.108	0.011
05434	666177.45	3765580.26	125.414	0.097	0.118	0.013
05435	666177.30	3765569.59	125.261	0.097	0.118	0.013

05436	666177.21	3765558.89	125.028	0.097	0.118	0.013
05437	666177.24	3765545.34	124.763	0.097	0.118	0.013
05438	666177.39	3765535.25	124.570	0.097	0.118	0.013
05439	666177.30	3765521.87	124.381	0.080	0.098	0.010
05440	666177.18	3765511.57	124.172	0.080	0.098	0.010
05441	666177.22	3765501.24	124.005	0.089	0.108	0.011
05442	666177.05	3765490.77	123.806	0.089	0.108	0.011
05443	666176.85	3765480.28	123.564	0.080	0.097	0.010
05444	666176.63	3765469.84	123.338	0.080	0.097	0.010
05445	666176.37	3765459.31	123.103	0.088	0.108	0.011
05446	666176.33	3765449.21	122.890	0.080	0.097	0.010
05447	666176.09	3765439.07	122.645	0.080	0.097	0.010
05448	666175.95	3765428.85	122.420	0.097	0.118	0.013
05449	666175.66	3765418.40	122.197	0.097	0.118	0.013
05450	666175.14	3765397.38	121.688	0.097	0.118	0.013
05451	666175.03	3765386.61	121.433	0.097	0.118	0.013
05452	666174.91	3765375.58	121.163	0.089	0.108	0.011
05453	666174.67	3765364.80	120.930	0.097	0.118	0.013
05454	666174.47	3765354.05	120.632	0.097	0.118	0.013
05455	666174.29	3765342.80	120.375	0.089	0.108	0.011
05456	666173.98	3765331.82	120.095	0.097	0.118	0.013
05457	666173.64	3765321.03	119.794	0.089	0.108	0.011
05458	666173.34	3765310.27	119.535	0.089	0.108	0.011
05459	666173.33	3765299.30	119.224	0.097	0.118	0.013
05460	666173.12	3765288.67	118.904	0.097	0.118	0.013
05461	666172.90	3765277.88	118.683	0.089	0.108	0.011
05462	666172.59	3765267.10	118.354	0.080	0.098	0.010
05463	666172.24	3765256.17	118.082	0.080	0.098	0.010
05464	666171.91	3765245.90	117.782	0.080	0.098	0.010
05465	666171.72	3765235.77	117.483	0.089	0.108	0.011
05466	666171.34	3765225.05	117.196	0.097	0.118	0.013
05467	666171.08	3765214.49	116.910	0.089	0.108	0.011
05468	666170.80	3765204.31	116.605	0.089	0.108	0.011
05469	666170.48	3765193.86	116.306	0.080	0.098	0.010
05470	666170.26	3765183.33	115.958	0.089	0.108	0.011
05471	666169.80	3765172.26	115.565	0.097	0.118	0.013

APPENDIX H

Control Survey Listing MVRM Calibration Site - Dist. 07

East bound I-210 bridge south of Maplewood between Lake Charles & Sulphur

Date & Time 3/24/2014 9:47 AM

Coordinate System U.S. State Plane 1983 **Zone** Louisiana South 1702

Project Datum (NAD 83) **Vertical Datum** (NAVD 88) **Geoid Model** GEOID12A

Coordinate Unit U.S. Survey Foot **Distance Unit** U.S. Survey Foot **Height Unit** U.S. Survey Foot

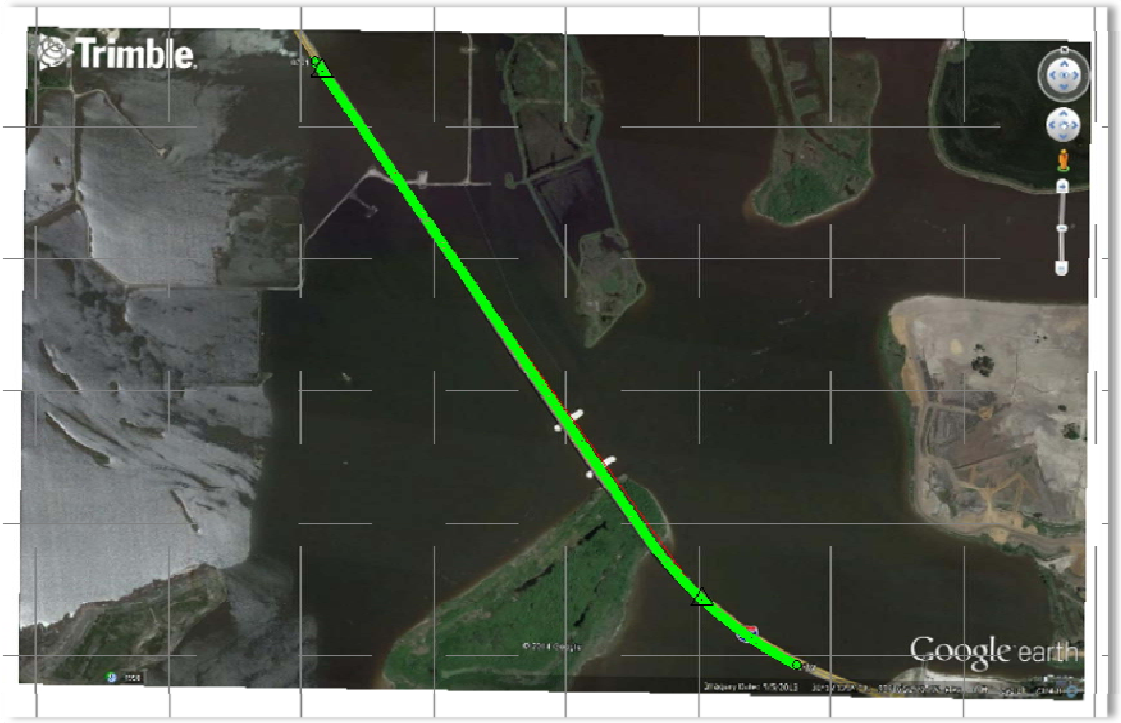


Figure 48
MVRM Control – 07 East bound I-210 bridge south of Maplewood 'tween Lake Charles & Sulphur

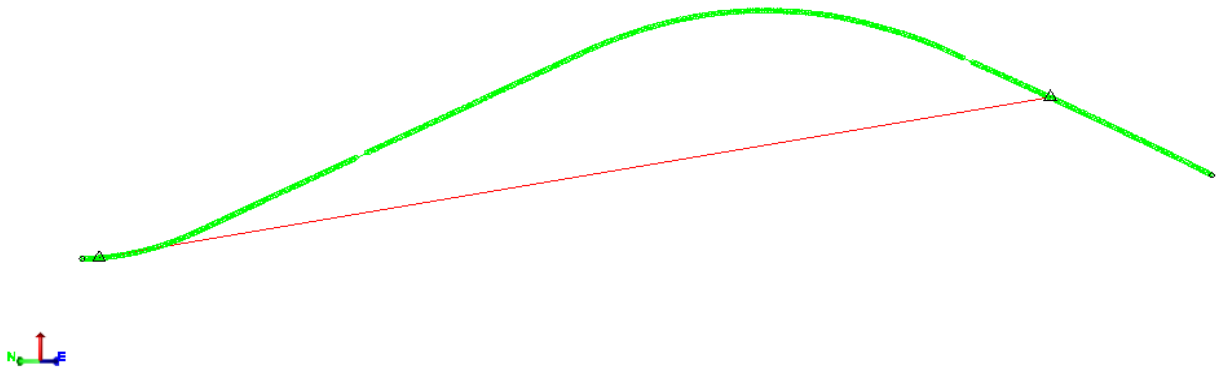


Figure 49
MVRM Control – 07 Profile 10 X vertical

Point ID	Northing	Easting	Elevation	H Prc	V Prc	RMS
0701	627089.48	2663617.57	12.60	0.08	0.08	0.01
0702	622289.08	2667430.13	61.59	0.07	0.09	0.01
07001	627090.84	2663616.82	12.62	0.14	0.13	0.01
07002	627081.87	2663622.89	12.71	0.11	0.10	0.01
07003	627072.22	2663629.84	12.75	0.11	0.10	0.01
07004	627061.81	2663637.03	12.79	0.13	0.12	0.01
07005	627053.22	2663642.98	12.82	0.12	0.11	0.01
07006	627044.47	2663648.80	12.86	0.13	0.12	0.01
07007	627036.12	2663654.34	12.93	0.11	0.10	0.01
07008	627027.48	2663660.38	13.00	0.13	0.12	0.01
07009	627018.77	2663666.41	13.11	0.11	0.10	0.01
07010	627009.90	2663672.61	13.18	0.13	0.12	0.01
07011	627001.52	2663678.30	13.25	0.11	0.12	0.01
07012	626993.29	2663684.09	13.36	0.13	0.12	0.01
07013	626984.69	2663690.09	13.49	0.12	0.11	0.01
07014	626975.41	2663696.33	13.60	0.13	0.12	0.01
07015	626966.21	2663702.73	13.76	0.12	0.11	0.01
07016	626956.84	2663709.35	13.88	0.12	0.11	0.01
07017	626947.70	2663715.81	14.04	0.11	0.10	0.01
07018	626938.45	2663722.30	14.23	0.12	0.11	0.01
07019	626929.11	2663728.85	14.40	0.11	0.10	0.01
07020	626919.51	2663735.54	14.57	0.13	0.12	0.01
07021	626910.28	2663742.01	14.81	0.11	0.10	0.01
07022	626900.61	2663748.87	14.99	0.11	0.10	0.01
07023	626891.08	2663755.44	15.31	0.13	0.12	0.01
07024	626881.49	2663762.22	15.49	0.11	0.10	0.01
07025	626872.03	2663768.87	15.74	0.12	0.11	0.01
07026	626862.49	2663775.41	15.99	0.11	0.10	0.01
07027	626852.84	2663781.94	16.22	0.13	0.12	0.01
07028	626843.58	2663788.46	16.50	0.13	0.12	0.01
07029	626834.34	2663794.89	16.80	0.11	0.10	0.01
07030	626824.97	2663801.23	17.05	0.13	0.12	0.01
07031	626815.12	2663808.28	17.35	0.13	0.12	0.01
07032	626805.62	2663814.69	17.67	0.11	0.10	0.01
07033	626795.76	2663821.48	18.00	0.12	0.11	0.01
07034	626785.83	2663828.34	18.34	0.12	0.11	0.01

07035	626776.18	2663835.17	18.71	0.11	0.10	0.01
07036	626766.60	2663841.96	19.06	0.13	0.12	0.01
07037	626756.84	2663848.61	19.46	0.11	0.10	0.01
07038	626747.03	2663855.47	19.85	0.13	0.12	0.01
07039	626737.05	2663862.36	20.26	0.12	0.11	0.01
07040	626727.14	2663869.26	20.67	0.13	0.12	0.01
07041	626717.14	2663876.15	21.08	0.12	0.11	0.01
07042	626707.49	2663882.80	21.55	0.12	0.11	0.01
07043	626697.53	2663889.61	22.02	0.11	0.10	0.01
07044	626688.11	2663896.33	22.50	0.13	0.12	0.01
07045	626678.43	2663903.21	22.94	0.11	0.10	0.01
07046	626668.83	2663909.70	23.43	0.12	0.11	0.01
07047	626659.12	2663916.52	23.89	0.12	0.11	0.01
07048	626649.53	2663923.17	24.41	0.13	0.12	0.01
07049	626639.60	2663930.11	24.95	0.13	0.12	0.01
07050	626629.85	2663936.94	25.45	0.11	0.10	0.01
07051	626620.14	2663943.70	25.99	0.11	0.10	0.01
07052	626610.56	2663950.49	26.51	0.13	0.12	0.01
07053	626601.46	2663956.95	27.09	0.11	0.10	0.01
07054	626590.45	2663964.52	27.71	0.13	0.12	0.01
07055	626580.75	2663971.40	28.33	0.13	0.12	0.01
07056	626571.03	2663978.11	28.89	0.12	0.11	0.01
07057	626561.43	2663984.99	29.47	0.12	0.11	0.01
07058	626551.17	2663992.23	30.11	0.13	0.12	0.01
07059	626541.20	2663999.09	30.67	0.12	0.11	0.01
07060	626531.47	2664005.86	31.29	0.13	0.12	0.01
07061	626521.33	2664012.76	31.92	0.11	0.11	0.01
07062	626511.73	2664019.25	32.49	0.13	0.12	0.01
07063	626502.49	2664025.65	33.07	0.12	0.12	0.01
07064	626493.08	2664032.30	33.66	0.12	0.12	0.01
07065	626483.60	2664038.80	34.20	0.10	0.10	0.01
07066	626474.26	2664045.10	34.78	0.12	0.12	0.01
07067	626464.70	2664051.82	35.35	0.11	0.11	0.01
07068	626455.47	2664059.08	35.96	0.11	0.11	0.01
07069	626445.81	2664065.77	36.55	0.10	0.10	0.01
07070	626435.65	2664072.44	37.14	0.11	0.11	0.01

07071	626426.02	2664079.20	37.76	0.12	0.12	0.01
07072	626416.23	2664086.12	38.33	0.12	0.12	0.01
07073	626406.37	2664092.83	38.96	0.12	0.12	0.01
07074	626396.34	2664099.51	39.54	0.12	0.12	0.01
07075	626386.69	2664105.92	40.11	0.12	0.12	0.01
07076	626377.03	2664112.67	40.72	0.12	0.12	0.01
07077	626367.36	2664119.58	41.30	0.10	0.11	0.01
07078	626357.80	2664126.10	41.91	0.12	0.11	0.01
07079	626346.19	2664134.29	42.63	0.11	0.10	0.01
07080	626335.96	2664141.30	43.24	0.10	0.09	0.01
07081	626326.37	2664148.16	43.85	0.11	0.10	0.01
07082	626315.93	2664155.07	44.42	0.10	0.09	0.01
07083	626306.11	2664161.95	45.00	0.10	0.09	0.01
07084	626296.30	2664168.75	45.64	0.12	0.11	0.01
07085	626286.53	2664175.45	46.25	0.12	0.11	0.01
07086	626276.79	2664182.14	46.84	0.10	0.09	0.01
07087	626266.73	2664189.06	47.48	0.12	0.11	0.01
07088	626256.61	2664195.98	48.07	0.12	0.11	0.01
07089	626246.76	2664202.74	48.69	0.10	0.09	0.01
07090	626236.85	2664209.71	49.31	0.11	0.10	0.01
07091	626227.00	2664216.53	49.93	0.11	0.10	0.01
07092	626217.69	2664223.02	50.45	0.10	0.09	0.01
07093	626207.96	2664229.81	51.07	0.10	0.09	0.01
07094	626198.04	2664236.56	51.68	0.11	0.10	0.01
07095	626188.63	2664242.95	52.25	0.10	0.11	0.01
07096	626179.50	2664249.57	52.83	0.10	0.11	0.01
07097	626170.02	2664256.03	53.39	0.09	0.10	0.01
07098	626160.23	2664262.82	53.98	0.10	0.11	0.01
07099	626150.25	2664269.85	54.62	0.10	0.11	0.01
07100	626140.34	2664276.82	55.19	0.11	0.13	0.01
07101	626130.83	2664283.57	55.80	0.10	0.11	0.01
07102	626121.16	2664290.31	56.37	0.11	0.13	0.01
07103	626111.21	2664297.15	56.92	0.09	0.10	0.01
07104	626101.13	2664304.23	57.59	0.09	0.10	0.01
07105	626091.30	2664311.01	58.18	0.10	0.11	0.01
07106	626081.46	2664318.30	58.79	0.10	0.12	0.01
07107	626071.28	2664325.23	59.40	0.10	0.12	0.01

07108	626061.57	2664332.02	59.93	0.09	0.10	0.01
07109	626052.20	2664338.54	60.47	0.10	0.12	0.01
07110	626043.44	2664344.62	61.01	0.09	0.10	0.01
07111	626033.07	2664351.71	61.73	0.12	0.13	0.01
07112	626023.23	2664358.66	62.31	0.10	0.12	0.01
07113	626013.10	2664365.68	62.92	0.09	0.10	0.01
07114	626002.98	2664372.48	63.55	0.12	0.13	0.01
07115	625993.09	2664379.23	64.14	0.12	0.13	0.01
07116	625983.49	2664385.89	64.77	0.04	0.12	0.00
07117	625973.54	2664392.74	65.34	0.09	0.10	0.01
07118	625963.71	2664399.66	65.95	0.09	0.10	0.01
07119	625953.69	2664406.46	66.56	0.11	0.12	0.01
07120	625944.01	2664413.16	67.10	0.09	0.10	0.01
07121	625934.31	2664419.91	67.72	0.09	0.10	0.01
07122	625924.29	2664426.75	68.37	0.09	0.10	0.01
07123	625914.83	2664433.21	68.90	0.10	0.11	0.01
07124	625905.34	2664439.85	69.50	0.09	0.10	0.01
07125	625896.04	2664446.41	70.06	0.11	0.13	0.01
07126	625886.64	2664452.97	70.62	0.09	0.10	0.01
07127	625877.26	2664459.43	71.18	0.11	0.13	0.01
07128	625867.57	2664466.19	71.84	0.11	0.13	0.01
07129	625817.36	2664501.80	74.85	0.07	0.08	0.01
07130	625807.02	2664509.04	75.52	0.12	0.13	0.01
07131	625793.05	2664518.78	76.36	0.10	0.11	0.01
07132	625782.88	2664525.73	77.01	0.07	0.08	0.01
07133	625772.83	2664532.95	77.60	0.08	0.08	0.01
07134	625759.59	2664542.06	78.44	0.09	0.10	0.01
07135	625749.32	2664549.09	79.04	0.09	0.10	0.01
07136	625735.35	2664558.50	79.86	0.09	0.10	0.01
07137	625721.70	2664568.26	80.71	0.09	0.09	0.01
07138	625711.69	2664575.28	81.33	0.10	0.11	0.01
07139	625701.83	2664581.98	81.93	0.09	0.10	0.01
07140	625692.22	2664588.79	82.50	0.09	0.10	0.01
07141	625682.99	2664595.23	83.06	0.10	0.11	0.01
07142	625672.72	2664602.31	83.68	0.08	0.09	0.01
07143	625662.30	2664609.64	84.37	0.10	0.11	0.01

07144	625652.01	2664617.05	84.94	0.10	0.11	0.01
07145	625641.81	2664624.11	85.57	0.09	0.10	0.01
07146	625631.44	2664631.15	86.17	0.10	0.11	0.01
07147	625621.68	2664638.04	86.81	0.09	0.10	0.01
07148	625611.91	2664644.70	87.42	0.08	0.09	0.01
07149	625602.19	2664651.30	87.95	0.10	0.11	0.01
07150	625592.75	2664657.76	88.53	0.09	0.10	0.01
07151	625583.36	2664664.38	89.14	0.10	0.11	0.01
07152	625573.59	2664671.03	89.71	0.09	0.10	0.01
07153	625563.53	2664677.92	90.32	0.08	0.09	0.01
07154	625553.46	2664684.84	90.93	0.10	0.11	0.01
07155	625543.63	2664691.52	91.55	0.10	0.11	0.01
07156	625533.77	2664698.37	92.11	0.10	0.11	0.01
07157	625523.71	2664705.30	92.76	0.08	0.09	0.01
07158	625514.16	2664712.07	93.33	0.10	0.11	0.01
07159	625504.11	2664719.03	93.91	0.10	0.11	0.01
07160	625494.11	2664725.70	94.50	0.10	0.11	0.01
07161	625484.23	2664732.83	95.13	0.09	0.10	0.01
07162	625473.85	2664739.89	95.73	0.08	0.09	0.01
07163	625463.65	2664746.82	96.30	0.10	0.11	0.01
07164	625453.91	2664753.71	96.92	0.10	0.11	0.01
07165	625443.82	2664760.67	97.58	0.08	0.09	0.01
07166	625433.86	2664767.59	98.16	0.09	0.10	0.01
07167	625424.04	2664774.45	98.79	0.10	0.11	0.01
07168	625414.43	2664781.36	99.35	0.08	0.09	0.01
07169	625404.64	2664788.19	99.96	0.09	0.10	0.01
07170	625394.50	2664795.41	100.57	0.09	0.10	0.01
07171	625384.38	2664802.48	101.28	0.09	0.10	0.01
07172	625374.31	2664809.52	101.78	0.09	0.10	0.01
07173	625364.14	2664816.64	102.44	0.10	0.11	0.01
07174	625353.85	2664823.84	103.10	0.10	0.11	0.01
07175	625343.79	2664830.75	103.70	0.08	0.09	0.01
07176	625333.62	2664837.80	104.28	0.08	0.09	0.01
07177	625323.41	2664845.02	104.92	0.09	0.10	0.01
07178	625314.01	2664851.73	105.49	0.08	0.09	0.01
07179	625304.60	2664858.33	106.12	0.09	0.10	0.01
07180	625294.22	2664865.60	106.76	0.09	0.10	0.01

07181	625283.84	2664872.79	107.37	0.08	0.09	0.01
07182	625269.90	2664882.42	108.25	0.08	0.09	0.01
07183	625259.34	2664889.71	108.89	0.09	0.10	0.01
07184	625249.05	2664896.88	109.53	0.10	0.11	0.01
07185	625238.73	2664903.82	110.19	0.09	0.10	0.01
07186	625228.62	2664910.90	110.78	0.08	0.09	0.01
07187	625215.55	2664919.96	111.60	0.09	0.10	0.01
07188	625205.64	2664926.92	112.19	0.08	0.09	0.01
07189	625195.86	2664933.86	112.82	0.08	0.09	0.01
07190	625185.89	2664940.87	113.42	0.09	0.10	0.01
07191	625175.32	2664948.20	114.06	0.09	0.10	0.01
07192	625164.87	2664955.41	114.66	0.09	0.10	0.01
07193	625154.46	2664962.43	115.32	0.10	0.11	0.01
07194	625144.29	2664969.37	115.94	0.10	0.11	0.01
07195	625133.93	2664976.71	116.51	0.10	0.11	0.01
07196	625124.08	2664983.62	117.11	0.09	0.10	0.01
07197	625114.11	2664990.18	117.71	0.10	0.11	0.01
07198	625104.07	2664997.11	118.35	0.09	0.10	0.01
07199	625094.24	2665004.00	118.93	0.08	0.09	0.01
07200	625084.49	2665010.65	119.57	0.10	0.11	0.01
07201	625074.55	2665017.36	120.15	0.09	0.10	0.01
07202	625064.61	2665024.42	120.78	0.10	0.11	0.01
07203	625054.52	2665031.64	121.38	0.08	0.09	0.01
07204	625044.84	2665038.49	121.99	0.10	0.11	0.01
07205	625034.87	2665045.57	122.58	0.09	0.10	0.01
07206	625025.00	2665052.64	123.18	0.10	0.11	0.01
07207	625015.26	2665059.53	123.77	0.09	0.10	0.01
07208	625005.06	2665066.24	124.39	0.08	0.09	0.01
07209	624995.05	2665073.21	124.95	0.08	0.09	0.01
07210	624982.12	2665082.44	125.79	0.09	0.10	0.01
07211	624972.32	2665089.17	126.36	0.09	0.10	0.01
07212	624962.32	2665096.07	126.96	0.09	0.10	0.01
07213	624952.79	2665102.98	127.65	0.09	0.10	0.01
07214	624942.88	2665109.92	128.25	0.09	0.10	0.01
07215	624932.75	2665116.68	128.83	0.09	0.10	0.01
07216	624922.78	2665123.63	129.45	0.08	0.09	0.01

07217	624912.81	2665130.74	130.07	0.10	0.11	0.01
07218	624902.65	2665137.79	130.65	0.09	0.10	0.01
07219	624892.69	2665144.62	131.26	0.09	0.10	0.01
07220	624883.09	2665151.30	131.80	0.08	0.09	0.01
07221	624873.33	2665158.16	132.46	0.08	0.09	0.01
07222	624864.89	2665164.34	132.98	0.08	0.09	0.01
07223	624855.62	2665170.58	133.53	0.09	0.10	0.01
07224	624845.36	2665177.76	134.17	0.10	0.11	0.01
07225	624835.03	2665184.84	134.83	0.08	0.09	0.01
07226	624824.58	2665192.09	135.42	0.08	0.09	0.01
07227	624814.04	2665199.13	136.05	0.09	0.10	0.01
07228	624800.20	2665208.72	136.85	0.09	0.10	0.01
07229	624790.01	2665215.79	137.43	0.10	0.11	0.01
07230	624779.93	2665222.79	137.92	0.10	0.11	0.01
07231	624769.98	2665229.74	138.48	0.09	0.10	0.01
07232	624760.17	2665236.66	139.02	0.10	0.11	0.01
07233	624750.18	2665243.54	139.54	0.09	0.10	0.01
07234	624740.17	2665250.72	140.07	0.10	0.11	0.01
07235	624729.84	2665257.83	140.61	0.10	0.11	0.01
07236	624719.69	2665264.76	141.12	0.08	0.09	0.01
07237	624709.42	2665272.08	141.62	0.10	0.11	0.01
07238	624699.25	2665279.05	142.15	0.10	0.11	0.01
07239	624689.16	2665285.97	142.67	0.10	0.11	0.01
07240	624678.88	2665293.10	143.17	0.09	0.10	0.01
07241	624668.59	2665300.13	143.59	0.10	0.11	0.01
07242	624658.42	2665307.14	144.08	0.10	0.11	0.01
07243	624648.48	2665314.11	144.53	0.09	0.10	0.01
07244	624638.32	2665320.95	144.97	0.09	0.10	0.01
07245	624628.15	2665327.85	145.41	0.08	0.09	0.01
07246	624617.85	2665335.12	145.89	0.09	0.10	0.01
07247	624604.18	2665344.69	146.50	0.08	0.09	0.01
07248	624590.77	2665354.42	147.04	0.10	0.11	0.01
07249	624580.52	2665361.56	147.46	0.08	0.09	0.01
07250	624570.40	2665368.62	147.88	0.08	0.09	0.01
07251	624560.24	2665375.56	148.27	0.09	0.10	0.01
07252	624550.10	2665382.50	148.59	0.08	0.09	0.01
07253	624540.29	2665389.62	149.06	0.09	0.10	0.01

07254	624530.11	2665396.51	149.41	0.10	0.11	0.01
07255	624519.91	2665403.44	149.71	0.08	0.09	0.01
07256	624509.69	2665410.44	150.13	0.09	0.10	0.01
07257	624499.52	2665417.63	150.47	0.08	0.09	0.01
07258	624489.34	2665424.64	150.83	0.09	0.10	0.01
07259	624479.06	2665431.89	151.17	0.08	0.09	0.01
07260	624469.02	2665439.01	151.53	0.08	0.08	0.01
07261	624458.52	2665446.13	151.81	0.08	0.08	0.01
07262	624448.28	2665453.34	152.10	0.09	0.10	0.01
07263	624438.08	2665460.49	152.46	0.10	0.11	0.01
07264	624428.08	2665467.75	152.72	0.08	0.08	0.01
07265	624418.44	2665474.39	153.05	0.08	0.09	0.01
07266	624404.12	2665484.17	153.42	0.09	0.10	0.01
07267	624393.79	2665491.46	153.70	0.10	0.11	0.01
07268	624383.41	2665498.57	153.94	0.10	0.11	0.01
07269	624369.85	2665508.14	154.32	0.10	0.11	0.01
07270	624359.57	2665515.24	154.55	0.08	0.08	0.01
07271	624349.47	2665522.09	154.77	0.08	0.08	0.01
07272	624339.46	2665528.85	154.99	0.10	0.11	0.01
07273	624329.37	2665535.88	155.21	0.09	0.10	0.01
07274	624319.26	2665542.78	155.48	0.09	0.10	0.01
07275	624309.15	2665549.93	155.66	0.10	0.11	0.01
07276	624299.35	2665556.79	155.86	0.08	0.08	0.01
07277	624289.44	2665563.47	156.05	0.09	0.10	0.01
07278	624279.78	2665570.19	156.22	0.09	0.10	0.01
07279	624269.79	2665577.17	156.38	0.10	0.11	0.01
07280	624259.96	2665584.10	156.56	0.08	0.08	0.01
07281	624249.98	2665591.04	156.72	0.08	0.08	0.01
07282	624241.37	2665597.16	156.83	0.09	0.10	0.01
07283	624231.31	2665604.19	157.00	0.10	0.11	0.01
07284	624221.19	2665611.31	157.12	0.10	0.11	0.01
07285	624210.89	2665618.29	157.17	0.10	0.11	0.01
07286	624200.98	2665625.38	157.38	0.10	0.11	0.01
07287	624190.98	2665632.20	157.45	0.09	0.09	0.01
07288	624180.98	2665638.98	157.54	0.09	0.09	0.01
07289	624170.78	2665646.13	157.68	0.08	0.08	0.01

07290	624160.59	2665653.48	157.71	0.10	0.11	0.01
07291	624146.73	2665663.08	157.85	0.10	0.11	0.01
07292	624136.43	2665670.21	157.93	0.08	0.08	0.01
07293	624125.80	2665677.50	158.01	0.08	0.08	0.01
07294	624115.26	2665684.88	158.06	0.08	0.08	0.01
07295	624104.89	2665691.99	158.08	0.08	0.08	0.01
07296	624095.59	2665698.35	158.12	0.09	0.09	0.01
07297	624084.99	2665705.67	158.17	0.07	0.08	0.01
07298	624074.90	2665712.79	158.23	0.09	0.09	0.01
07299	624064.54	2665719.82	158.24	0.07	0.08	0.01
07300	624054.12	2665726.94	158.23	0.10	0.11	0.01
07301	624044.08	2665734.10	158.29	0.07	0.08	0.01
07302	624033.70	2665741.12	158.22	0.09	0.09	0.01
07303	624023.27	2665748.37	158.20	0.10	0.11	0.01
07304	624013.34	2665755.49	158.19	0.08	0.08	0.01
07305	624003.48	2665762.39	158.18	0.10	0.11	0.01
07306	623993.60	2665769.09	158.15	0.10	0.11	0.01
07307	623983.69	2665775.94	158.20	0.07	0.08	0.01
07308	623975.47	2665781.97	158.11	0.10	0.11	0.01
07309	623967.16	2665787.76	158.08	0.09	0.09	0.01
07310	623956.96	2665794.85	158.01	0.07	0.08	0.01
07311	623946.57	2665801.99	157.88	0.07	0.08	0.01
07312	623936.50	2665809.17	157.91	0.07	0.08	0.01
07313	623926.58	2665816.02	157.87	0.10	0.11	0.01
07314	623916.82	2665822.88	157.78	0.07	0.08	0.01
07315	623906.94	2665829.75	157.69	0.10	0.11	0.01
07316	623896.97	2665836.88	157.59	0.07	0.08	0.01
07317	623886.72	2665844.01	157.51	0.09	0.09	0.01
07318	623876.56	2665851.20	157.41	0.07	0.08	0.01
07319	623866.42	2665857.98	157.30	0.07	0.08	0.01
07320	623856.52	2665864.85	157.15	0.10	0.11	0.01
07321	623846.71	2665871.78	157.04	0.10	0.11	0.01
07322	623836.48	2665878.64	156.89	0.10	0.11	0.01
07323	623826.00	2665885.74	156.73	0.10	0.11	0.01
07324	623815.08	2665893.56	156.58	0.10	0.11	0.01
07325	623804.35	2665901.06	156.36	0.07	0.08	0.01
07326	623793.61	2665908.39	156.23	0.10	0.11	0.01

07327	623783.13	2665915.71	155.99	0.07	0.08	0.01
07328	623772.41	2665923.07	155.77	0.09	0.09	0.01
07329	623762.29	2665930.27	155.63	0.08	0.10	0.01
07330	623752.30	2665937.13	155.45	0.08	0.10	0.01
07331	623742.32	2665944.19	155.24	0.08	0.10	0.01
07332	623731.91	2665951.03	155.02	0.07	0.09	0.01
07333	623722.10	2665958.16	154.77	0.08	0.10	0.01
07334	623712.10	2665964.90	154.52	0.07	0.09	0.01
07335	623702.05	2665972.01	154.28	0.07	0.09	0.01
07336	623691.98	2665979.12	153.98	0.07	0.09	0.01
07337	623682.11	2665986.08	153.69	0.09	0.11	0.01
07338	623671.98	2665993.06	153.45	0.07	0.09	0.01
07339	623661.94	2666000.07	153.16	0.07	0.09	0.01
07340	623652.92	2666006.22	152.89	0.09	0.11	0.01
07341	623642.59	2666013.23	152.61	0.07	0.09	0.01
07342	623632.36	2666020.47	152.31	0.08	0.10	0.01
07343	623622.94	2666027.05	152.01	0.08	0.10	0.01
07344	623613.02	2666033.67	151.72	0.07	0.09	0.01
07345	623603.64	2666040.22	151.37	0.08	0.10	0.01
07346	623594.26	2666046.62	151.03	0.07	0.09	0.01
07347	623584.89	2666053.02	150.70	0.07	0.09	0.01
07348	623575.46	2666059.46	150.39	0.07	0.09	0.01
07349	623565.53	2666066.13	150.04	0.07	0.09	0.01
07350	623555.73	2666072.76	149.70	0.08	0.10	0.01
07351	623545.85	2666079.92	149.36	0.07	0.09	0.01
07352	623535.46	2666086.91	149.01	0.08	0.10	0.01
07353	623525.18	2666094.23	148.59	0.07	0.09	0.01
07354	623514.82	2666101.37	148.23	0.07	0.09	0.01
07355	623504.94	2666108.45	147.84	0.07	0.09	0.01
07356	623495.35	2666115.15	147.53	0.07	0.09	0.01
07357	623485.38	2666122.16	147.17	0.09	0.10	0.01
07358	623475.86	2666128.85	146.81	0.08	0.09	0.01
07359	623466.39	2666135.48	146.45	0.08	0.09	0.01
07360	623456.65	2666142.33	146.07	0.10	0.12	0.01
07361	623446.84	2666148.84	145.73	0.09	0.10	0.01
07362	623437.47	2666155.30	145.38	0.10	0.12	0.01

07363	623428.24	2666161.92	145.00	0.10	0.12	0.01
07364	623418.75	2666168.54	144.59	0.09	0.10	0.01
07365	623409.31	2666175.15	144.19	0.10	0.12	0.01
07366	623399.70	2666181.86	143.82	0.08	0.09	0.01
07367	623389.56	2666188.84	143.39	0.10	0.12	0.01
07368	623379.89	2666195.39	142.97	0.08	0.09	0.01
07369	623370.49	2666202.13	142.49	0.09	0.10	0.01
07370	623360.91	2666208.89	142.02	0.09	0.10	0.01
07371	623351.16	2666215.84	141.57	0.09	0.10	0.01
07372	623341.62	2666222.30	141.09	0.08	0.09	0.01
07373	623331.72	2666229.26	140.64	0.08	0.09	0.01
07374	623322.12	2666236.00	140.16	0.08	0.09	0.01
07375	623312.65	2666243.04	139.65	0.08	0.09	0.01
07376	623302.93	2666249.99	139.15	0.09	0.10	0.01
07377	623293.22	2666256.97	138.64	0.08	0.09	0.01
07378	623283.61	2666263.92	138.17	0.08	0.09	0.01
07379	623273.83	2666271.12	137.58	0.08	0.09	0.01
07380	623264.15	2666278.25	137.02	0.08	0.09	0.01
07381	623254.11	2666285.44	136.42	0.08	0.09	0.01
07382	623244.16	2666292.78	135.81	0.10	0.12	0.01
07383	623234.54	2666300.21	135.25	0.09	0.10	0.01
07384	623221.72	2666310.25	134.44	0.08	0.09	0.01
07385	623213.39	2666317.18	133.84	0.09	0.10	0.01
07386	623202.03	2666325.74	133.10	0.08	0.09	0.01
07387	623192.18	2666333.17	132.50	0.08	0.09	0.01
07388	623182.78	2666340.45	132.00	0.08	0.09	0.01
07389	623173.24	2666347.88	131.37	0.08	0.09	0.01
07390	623163.67	2666355.49	130.80	0.10	0.12	0.01
07391	623118.63	2666392.33	127.89	0.04	0.05	0.00
07392	623108.96	2666400.33	127.30	0.07	0.09	0.01
07393	623099.45	2666408.44	126.71	0.10	0.12	0.01
07394	623090.23	2666416.54	126.13	0.12	0.14	0.01
07395	623081.23	2666424.29	125.56	0.12	0.14	0.01
07396	623072.12	2666432.19	124.95	0.10	0.12	0.01
07397	623062.84	2666440.04	124.35	0.10	0.13	0.01
07398	623053.79	2666447.54	123.76	0.10	0.11	0.01
07399	623044.16	2666455.70	123.19	0.08	0.10	0.01

07400	623035.51	2666463.36	122.62	0.09	0.11	0.01
07401	623026.74	2666471.27	122.09	0.09	0.11	0.01
07402	623018.64	2666478.74	121.48	0.09	0.11	0.01
07403	623010.27	2666486.21	120.97	0.09	0.11	0.01
07404	623001.68	2666493.90	120.44	0.08	0.09	0.01
07405	622993.26	2666501.50	119.90	0.09	0.10	0.01
07406	622984.93	2666509.40	119.33	0.09	0.10	0.01
07407	622976.66	2666517.22	118.74	0.10	0.12	0.01
07408	622968.30	2666524.75	118.23	0.08	0.09	0.01
07409	622960.05	2666532.55	117.66	0.10	0.12	0.01
07410	622951.64	2666540.47	117.10	0.08	0.10	0.01
07411	622943.22	2666548.57	116.53	0.08	0.09	0.01
07412	622934.85	2666556.42	115.96	0.08	0.10	0.01
07413	622926.61	2666564.62	115.32	0.09	0.11	0.01
07414	622918.44	2666572.82	114.75	0.08	0.09	0.01
07415	622910.30	2666580.80	114.25	0.08	0.09	0.01
07416	622902.21	2666589.04	113.69	0.10	0.12	0.01
07417	622893.70	2666597.36	113.13	0.08	0.09	0.01
07418	622885.33	2666605.61	112.60	0.09	0.11	0.01
07419	622876.77	2666614.09	111.91	0.08	0.09	0.01
07420	622868.44	2666622.66	111.32	0.09	0.10	0.01
07421	622860.35	2666630.87	110.78	0.09	0.10	0.01
07422	622852.22	2666638.99	110.23	0.08	0.09	0.01
07423	622844.07	2666647.24	109.59	0.10	0.12	0.01
07424	622833.44	2666658.65	108.83	0.09	0.11	0.01
07425	622825.61	2666667.08	108.26	0.09	0.11	0.01
07426	622817.85	2666675.77	107.63	0.10	0.12	0.01
07427	622810.53	2666684.06	107.13	0.08	0.09	0.01
07428	622802.97	2666692.06	106.59	0.09	0.10	0.01
07429	622794.72	2666700.86	105.99	0.09	0.11	0.01
07430	622786.72	2666709.80	105.41	0.09	0.11	0.01
07431	622778.87	2666718.66	104.85	0.09	0.11	0.01
07432	622771.11	2666727.52	104.30	0.08	0.10	0.01
07433	622763.17	2666736.35	103.65	0.09	0.11	0.01
07434	622755.14	2666745.27	103.03	0.10	0.12	0.01
07435	622747.21	2666754.14	102.44	0.08	0.09	0.01

07436	622739.72	2666762.86	101.84	0.09	0.11	0.01
07437	622731.84	2666771.72	101.30	0.10	0.12	0.01
07438	622723.89	2666780.98	100.67	0.08	0.09	0.01
07439	622716.10	2666789.97	100.09	0.09	0.11	0.01
07440	622708.66	2666798.77	99.51	0.10	0.12	0.01
07441	622701.09	2666807.92	98.93	0.09	0.10	0.01
07442	622694.04	2666816.43	98.41	0.08	0.09	0.01
07443	622686.56	2666825.80	97.74	0.10	0.12	0.01
07444	622676.47	2666838.13	97.00	0.09	0.10	0.01
07445	622668.81	2666847.19	96.41	0.09	0.10	0.01
07446	622661.28	2666856.31	95.85	0.09	0.10	0.01
07447	622653.75	2666865.80	95.20	0.10	0.12	0.01
07448	622646.30	2666875.11	94.57	0.10	0.11	0.01
07449	622638.97	2666884.09	94.05	0.09	0.10	0.01
07450	622631.73	2666893.20	93.50	0.09	0.10	0.01
07451	622624.37	2666902.57	92.90	0.09	0.10	0.01
07452	622617.18	2666911.73	92.29	0.08	0.09	0.01
07453	622610.31	2666920.63	91.73	0.08	0.09	0.01
07454	622603.08	2666929.97	91.13	0.08	0.09	0.01
07455	622596.12	2666939.19	90.55	0.09	0.10	0.01
07456	622589.28	2666948.43	90.05	0.10	0.11	0.01
07457	622582.08	2666957.93	89.49	0.10	0.11	0.01
07458	622575.23	2666967.29	88.84	0.10	0.11	0.01
07459	622568.21	2666976.91	88.27	0.09	0.10	0.01
07460	622561.30	2666986.31	87.69	0.10	0.11	0.01
07461	622554.34	2666995.92	87.09	0.10	0.11	0.01
07462	622547.40	2667005.42	86.48	0.10	0.11	0.01
07463	622540.49	2667014.98	85.89	0.10	0.11	0.01
07464	622533.63	2667024.77	85.30	0.08	0.09	0.01
07465	622527.77	2667033.27	84.77	0.08	0.09	0.01
07466	622521.95	2667041.69	84.23	0.08	0.09	0.01
07467	622514.51	2667051.91	83.67	0.08	0.09	0.01
07468	622507.61	2667061.87	83.03	0.10	0.11	0.01
07469	622500.78	2667071.92	82.52	0.08	0.09	0.01
07470	622493.41	2667082.46	81.87	0.10	0.11	0.01
07471	622486.29	2667092.96	81.22	0.09	0.10	0.01
07472	622479.34	2667103.23	80.58	0.09	0.10	0.01

07473	622472.63	2667113.42	79.92	0.10	0.11	0.01
07474	622465.97	2667123.96	79.34	0.09	0.10	0.01
07475	622459.32	2667134.24	78.70	0.08	0.09	0.01
07476	622452.90	2667144.53	78.18	0.09	0.10	0.01
07477	622446.08	2667154.83	77.50	0.08	0.09	0.01
07478	622439.65	2667164.60	76.95	0.09	0.10	0.01
07479	622433.63	2667174.31	76.36	0.08	0.09	0.01
07480	622427.49	2667184.16	75.76	0.10	0.11	0.01
07481	622421.29	2667194.30	75.19	0.10	0.11	0.01
07482	622414.81	2667204.72	74.61	0.09	0.10	0.01
07483	622408.59	2667214.88	74.03	0.08	0.09	0.01
07484	622402.29	2667224.95	73.47	0.10	0.11	0.01
07485	622396.27	2667234.80	72.88	0.09	0.10	0.01
07486	622390.40	2667244.32	72.37	0.08	0.09	0.01
07487	622384.46	2667254.43	71.73	0.09	0.10	0.01
07488	622378.15	2667264.86	71.13	0.09	0.10	0.01
07489	622370.18	2667278.88	70.33	0.08	0.09	0.01
07490	622362.34	2667292.54	69.57	0.09	0.10	0.01
07491	622356.57	2667302.73	69.01	0.10	0.11	0.01
07492	622350.75	2667312.84	68.37	0.08	0.09	0.01
07493	622345.06	2667323.14	67.75	0.09	0.11	0.01
07494	622337.13	2667337.83	66.94	0.09	0.10	0.01
07495	622331.47	2667348.46	66.37	0.10	0.11	0.01
07496	622325.89	2667358.58	65.77	0.10	0.11	0.01
07497	622320.46	2667368.75	65.22	0.09	0.10	0.01
07498	622315.06	2667379.45	64.61	0.09	0.11	0.01
07499	622309.26	2667390.35	63.98	0.09	0.11	0.01
07500	622303.75	2667400.99	63.35	0.08	0.09	0.01
07501	622298.09	2667411.76	62.75	0.09	0.10	0.01
07502	622293.29	2667421.08	62.21	0.10	0.11	0.01
07503	622288.35	2667430.57	61.61	0.09	0.10	0.01

APPENDIX I

Control Survey Listing MVRM Calibration Site - Dist. 08

East bound bridge over LA Highway 6 over Toledo Bend Reservoir

Date & Time 4/07/2014 3:49 PM

Coordinate System U.S. State Plane 1983 **Zone** Louisiana South 1702

Project Datum (NAD 83) **Vertical Datum** (NAVD 88) **Geoid Model** GEOID12A

Coordinate Unit U.S. Survey Foot **Distance Unit** U.S. Survey Foot **Height Unit** U.S. Survey Foot

Figure 50
MVRM Control – 08 East bound bridge over LA Highway 6 over Toledo Bend Reservoir

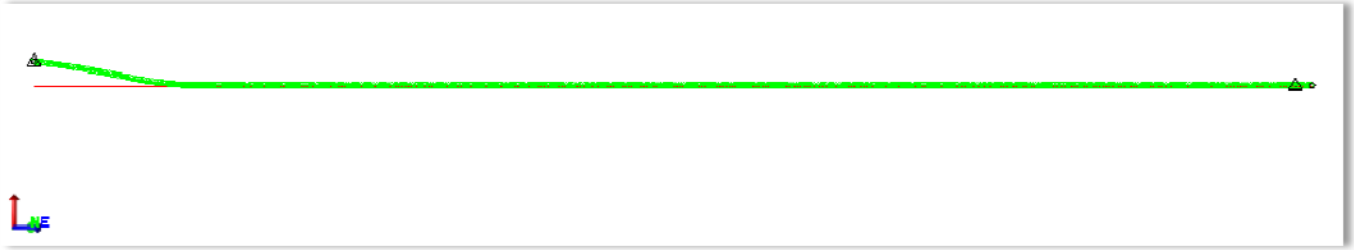


Figure 51
MVRM Control – 08 Profile 10 X vertical

Point ID	Northing	Easting	Elevation	H Prc	V Prc	RMS
0801	354131.39	2893160.18	194.14	0.11	0.13	0.01
0802	357235.57	2897561.42	183.82	0.06	0.08	0.01
080001	354131.42	2893160.17	194.18	0.06	0.07	0.01
080002	354138.09	2893170.12	194.02	0.06	0.07	0.01
080003	354144.33	2893179.12	193.95	0.07	0.08	0.01
080004	354150.37	2893188.09	193.80	0.06	0.07	0.01
080005	354156.60	2893197.09	193.65	0.07	0.08	0.01
080006	354162.92	2893206.05	193.53	0.07	0.08	0.01
080007	354169.69	2893215.64	193.36	0.06	0.07	0.01
080008	354176.79	2893225.51	193.16	0.06	0.07	0.01
080009	354183.57	2893235.02	193.02	0.06	0.07	0.01
080010	354190.06	2893244.50	192.88	0.05	0.06	0.01
080011	354197.00	2893254.18	192.67	0.06	0.07	0.01
080012	354203.80	2893264.19	192.49	0.05	0.06	0.01
080013	354210.79	2893274.25	192.31	0.06	0.07	0.01
080014	354217.98	2893284.47	192.13	0.07	0.08	0.01
080015	354225.08	2893294.64	191.88	0.05	0.06	0.01
080016	354232.27	2893304.84	191.74	0.05	0.06	0.01
080017	354241.10	2893317.12	191.42	0.05	0.06	0.01
080018	354248.19	2893327.22	191.20	0.07	0.08	0.01
080019	354255.42	2893337.47	190.95	0.06	0.07	0.01
080020	354262.65	2893347.89	190.75	0.07	0.08	0.01
080021	354269.96	2893358.11	190.48	0.07	0.08	0.01
080022	354277.07	2893367.97	190.25	0.07	0.08	0.01
080023	354284.54	2893378.39	190.01	0.06	0.07	0.01
080024	354291.69	2893388.72	189.71	0.06	0.07	0.01
080025	354298.79	2893398.75	189.51	0.07	0.08	0.01
080026	354305.82	2893409.03	189.27	0.05	0.06	0.01
080027	354312.91	2893419.05	189.05	0.06	0.06	0.01
080028	354319.96	2893429.11	188.81	0.06	0.07	0.01
080029	354327.18	2893439.26	188.53	0.07	0.08	0.01
080030	354334.33	2893449.50	188.23	0.05	0.06	0.01
080031	354341.71	2893459.77	188.03	0.07	0.08	0.01
080032	354348.50	2893469.28	187.84	0.09	0.10	0.01
080033	354355.67	2893479.53	187.63	0.06	0.07	0.00

080034	354362.70	2893489.51	187.34	0.06	0.08	0.00
080035	354369.77	2893499.08	187.00	0.06	0.07	0.01
080036	354376.68	2893508.73	186.80	0.06	0.06	0.01
080037	354383.45	2893518.25	186.57	0.08	0.09	0.01
080038	354390.34	2893527.81	186.36	0.07	0.08	0.01
080039	354397.05	2893537.48	186.14	0.07	0.08	0.01
080040	354403.71	2893547.10	185.91	0.07	0.08	0.01
080041	354410.40	2893556.74	185.72	0.06	0.06	0.01
080042	354417.00	2893566.32	185.59	0.07	0.08	0.01
080043	354423.71	2893575.72	185.39	0.06	0.07	0.01
080044	354430.41	2893585.32	185.29	0.06	0.07	0.01
080045	354437.01	2893594.54	185.13	0.07	0.08	0.01
080046	354443.49	2893603.93	185.04	0.07	0.08	0.01
080047	354450.24	2893613.50	184.85	0.05	0.06	0.01
080048	354456.94	2893622.75	184.72	0.07	0.08	0.01
080049	354463.26	2893631.87	184.61	0.06	0.07	0.01
080050	354469.85	2893641.16	184.51	0.05	0.06	0.01
080051	354476.58	2893650.50	184.42	0.05	0.06	0.01
080052	354483.31	2893660.17	184.29	0.05	0.06	0.01
080053	354490.17	2893669.66	184.23	0.06	0.07	0.01
080054	354496.80	2893679.10	184.16	0.06	0.07	0.01
080055	354503.50	2893688.62	184.13	0.05	0.06	0.01
080056	354510.24	2893698.33	184.08	0.05	0.06	0.01
080057	354516.95	2893707.40	184.02	0.06	0.07	0.01
080058	354523.51	2893716.57	184.00	0.05	0.06	0.01
080059	354530.19	2893726.06	183.96	0.06	0.07	0.01
080060	354536.80	2893735.80	183.95	0.06	0.07	0.01
080061	354543.68	2893745.48	183.99	0.06	0.07	0.01
080062	354550.44	2893755.08	183.99	0.07	0.08	0.01
080063	354556.90	2893764.35	183.98	0.05	0.06	0.01
080064	354563.64	2893773.82	183.99	0.05	0.06	0.01
080065	354571.97	2893785.86	183.95	0.06	0.07	0.01
080066	354579.15	2893795.80	183.98	0.07	0.08	0.01
080067	354586.10	2893805.96	183.95	0.07	0.08	0.01
080068	354593.32	2893816.08	183.96	0.07	0.08	0.01
080069	354600.21	2893826.09	183.97	0.06	0.07	0.01
080070	354607.19	2893836.04	183.90	0.06	0.07	0.01

080071	354614.45	2893846.55	183.94	0.06	0.07	0.01
080072	354621.68	2893856.66	183.94	0.06	0.07	0.01
080073	354628.58	2893866.68	183.96	0.07	0.08	0.01
080074	354635.75	2893876.98	183.97	0.07	0.08	0.01
080075	354643.07	2893887.25	183.95	0.07	0.08	0.01
080076	354652.50	2893900.20	183.93	0.07	0.08	0.01
080077	354660.18	2893910.82	183.96	0.07	0.08	0.01
080078	354667.83	2893921.64	183.95	0.05	0.06	0.01
080079	354675.28	2893932.38	183.95	0.07	0.08	0.01
080080	354682.80	2893942.94	183.97	0.05	0.06	0.01
080081	354690.49	2893953.73	183.96	0.05	0.06	0.01
080082	354697.91	2893964.17	183.99	0.05	0.06	0.01
080083	354705.19	2893974.38	183.97	0.05	0.06	0.01
080084	354712.62	2893984.87	184.00	0.05	0.06	0.01
080085	354719.90	2893995.44	183.96	0.05	0.06	0.01
080086	354727.47	2894006.14	183.94	0.07	0.08	0.01
080087	354733.47	2894014.49	184.00	0.08	0.10	0.01
080088	354739.49	2894023.12	183.92	0.09	0.10	0.01
080089	354745.30	2894031.38	183.93	0.08	0.09	0.01
080090	354753.10	2894042.40	183.97	0.09	0.10	0.01
080091	354759.26	2894050.71	184.02	0.06	0.07	0.00
080092	354765.07	2894059.13	183.97	0.05	0.06	0.01
080093	354772.75	2894069.93	183.95	0.06	0.07	0.01
080094	354778.39	2894078.20	183.96	0.06	0.07	0.01
080095	354784.18	2894086.40	183.99	0.07	0.08	0.01
080096	354791.47	2894096.83	184.03	0.06	0.07	0.01
080097	354797.27	2894105.00	184.02	0.07	0.08	0.01
080098	354804.82	2894115.76	183.97	0.06	0.07	0.01
080099	354810.70	2894124.08	183.91	0.07	0.08	0.01
080100	354820.14	2894137.20	183.91	0.06	0.07	0.01
080101	354826.75	2894146.76	183.97	0.06	0.07	0.01
080102	354832.50	2894154.97	183.91	0.06	0.07	0.01
080103	354839.71	2894165.65	183.97	0.05	0.06	0.01
080104	354847.40	2894176.25	183.95	0.07	0.08	0.01
080105	354853.32	2894184.67	183.95	0.07	0.08	0.01
080106	354860.90	2894195.31	183.94	0.06	0.07	0.01

080107	354868.15	2894205.63	183.93	0.06	0.07	0.01
080108	354875.18	2894215.41	183.96	0.06	0.07	0.01
080109	354882.19	2894225.41	183.92	0.05	0.06	0.01
080110	354889.48	2894235.66	183.92	0.07	0.08	0.01
080111	354896.41	2894245.72	183.90	0.05	0.06	0.01
080112	354903.43	2894255.66	183.92	0.07	0.08	0.01
080113	354910.46	2894265.69	183.95	0.07	0.08	0.01
080114	354918.12	2894276.35	183.93	0.07	0.08	0.01
080115	354925.76	2894287.26	183.89	0.06	0.08	0.01
080116	354933.51	2894297.88	183.88	0.05	0.06	0.01
080117	354941.09	2894308.77	183.87	0.07	0.08	0.01
080118	354948.67	2894319.29	183.88	0.05	0.06	0.01
080119	354955.75	2894329.42	183.90	0.06	0.07	0.01
080120	354963.14	2894339.85	183.89	0.06	0.07	0.00
080121	354970.79	2894350.51	183.86	0.06	0.07	0.00
080122	354977.95	2894360.95	183.90	0.06	0.06	0.01
080123	354985.49	2894371.38	183.87	0.07	0.07	0.01
080124	354992.63	2894381.71	183.91	0.07	0.08	0.01
080125	355000.21	2894391.94	183.88	0.05	0.06	0.01
080126	355007.53	2894402.44	183.86	0.05	0.06	0.01
080127	355013.54	2894410.92	183.87	0.07	0.08	0.01
080128	355019.47	2894419.48	183.91	0.05	0.06	0.01
080129	355025.42	2894427.79	183.91	0.06	0.07	0.01
080130	355031.51	2894436.44	183.96	0.06	0.07	0.01
080131	355037.43	2894444.97	183.93	0.06	0.07	0.01
080132	355043.37	2894453.19	183.90	0.05	0.06	0.01
080133	355051.05	2894463.91	183.93	0.07	0.08	0.01
080134	355058.65	2894474.50	183.93	0.06	0.07	0.01
080135	355064.52	2894482.89	183.98	0.05	0.06	0.01
080136	355073.82	2894496.17	183.97	0.06	0.07	0.01
080137	355081.05	2894506.78	183.96	0.07	0.08	0.01
080138	355088.55	2894517.28	183.94	0.06	0.07	0.01
080139	355094.29	2894525.48	183.90	0.06	0.07	0.01
080140	355101.86	2894536.02	183.93	0.07	0.08	0.01
080141	355108.92	2894546.18	183.95	0.07	0.08	0.01
080142	355116.14	2894556.40	183.96	0.07	0.08	0.01
080143	355123.25	2894566.70	183.97	0.05	0.06	0.01

080144	355130.69	2894577.00	183.92	0.07	0.08	0.01
080145	355138.09	2894587.71	183.93	0.05	0.06	0.01
080146	355145.77	2894598.57	183.98	0.06	0.07	0.01
080147	355153.37	2894609.26	183.95	0.08	0.10	0.01
080148	355159.47	2894617.57	184.00	0.07	0.07	0.01
080149	355165.24	2894625.81	183.97	0.08	0.10	0.01
080150	355171.18	2894634.20	184.02	0.07	0.08	0.01
080151	355177.07	2894642.77	183.92	0.08	0.09	0.01
080152	355184.42	2894653.50	183.97	0.06	0.06	0.01
080153	355192.01	2894664.24	183.99	0.05	0.06	0.01
080154	355199.39	2894674.67	184.00	0.07	0.08	0.01
080155	355207.04	2894685.15	183.96	0.06	0.07	0.01
080156	355214.62	2894695.74	183.97	0.06	0.07	0.01
080157	355220.64	2894704.64	183.97	0.06	0.07	0.01
080158	355226.60	2894713.15	183.98	0.08	0.09	0.01
080159	355232.55	2894721.56	183.99	0.06	0.08	0.01
080160	355240.13	2894732.38	184.00	0.07	0.09	0.01
080161	355247.42	2894742.70	184.00	0.07	0.08	0.01
080162	355254.92	2894753.14	183.97	0.05	0.06	0.01
080163	355262.25	2894763.85	183.95	0.07	0.08	0.01
080164	355269.65	2894774.39	183.93	0.05	0.06	0.01
080165	355277.42	2894785.07	183.86	0.06	0.07	0.01
080166	355285.15	2894795.86	183.93	0.06	0.07	0.01
080167	355291.02	2894804.07	183.94	0.07	0.08	0.01
080168	355296.77	2894812.30	183.93	0.07	0.09	0.01
080169	355302.62	2894820.61	183.96	0.06	0.07	0.01
080170	355308.43	2894829.02	183.94	0.05	0.06	0.01
080171	355314.33	2894837.35	183.97	0.06	0.07	0.01
080172	355321.78	2894848.23	183.93	0.06	0.07	0.01
080173	355329.39	2894858.80	183.94	0.06	0.07	0.01
080174	355335.36	2894867.29	183.95	0.06	0.07	0.01
080175	355341.30	2894875.87	183.93	0.06	0.07	0.01
080176	355347.35	2894884.60	183.91	0.07	0.08	0.01
080177	355353.52	2894893.48	183.93	0.05	0.06	0.01
080178	355359.75	2894902.56	183.95	0.05	0.06	0.01
080179	355366.06	2894911.29	183.90	0.06	0.07	0.01

080180	355371.97	2894919.69	183.91	0.05	0.06	0.01
080181	355377.84	2894928.04	183.91	0.05	0.06	0.01
080182	355383.76	2894936.38	183.95	0.06	0.07	0.01
080183	355391.24	2894946.89	183.95	0.07	0.09	0.01
080184	355398.85	2894957.70	183.96	0.06	0.06	0.01
080185	355404.63	2894965.91	183.93	0.07	0.09	0.01
080186	355410.44	2894974.19	183.93	0.06	0.08	0.01
080187	355416.19	2894982.41	183.94	0.06	0.07	0.01
080188	355423.81	2894993.30	183.94	0.06	0.07	0.01
080189	355431.41	2895003.86	183.90	0.05	0.06	0.01
080190	355438.86	2895014.22	183.91	0.06	0.07	0.01
080191	355447.83	2895026.93	183.92	0.07	0.09	0.01
080192	355453.63	2895035.09	183.90	0.07	0.08	0.01
080193	355459.34	2895043.43	183.92	0.06	0.07	0.01
080194	355468.85	2895056.95	183.93	0.06	0.07	0.01
080195	355476.46	2895067.81	183.97	0.05	0.06	0.01
080196	355484.18	2895078.63	183.92	0.05	0.06	0.01
080197	355490.10	2895086.75	183.93	0.06	0.07	0.01
080198	355497.67	2895097.35	183.90	0.06	0.07	0.01
080199	355503.58	2895105.73	183.91	0.05	0.06	0.01
080200	355509.38	2895114.01	183.91	0.07	0.08	0.01
080201	355516.78	2895124.78	183.93	0.05	0.06	0.01
080202	355522.64	2895132.95	183.94	0.07	0.08	0.01
080203	355528.51	2895141.21	183.95	0.05	0.06	0.01
080204	355534.69	2895149.77	183.93	0.06	0.07	0.01
080205	355540.76	2895158.47	183.89	0.05	0.06	0.01
080206	355547.05	2895167.58	183.92	0.05	0.06	0.01
080207	355553.15	2895176.20	183.93	0.07	0.08	0.01
080208	355559.14	2895184.80	183.89	0.05	0.06	0.01
080209	355565.36	2895193.79	183.87	0.07	0.08	0.01
080210	355571.53	2895202.34	183.89	0.05	0.06	0.01
080211	355577.59	2895210.61	183.89	0.07	0.08	0.01
080212	355583.61	2895219.15	183.87	0.05	0.06	0.01
080213	355591.30	2895229.87	183.92	0.07	0.08	0.01
080214	355597.14	2895238.21	183.92	0.07	0.09	0.01
080215	355603.10	2895246.59	183.92	0.05	0.06	0.01
080216	355608.99	2895254.85	183.92	0.06	0.08	0.01

080217	355614.99	2895263.34	183.92	0.07	0.08	0.01
080218	355620.81	2895271.59	183.92	0.07	0.08	0.01
080219	355626.55	2895279.88	183.94	0.05	0.06	0.01
080220	355634.14	2895290.75	183.93	0.06	0.07	0.01
080221	355639.94	2895298.94	183.92	0.06	0.07	0.01
080222	355645.84	2895307.12	183.94	0.06	0.07	0.01
080223	355653.25	2895317.84	183.94	0.05	0.06	0.01
080224	355660.79	2895328.74	183.93	0.06	0.07	0.01
080225	355668.21	2895339.44	183.95	0.07	0.08	0.01
080226	355675.57	2895349.95	183.97	0.07	0.08	0.01
080227	355682.88	2895360.64	183.95	0.06	0.07	0.01
080228	355688.71	2895368.92	183.94	0.05	0.06	0.01
080229	355696.39	2895379.83	183.91	0.06	0.08	0.01
080230	355702.03	2895388.15	183.90	0.05	0.06	0.01
080231	355709.47	2895398.50	183.93	0.05	0.06	0.01
080232	355717.24	2895409.21	183.94	0.05	0.06	0.01
080233	355725.05	2895419.85	183.96	0.05	0.06	0.01
080234	355732.60	2895430.37	183.92	0.07	0.08	0.01
080235	355738.47	2895438.65	183.93	0.07	0.08	0.01
080236	355744.38	2895447.20	183.95	0.06	0.07	0.01
080237	355750.34	2895455.59	183.95	0.06	0.07	0.01
080238	355756.66	2895464.48	183.93	0.07	0.08	0.01
080239	355762.74	2895473.23	183.93	0.07	0.08	0.01
080240	355769.22	2895482.18	183.93	0.07	0.08	0.01
080241	355775.48	2895491.12	183.90	0.06	0.07	0.01
080242	355781.80	2895499.83	183.88	0.06	0.07	0.01
080243	355787.94	2895508.60	183.87	0.07	0.08	0.01
080244	355794.13	2895517.17	183.89	0.07	0.08	0.01
080245	355799.84	2895525.46	183.87	0.05	0.06	0.01
080246	355805.80	2895534.12	183.91	0.07	0.08	0.01
080247	355811.80	2895542.58	183.92	0.07	0.08	0.01
080248	355817.71	2895551.07	183.91	0.07	0.08	0.01
080249	355823.83	2895559.98	183.89	0.07	0.08	0.01
080250	355830.22	2895569.03	183.93	0.07	0.08	0.01
080251	355836.82	2895578.22	183.90	0.06	0.07	0.01
080252	355843.18	2895587.20	183.98	0.07	0.09	0.01

080253	355849.26	2895595.73	183.89	0.06	0.08	0.01
080254	355855.81	2895605.33	183.91	0.06	0.08	0.01
080255	355863.19	2895615.66	183.95	0.05	0.06	0.01
080256	355869.00	2895624.19	183.89	0.05	0.06	0.01
080257	355875.34	2895632.90	183.92	0.05	0.07	0.01
080258	355881.31	2895641.53	183.93	0.06	0.07	0.01
080259	355887.29	2895650.06	183.90	0.05	0.07	0.01
080260	355893.30	2895658.50	183.91	0.07	0.09	0.01
080261	355899.21	2895666.84	183.91	0.07	0.09	0.01
080262	355905.21	2895675.59	183.92	0.07	0.09	0.01
080263	355911.32	2895684.12	183.92	0.06	0.08	0.01
080264	355917.06	2895692.52	183.94	0.06	0.07	0.01
080265	355922.78	2895700.72	183.91	0.07	0.08	0.01
080266	355930.38	2895711.55	183.91	0.06	0.07	0.01
080267	355936.25	2895719.88	183.91	0.07	0.08	0.01
080268	355944.07	2895730.83	183.91	0.07	0.08	0.01
080269	355950.02	2895739.06	183.96	0.07	0.09	0.01
080270	355955.87	2895747.33	183.92	0.06	0.07	0.01
080271	355961.85	2895755.53	183.92	0.05	0.07	0.01
080272	355969.25	2895765.98	183.90	0.07	0.09	0.01
080273	355976.66	2895776.23	183.93	0.06	0.08	0.01
080274	355982.47	2895784.64	183.92	0.07	0.08	0.01
080275	355988.16	2895793.08	183.88	0.06	0.07	0.01
080276	355994.06	2895801.24	183.90	0.05	0.06	0.01
080277	356000.14	2895809.82	183.91	0.06	0.07	0.01
080278	356006.11	2895818.21	183.92	0.05	0.06	0.01
080279	356012.01	2895826.65	183.90	0.07	0.09	0.01
080280	356017.91	2895835.26	183.92	0.07	0.09	0.01
080281	356025.90	2895846.53	183.92	0.06	0.07	0.01
080282	356035.47	2895860.27	183.92	0.05	0.06	0.01
080283	356043.29	2895870.91	183.90	0.05	0.06	0.01
080284	356049.14	2895879.05	183.97	0.05	0.06	0.01
080285	356056.69	2895889.76	183.90	0.06	0.07	0.01
080286	356064.29	2895900.56	183.88	0.07	0.08	0.01
080287	356071.90	2895911.38	183.89	0.06	0.08	0.01
080288	356079.40	2895922.21	183.92	0.07	0.09	0.01
080289	356087.08	2895933.03	183.90	0.07	0.09	0.01

080290	356094.64	2895943.87	183.90	0.07	0.09	0.01
080291	356102.23	2895954.59	183.90	0.06	0.07	0.01
080292	356107.89	2895962.92	183.88	0.07	0.08	0.01
080293	356113.79	2895971.40	183.85	0.07	0.09	0.01
080294	356119.81	2895979.75	183.88	0.07	0.08	0.01
080295	356125.74	2895988.15	183.87	0.06	0.07	0.01
080296	356131.81	2895996.80	183.85	0.07	0.08	0.01
080297	356138.01	2896005.28	183.88	0.06	0.08	0.01
080298	356144.02	2896013.91	183.86	0.06	0.08	0.01
080299	356149.93	2896022.38	183.89	0.06	0.07	0.01
080300	356155.69	2896030.63	183.91	0.07	0.08	0.01
080301	356163.27	2896041.18	183.92	0.07	0.09	0.01
080302	356170.94	2896052.03	183.95	0.07	0.08	0.01
080303	356178.62	2896062.98	183.92	0.06	0.07	0.01
080304	356186.22	2896073.84	183.85	0.07	0.09	0.01
080305	356191.96	2896082.17	183.95	0.06	0.07	0.01
080306	356198.09	2896090.74	183.97	0.07	0.09	0.01
080307	356203.89	2896099.20	183.94	0.07	0.09	0.01
080308	356211.62	2896110.22	183.96	0.07	0.08	0.01
080309	356219.22	2896121.16	183.94	0.07	0.09	0.01
080310	356227.01	2896131.85	183.91	0.06	0.07	0.01
080311	356232.76	2896140.03	183.94	0.07	0.08	0.01
080312	356240.22	2896150.75	183.99	0.08	0.09	0.01
080313	356246.08	2896158.92	183.94	0.08	0.09	0.01
080314	356252.10	2896167.62	183.97	0.07	0.09	0.01
080315	356259.74	2896178.42	183.98	0.08	0.09	0.01
080316	356267.44	2896189.74	183.93	0.06	0.07	0.01
080317	356273.50	2896197.95	183.96	0.08	0.09	0.01
080318	356279.48	2896206.33	183.96	0.06	0.07	0.01
080319	356285.56	2896214.92	183.97	0.08	0.10	0.01
080320	356291.41	2896223.28	183.95	0.08	0.10	0.01
080321	356297.55	2896231.76	184.01	0.06	0.08	0.01
080322	356303.46	2896240.22	183.98	0.08	0.10	0.01
080323	356309.49	2896248.50	183.95	0.08	0.09	0.01
080324	356316.87	2896259.16	184.03	0.06	0.07	0.01
080325	356324.37	2896269.54	183.97	0.06	0.07	0.01

080326	356331.58	2896279.65	183.97	0.07	0.08	0.01
080327	356338.81	2896289.95	183.97	0.07	0.09	0.01
080328	356346.35	2896300.46	183.95	0.07	0.09	0.01
080329	356353.89	2896311.34	183.98	0.06	0.08	0.01
080330	356361.71	2896322.05	184.01	0.08	0.10	0.01
080331	356369.45	2896332.86	184.00	0.08	0.10	0.01
080332	356375.05	2896341.16	183.95	0.07	0.08	0.01
080333	356382.74	2896351.90	183.92	0.08	0.10	0.01
080334	356388.40	2896360.21	183.93	0.07	0.08	0.01
080335	356394.25	2896368.39	183.91	0.07	0.09	0.01
080336	356401.86	2896378.91	183.93	0.07	0.09	0.01
080337	356409.24	2896389.61	183.92	0.07	0.09	0.01
080338	356415.12	2896397.83	183.92	0.07	0.09	0.01
080339	356422.61	2896408.69	183.94	0.08	0.09	0.01
080340	356430.31	2896419.55	183.92	0.08	0.10	0.01
080341	356437.79	2896430.40	183.96	0.08	0.09	0.01
080342	356443.36	2896438.74	183.92	0.07	0.09	0.01
080343	356451.06	2896449.58	183.93	0.08	0.10	0.01
080344	356456.89	2896457.86	183.93	0.06	0.08	0.01
080345	356464.59	2896468.68	183.93	0.08	0.10	0.01
080346	356470.51	2896477.13	183.90	0.07	0.09	0.01
080347	356478.00	2896487.80	183.91	0.07	0.08	0.01
080348	356483.79	2896496.02	183.93	0.07	0.08	0.01
080349	356489.74	2896504.33	183.88	0.08	0.10	0.01
080350	356495.92	2896512.77	183.91	0.08	0.10	0.01
080351	356501.60	2896521.03	183.89	0.08	0.09	0.01
080352	356507.43	2896529.26	183.89	0.08	0.10	0.01
080353	356513.51	2896537.72	183.93	0.07	0.08	0.01
080354	356519.38	2896546.32	183.96	0.06	0.08	0.01
080355	356525.30	2896554.74	183.92	0.08	0.10	0.01
080356	356531.09	2896563.15	183.94	0.07	0.09	0.01
080357	356537.20	2896571.67	183.92	0.07	0.08	0.01
080358	356543.05	2896579.87	183.93	0.07	0.09	0.01
080359	356550.81	2896590.88	183.90	0.08	0.10	0.01
080360	356556.67	2896599.41	183.91	0.08	0.10	0.01
080361	356563.73	2896609.55	183.88	0.08	0.10	0.01
080362	356571.06	2896619.92	183.92	0.07	0.08	0.01

080363	356578.79	2896630.53	183.91	0.08	0.09	0.01
080364	356586.23	2896640.96	183.92	0.06	0.07	0.01
080365	356592.20	2896649.48	183.91	0.06	0.07	0.01
080366	356599.64	2896660.19	183.96	0.08	0.09	0.01
080367	356605.50	2896668.32	183.96	0.07	0.08	0.01
080368	356611.61	2896676.87	183.97	0.07	0.09	0.01
080369	356617.55	2896685.33	183.98	0.07	0.08	0.01
080370	356625.60	2896696.58	183.97	0.06	0.07	0.01
080371	356631.45	2896705.09	183.95	0.07	0.08	0.01
080372	356637.43	2896713.59	183.95	0.06	0.08	0.01
080373	356643.35	2896722.00	183.94	0.06	0.07	0.01
080374	356649.16	2896730.43	183.96	0.06	0.08	0.01
080375	356655.04	2896738.60	183.93	0.06	0.08	0.01
080376	356661.38	2896747.22	183.97	0.07	0.09	0.01
080377	356667.20	2896755.97	183.92	0.07	0.08	0.01
080378	356673.17	2896764.73	183.89	0.06	0.07	0.01
080379	356679.22	2896773.31	183.88	0.07	0.08	0.01
080380	356685.07	2896781.42	183.93	0.07	0.09	0.01
080381	356690.96	2896789.57	183.91	0.06	0.08	0.01
080382	356696.75	2896797.86	183.89	0.06	0.07	0.01
080383	356702.57	2896806.09	183.91	0.07	0.09	0.01
080384	356708.48	2896814.46	183.90	0.07	0.09	0.01
080385	356714.36	2896822.77	183.90	0.07	0.08	0.01
080386	356720.11	2896831.28	183.87	0.07	0.09	0.01
080387	356726.38	2896840.11	183.86	0.07	0.08	0.01
080388	356732.37	2896848.79	183.89	0.06	0.07	0.01
080389	356738.26	2896857.20	183.91	0.06	0.07	0.01
080390	356744.50	2896865.71	183.92	0.06	0.08	0.01
080391	356750.48	2896874.36	183.87	0.06	0.07	0.01
080392	356756.40	2896882.81	183.88	0.06	0.08	0.01
080393	356763.02	2896891.98	183.88	0.06	0.08	0.01
080394	356769.35	2896900.92	183.90	0.06	0.08	0.01
080395	356775.40	2896909.61	183.88	0.06	0.07	0.01
080396	356781.32	2896917.94	183.89	0.06	0.08	0.01
080397	356787.19	2896926.18	183.92	0.06	0.08	0.01
080398	356793.36	2896934.76	183.89	0.07	0.09	0.01

080399	356799.52	2896943.37	183.88	0.07	0.09	0.01
080400	356805.40	2896951.69	183.90	0.05	0.07	0.01
080401	356812.98	2896962.46	183.91	0.05	0.07	0.01
080402	356820.41	2896972.88	183.88	0.07	0.09	0.01
080403	356827.93	2896983.54	183.90	0.07	0.09	0.01
080404	356835.29	2896994.32	183.90	0.07	0.09	0.01
080405	356841.10	2897002.54	183.91	0.07	0.09	0.01
080406	356846.90	2897010.91	183.92	0.07	0.09	0.01
080407	356852.71	2897019.26	183.93	0.07	0.09	0.01
080408	356860.62	2897030.20	183.96	0.06	0.08	0.01
080409	356866.39	2897038.51	183.93	0.07	0.09	0.01
080410	356872.35	2897046.81	183.91	0.07	0.09	0.01
080411	356880.27	2897057.46	183.93	0.06	0.08	0.01
080412	356889.65	2897071.02	183.95	0.07	0.09	0.01
080413	356895.60	2897079.25	183.91	0.07	0.09	0.01
080414	356901.49	2897087.62	183.95	0.07	0.09	0.01
080415	356909.06	2897098.56	183.93	0.06	0.08	0.01
080416	356914.85	2897106.95	183.92	0.06	0.08	0.01
080417	356922.37	2897117.62	183.91	0.06	0.08	0.01
080418	356930.23	2897128.45	183.92	0.07	0.09	0.01
080419	356937.94	2897139.27	183.94	0.05	0.07	0.01
080420	356945.45	2897150.10	183.93	0.06	0.08	0.01
080421	356953.28	2897160.82	183.92	0.07	0.09	0.01
080422	356959.09	2897169.13	183.90	0.05	0.07	0.01
080423	356966.71	2897179.96	183.91	0.06	0.08	0.01
080424	356972.56	2897188.10	183.92	0.07	0.09	0.01
080425	356980.23	2897198.99	183.95	0.05	0.07	0.01
080426	356987.99	2897209.69	183.90	0.06	0.08	0.01
080427	356993.52	2897218.07	183.90	0.06	0.08	0.01
080428	356999.32	2897226.22	183.84	0.05	0.07	0.01
080429	357006.62	2897236.76	183.89	0.05	0.07	0.01
080430	357013.73	2897247.04	183.85	0.07	0.09	0.01
080431	357020.56	2897256.67	183.88	0.06	0.08	0.01
080432	357027.84	2897267.16	183.89	0.06	0.08	0.01
080433	357035.45	2897278.03	183.90	0.05	0.07	0.01
080434	357041.16	2897286.23	183.87	0.07	0.09	0.01
080435	357047.17	2897294.55	183.88	0.06	0.08	0.01

080436	357053.15	2897302.87	183.89	0.06	0.08	0.01
080437	357058.97	2897311.06	183.89	0.06	0.08	0.01
080438	357064.93	2897319.43	183.90	0.07	0.09	0.01
080439	357072.50	2897330.50	183.92	0.05	0.07	0.01
080440	357078.41	2897338.82	183.92	0.05	0.07	0.01
080441	357085.86	2897349.82	183.93	0.07	0.09	0.01
080442	357093.67	2897360.73	183.95	0.07	0.09	0.01
080443	357099.68	2897369.06	183.89	0.07	0.09	0.01
080444	357105.86	2897377.85	183.89	0.07	0.09	0.01
080445	357111.88	2897386.36	183.88	0.05	0.07	0.01
080446	357117.93	2897394.93	183.88	0.07	0.08	0.01
080447	357124.03	2897403.62	183.90	0.07	0.09	0.01
080448	357129.87	2897411.93	183.91	0.05	0.07	0.01
080449	357135.64	2897420.26	183.88	0.05	0.07	0.01
080450	357143.38	2897430.99	183.91	0.07	0.09	0.01
080451	357150.95	2897442.00	183.94	0.05	0.07	0.01
080452	357156.90	2897450.55	183.91	0.05	0.07	0.01
080453	357162.86	2897458.93	183.92	0.07	0.09	0.01
080454	357169.17	2897467.50	183.95	0.05	0.07	0.01
080455	357175.23	2897476.06	183.92	0.06	0.08	0.01
080456	357181.20	2897484.33	183.91	0.05	0.07	0.01
080457	357187.32	2897492.91	183.86	0.06	0.08	0.01
080458	357193.49	2897501.48	183.89	0.05	0.07	0.01
080459	357199.21	2897509.68	183.88	0.06	0.08	0.01
080460	357205.24	2897518.33	183.96	0.07	0.09	0.01
080461	357211.35	2897527.12	183.91	0.06	0.08	0.01
080462	357217.38	2897535.64	183.90	0.06	0.07	0.01
080463	357224.68	2897546.12	183.95	0.06	0.08	0.01
080464	357232.30	2897556.99	183.94	0.07	0.09	0.01

APPENDIX J

Control Survey Listing MVRM Calibration Site - Dist. 58

North bound U.S. Highway 165 northeast of Olla

Date & Time 4/22/2014 1:15 PM

Coordinate System U.S. State Plane 1983 **Zone** Louisiana North 1701

Project Datum (NAD 83) **Vertical Datum** (NAVD 88) **Geoid Model** GEOID12A

Coordinate Unit U.S. Survey Foot **Distance Unit** U.S. Survey Foot **Height Unit** U.S. Survey Foot

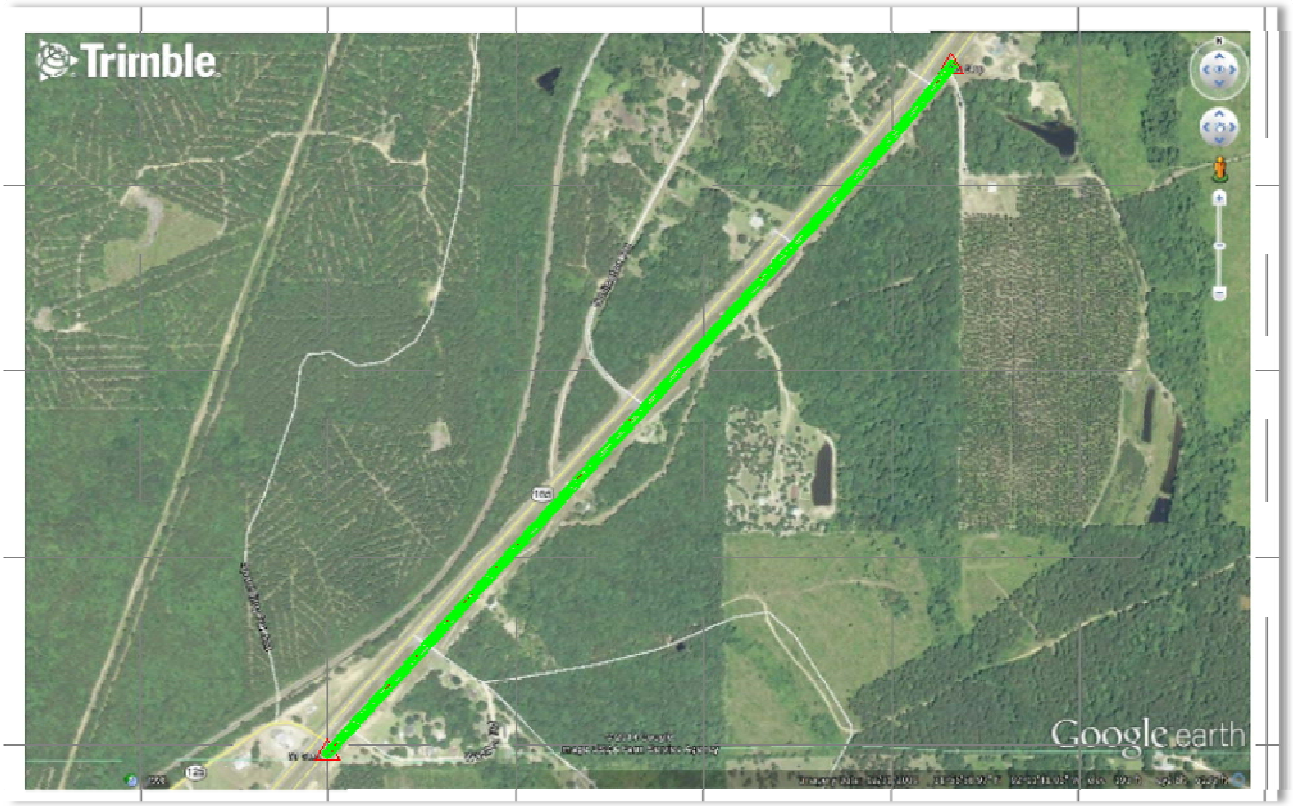


Figure 52
MVRM Control – 58 North bound U.S. Highway 165 northeast of Olla

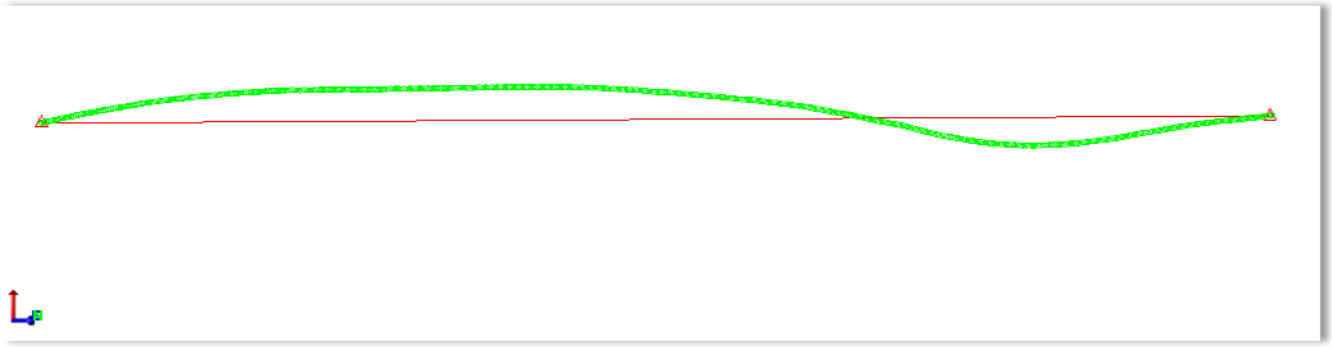


Figure 53
MVRM Control – 58 Profile 10 X vertical

Point ID	Northing	Easting	Elevation	H Prc	V Prc	RMS
5801	519495.55	3373788.35	180.07	0.07	0.09	0.02
5802	523348.08	3377272.41	183.18	0.14	0.15	0.02
58001	519494.61	3373788.39	180.00	0.12	0.13	0.02
58002	519502.41	3373795.93	180.28	0.11	0.12	0.02
58003	519510.22	3373803.45	180.60	0.11	0.12	0.02
58004	519518.08	3373810.76	180.82	0.11	0.13	0.02
58005	519526.78	3373818.84	181.11	0.11	0.13	0.02
58006	519535.90	3373827.31	181.36	0.11	0.13	0.02
58007	519543.62	3373834.12	181.53	0.12	0.14	0.02
58008	519551.55	3373841.32	181.89	0.11	0.12	0.02
58009	519559.67	3373848.65	182.09	0.12	0.13	0.02
58010	519567.79	3373856.22	182.35	0.11	0.12	0.02
58011	519576.38	3373864.10	182.59	0.12	0.14	0.02
58012	519584.68	3373871.64	182.85	0.12	0.13	0.02
58013	519593.10	3373879.20	183.07	0.12	0.14	0.02
58014	519601.27	3373886.76	183.34	0.12	0.13	0.02
58015	519609.83	3373894.63	183.51	0.12	0.13	0.02
58016	519618.10	3373902.23	183.73	0.12	0.13	0.02
58017	519626.39	3373909.77	183.92	0.11	0.12	0.02
58018	519634.72	3373917.41	184.16	0.11	0.13	0.02
58019	519642.93	3373925.02	184.37	0.11	0.12	0.02
58020	519651.14	3373932.38	184.58	0.11	0.12	0.02
58021	519659.19	3373939.85	184.77	0.12	0.14	0.02
58022	519667.27	3373947.28	185.00	0.11	0.12	0.02
58023	519675.66	3373954.87	185.24	0.12	0.14	0.02
58024	519683.99	3373962.38	185.44	0.12	0.14	0.02
58025	519692.22	3373970.03	185.59	0.13	0.14	0.02
58026	519700.80	3373977.63	185.78	0.11	0.12	0.02
58027	519709.08	3373985.06	185.98	0.11	0.12	0.02
58028	519717.37	3373992.68	186.17	0.11	0.12	0.02
58029	519725.62	3374000.15	186.36	0.11	0.12	0.02
58030	519733.93	3374007.93	186.58	0.11	0.13	0.02
58031	519742.35	3374015.45	186.77	0.11	0.12	0.02
58032	519750.60	3374023.01	186.98	0.12	0.13	0.02
58033	519758.74	3374030.58	187.11	0.11	0.12	0.02
58034	519766.65	3374037.85	187.28	0.11	0.12	0.01

58035	519774.80	3374045.37	187.45	0.11	0.13	0.02
58036	519783.07	3374053.00	187.62	0.10	0.12	0.02
58037	519791.55	3374060.77	187.87	0.12	0.13	0.01
58038	519799.86	3374068.34	188.11	0.14	0.15	0.01
58039	519808.34	3374076.03	188.31	0.12	0.13	0.01
58040	519816.55	3374083.65	188.52	0.14	0.14	0.01
58041	519825.22	3374091.74	188.59	0.11	0.13	0.02
58042	519833.67	3374099.49	188.78	0.13	0.15	0.02
58043	519842.42	3374107.45	188.91	0.13	0.15	0.02
58044	519851.04	3374115.28	189.13	0.12	0.14	0.02
58045	519861.90	3374125.06	189.27	0.13	0.15	0.02
58046	519870.80	3374133.09	189.39	0.11	0.13	0.02
58047	519879.60	3374140.94	189.62	0.13	0.15	0.02
58048	519888.11	3374148.97	189.78	0.11	0.13	0.02
58049	519896.65	3374156.83	189.95	0.12	0.14	0.02
58050	519905.07	3374164.72	190.12	0.13	0.15	0.02
58051	519913.57	3374172.64	190.28	0.11	0.13	0.02
58052	519922.11	3374180.48	190.25	0.13	0.15	0.02
58053	519930.60	3374188.32	190.45	0.11	0.13	0.02
58054	519939.38	3374196.19	190.58	0.12	0.13	0.02
58055	519948.06	3374204.07	190.75	0.11	0.13	0.02
58056	519956.66	3374211.88	190.88	0.12	0.14	0.02
58057	519965.31	3374219.84	191.01	0.12	0.13	0.02
58058	519974.04	3374227.74	191.16	0.12	0.14	0.02
58059	519982.51	3374235.51	191.26	0.12	0.14	0.02
58060	519990.97	3374243.49	191.39	0.13	0.14	0.02
58061	519999.39	3374251.28	191.44	0.11	0.13	0.02
58062	520007.89	3374259.13	191.55	0.11	0.13	0.02
58063	520016.58	3374266.88	191.59	0.12	0.13	0.02
58064	520025.33	3374274.95	191.65	0.11	0.13	0.01
58065	520033.79	3374282.96	191.76	0.12	0.14	0.02
58066	520044.71	3374292.89	191.87	0.13	0.15	0.02
58067	520053.77	3374301.12	192.11	0.12	0.14	0.02
58068	520062.52	3374309.03	192.22	0.13	0.14	0.01
58069	520071.25	3374316.87	192.31	0.13	0.14	0.01
58070	520080.03	3374324.93	192.50	0.13	0.15	0.01

58071	520088.78	3374333.12	192.41	0.14	0.16	0.01
58072	520097.69	3374341.37	192.57	0.13	0.15	0.01
58073	520106.51	3374349.22	192.60	0.12	0.14	0.01
58074	520115.00	3374357.09	192.76	0.13	0.14	0.01
58075	520123.73	3374365.02	192.91	0.16	0.16	0.01
58076	520132.42	3374372.94	192.99	0.16	0.16	0.01
58077	520141.06	3374380.69	192.92	0.15	0.15	0.01
58078	520149.54	3374388.57	193.09	0.14	0.14	0.01
58079	520160.48	3374398.59	193.10	0.16	0.16	0.01
58080	520169.30	3374406.43	193.16	0.14	0.14	0.01
58081	520177.77	3374414.26	193.25	0.16	0.16	0.01
58082	520186.04	3374421.76	193.36	0.14	0.14	0.01
58083	520194.56	3374429.79	193.52	0.15	0.15	0.01
58084	520203.43	3374437.75	193.50	0.16	0.16	0.01
58085	520212.00	3374445.84	193.62	0.14	0.14	0.01
58086	520220.55	3374453.86	193.72	0.14	0.14	0.01
58087	520229.20	3374461.57	193.68	0.12	0.14	0.02
58088	520237.79	3374469.31	193.72	0.13	0.15	0.02
58089	520246.13	3374476.93	193.79	0.14	0.14	0.01
58090	520254.10	3374484.27	193.84	0.15	0.15	0.01
58091	520262.54	3374491.95	193.87	0.14	0.14	0.01
58092	520271.12	3374499.63	193.85	0.15	0.15	0.01
58093	520280.06	3374507.62	193.89	0.15	0.15	0.01
58094	520288.87	3374515.85	193.84	0.13	0.15	0.02
58095	520297.87	3374524.13	193.83	0.14	0.16	0.02
58096	520306.85	3374532.29	193.91	0.14	0.16	0.02
58097	520315.45	3374540.42	193.91	0.13	0.14	0.02
58098	520324.51	3374548.55	193.89	0.13	0.14	0.02
58099	520333.39	3374556.44	193.89	0.13	0.14	0.01
58100	520342.03	3374564.45	193.96	0.13	0.14	0.01
58101	520350.45	3374572.05	194.01	0.13	0.13	0.01
58102	520359.28	3374580.20	194.07	0.13	0.13	0.01
58103	520368.35	3374588.72	194.11	0.13	0.13	0.01
58104	520377.25	3374596.99	194.07	0.14	0.15	0.01
58105	520386.19	3374605.11	194.14	0.15	0.15	0.01
58106	520395.19	3374613.23	194.12	0.13	0.15	0.02
58107	520404.19	3374621.59	194.14	0.11	0.13	0.01

58108	520413.16	3374629.77	194.09	0.13	0.13	0.01
58109	520422.46	3374637.99	194.19	0.13	0.13	0.01
58110	520431.59	3374646.28	194.21	0.15	0.15	0.01
58111	520440.33	3374654.47	194.31	0.14	0.14	0.01
58112	520449.52	3374662.99	194.22	0.13	0.13	0.01
58113	520458.94	3374671.53	194.17	0.13	0.14	0.01
58114	520467.43	3374679.28	194.20	0.14	0.15	0.01
58115	520475.45	3374686.48	194.09	0.14	0.15	0.01
58116	520484.03	3374694.19	194.16	0.14	0.15	0.01
58117	520492.51	3374701.82	194.24	0.15	0.15	0.01
58118	520501.02	3374709.58	194.21	0.16	0.16	0.01
58119	520511.70	3374719.31	194.19	0.14	0.14	0.01
58120	520520.40	3374727.13	194.18	0.14	0.14	0.01
58121	520528.93	3374735.02	194.23	0.16	0.16	0.01
58122	520537.63	3374742.83	194.19	0.16	0.16	0.01
58123	520546.34	3374750.74	194.17	0.16	0.16	0.01
58124	520555.10	3374758.96	194.21	0.15	0.15	0.01
58125	520563.71	3374766.77	194.39	0.14	0.14	0.01
58126	520572.30	3374774.61	194.39	0.14	0.14	0.01
58127	520581.01	3374782.59	194.43	0.15	0.15	0.01
58128	520589.65	3374790.70	194.47	0.13	0.14	0.02
58129	520598.16	3374798.70	194.56	0.13	0.14	0.02
58130	520607.02	3374806.49	194.50	0.12	0.14	0.02
58131	520615.65	3374814.42	194.46	0.16	0.15	0.01
58132	520624.62	3374822.61	194.48	0.16	0.16	0.01
58133	520633.74	3374830.64	194.46	0.15	0.15	0.01
58134	520642.59	3374838.74	194.49	0.15	0.15	0.01
58135	520651.59	3374846.99	194.53	0.13	0.14	0.01
58136	520660.71	3374855.26	194.54	0.15	0.15	0.01
58137	520669.38	3374863.67	194.61	0.14	0.16	0.02
58138	520678.19	3374871.84	194.59	0.15	0.15	0.01
58139	520687.18	3374880.10	194.63	0.15	0.15	0.01
58140	520695.91	3374888.20	194.66	0.14	0.14	0.01
58141	520704.67	3374895.75	194.56	0.13	0.13	0.01
58142	520713.47	3374903.77	194.60	0.15	0.16	0.01
58143	520722.24	3374911.77	194.63	0.15	0.16	0.01

58144	520731.18	3374919.80	194.69	0.14	0.15	0.01
58145	520739.76	3374927.58	194.68	0.13	0.13	0.01
58146	520748.44	3374935.53	194.70	0.14	0.14	0.01
58147	520757.23	3374943.36	194.75	0.15	0.15	0.01
58148	520765.98	3374951.24	194.80	0.15	0.15	0.01
58149	520774.83	3374959.50	194.80	0.15	0.15	0.01
58150	520782.88	3374967.02	194.89	0.15	0.15	0.01
58151	520791.45	3374974.81	194.88	0.13	0.14	0.01
58152	520800.31	3374983.08	194.96	0.14	0.14	0.01
58153	520809.06	3374991.14	194.88	0.17	0.16	0.02
58154	520817.99	3374999.50	194.88	0.17	0.16	0.02
58155	520826.68	3375007.63	194.88	0.15	0.15	0.01
58156	520835.35	3375015.59	194.82	0.15	0.15	0.01
58157	520844.11	3375023.60	194.89	0.15	0.15	0.01
58158	520853.13	3375031.99	195.04	0.15	0.15	0.01
58159	520861.91	3375040.02	194.99	0.14	0.14	0.01
58160	520870.99	3375048.17	195.00	0.15	0.15	0.01
58161	520880.14	3375056.60	195.06	0.15	0.15	0.01
58162	520889.42	3375065.04	195.02	0.14	0.14	0.01
58163	520898.50	3375073.24	195.09	0.15	0.15	0.01
58164	520907.45	3375081.27	195.12	0.15	0.15	0.01
58165	520916.30	3375089.58	195.14	0.13	0.14	0.01
58166	520925.65	3375098.19	195.10	0.15	0.16	0.02
58167	520934.93	3375106.67	195.16	0.15	0.15	0.01
58168	520943.97	3375115.00	195.15	0.16	0.16	0.01
58169	520953.04	3375123.17	195.20	0.16	0.16	0.01
58170	520962.30	3375131.68	195.29	0.14	0.14	0.01
58171	520972.10	3375140.48	195.22	0.16	0.16	0.01
58172	520981.54	3375149.08	195.23	0.13	0.14	0.01
58173	520990.73	3375157.40	195.18	0.14	0.15	0.01
58174	520999.91	3375165.71	195.23	0.13	0.14	0.01
58175	521009.13	3375174.07	195.27	0.15	0.15	0.01
58176	521018.41	3375182.56	195.27	0.16	0.16	0.02
58177	521027.44	3375190.79	195.21	0.18	0.16	0.01
58178	521036.31	3375198.89	195.15	0.18	0.16	0.01
58179	521045.34	3375207.12	195.19	0.18	0.16	0.01
58180	521054.33	3375215.14	195.21	0.14	0.14	0.01

58181	521063.34	3375223.43	195.23	0.15	0.15	0.01
58182	521072.35	3375231.45	195.25	0.17	0.16	0.02
58183	521081.44	3375240.05	195.30	0.15	0.15	0.01
58184	521092.97	3375250.46	195.26	0.15	0.15	0.01
58185	521101.71	3375258.53	195.24	0.17	0.16	0.02
58186	521110.46	3375266.35	195.21	0.16	0.15	0.01
58187	521119.30	3375274.29	195.30	0.18	0.16	0.01
58188	521128.44	3375282.49	195.26	0.17	0.16	0.02
58189	521137.56	3375290.80	195.19	0.17	0.16	0.02
58190	521146.78	3375299.16	195.23	0.17	0.16	0.02
58191	521155.97	3375307.49	195.10	0.15	0.13	0.01
58192	521165.39	3375316.04	195.08	0.17	0.15	0.01
58193	521174.79	3375324.80	195.04	0.16	0.15	0.01
58194	521184.32	3375333.40	194.97	0.17	0.16	0.02
58195	521193.74	3375341.95	194.93	0.14	0.14	0.01
58196	521203.04	3375350.61	194.98	0.14	0.14	0.01
58197	521212.42	3375359.41	194.93	0.16	0.15	0.01
58198	521222.02	3375368.09	194.86	0.14	0.14	0.01
58199	521231.43	3375376.83	194.77	0.16	0.15	0.01
58200	521240.77	3375385.23	194.73	0.15	0.14	0.01
58201	521250.23	3375393.73	194.71	0.15	0.14	0.01
58202	521259.58	3375402.29	194.60	0.17	0.16	0.02
58203	521270.23	3375411.97	194.47	0.13	0.14	0.01
58204	521278.94	3375419.95	194.44	0.13	0.13	0.01
58205	521288.13	3375428.30	194.35	0.14	0.15	0.01
58206	521297.37	3375437.03	194.33	0.14	0.15	0.01
58207	521307.04	3375445.93	194.31	0.15	0.14	0.01
58208	521316.78	3375454.88	194.23	0.15	0.14	0.01
58209	521326.19	3375463.32	194.10	0.15	0.16	0.02
58210	521335.20	3375471.82	194.06	0.15	0.16	0.02
58211	521344.85	3375480.62	194.01	0.15	0.16	0.02
58212	521354.54	3375489.58	193.89	0.15	0.16	0.02
58213	521364.07	3375498.06	193.82	0.13	0.14	0.01
58214	521373.62	3375506.94	193.62	0.16	0.16	0.02
58215	521383.10	3375515.47	193.50	0.15	0.15	0.01
58216	521392.46	3375523.88	193.38	0.14	0.14	0.01

58217	521401.78	3375532.61	193.23	0.15	0.16	0.02
58218	521410.77	3375541.16	193.17	0.13	0.14	0.01
58219	521419.98	3375549.43	193.17	0.13	0.14	0.01
58220	521429.10	3375557.84	193.08	0.14	0.15	0.01
58221	521438.62	3375566.38	193.06	0.15	0.16	0.02
58222	521447.76	3375575.04	193.07	0.13	0.14	0.01
58223	521457.20	3375583.50	192.99	0.15	0.15	0.02
58224	521466.53	3375592.23	192.81	0.13	0.13	0.01
58225	521475.59	3375600.45	192.73	0.13	0.13	0.01
58226	521485.43	3375609.27	192.54	0.13	0.13	0.01
58227	521494.89	3375617.88	192.38	0.14	0.14	0.01
58228	521504.02	3375626.36	192.31	0.14	0.14	0.01
58229	521513.54	3375635.10	192.17	0.13	0.13	0.01
58230	521522.92	3375643.71	192.07	0.13	0.13	0.01
58231	521532.06	3375652.05	191.93	0.14	0.15	0.01
58232	521541.52	3375660.61	191.82	0.15	0.16	0.02
58233	521550.83	3375668.76	191.76	0.13	0.14	0.01
58234	521559.95	3375677.16	191.64	0.14	0.15	0.01
58235	521569.18	3375685.64	191.50	0.14	0.15	0.01
58236	521578.28	3375693.99	191.46	0.15	0.16	0.02
58237	521587.57	3375702.67	191.36	0.15	0.16	0.02
58238	521596.84	3375711.39	191.20	0.15	0.16	0.02
58239	521606.11	3375720.01	191.11	0.15	0.16	0.02
58240	521615.40	3375728.44	190.98	0.15	0.16	0.02
58241	521624.68	3375736.73	190.85	0.13	0.13	0.01
58242	521633.85	3375744.97	190.70	0.14	0.15	0.01
58243	521642.76	3375753.16	190.61	0.14	0.15	0.01
58244	521651.89	3375761.63	190.49	0.15	0.15	0.02
58245	521661.05	3375769.84	190.35	0.15	0.15	0.02
58246	521670.17	3375778.24	190.18	0.14	0.14	0.01
58247	521678.92	3375786.36	190.05	0.15	0.15	0.02
58248	521687.65	3375794.45	189.97	0.15	0.16	0.02
58249	521696.68	3375802.74	189.91	0.15	0.16	0.02
58250	521705.72	3375811.11	189.82	0.14	0.15	0.01
58251	521714.51	3375818.80	189.65	0.13	0.13	0.01
58252	521723.61	3375827.19	189.56	0.14	0.15	0.01
58253	521732.89	3375835.52	189.32	0.15	0.16	0.02

58254	521742.04	3375844.14	189.21	0.13	0.13	0.01
58255	521751.25	3375852.61	189.03	0.14	0.15	0.01
58256	521760.23	3375860.83	188.83	0.16	0.16	0.02
58257	521769.45	3375869.20	188.70	0.13	0.13	0.01
58258	521778.50	3375877.44	188.54	0.17	0.16	0.02
58259	521787.21	3375885.33	188.46	0.16	0.15	0.01
58260	521796.42	3375893.61	188.32	0.13	0.14	0.01
58261	521805.56	3375901.87	188.14	0.14	0.15	0.01
58262	521814.78	3375910.44	188.07	0.14	0.15	0.01
58263	521823.93	3375919.06	187.93	0.13	0.14	0.01
58264	521832.86	3375927.13	187.77	0.14	0.15	0.01
58265	521841.52	3375935.07	187.61	0.15	0.15	0.02
58266	521850.35	3375942.85	187.43	0.13	0.13	0.01
58267	521859.22	3375950.87	187.32	0.14	0.13	0.01
58268	521868.46	3375959.22	187.08	0.17	0.15	0.02
58269	521877.24	3375967.09	186.89	0.17	0.16	0.02
58270	521885.99	3375975.04	186.78	0.16	0.15	0.01
58271	521894.87	3375983.19	186.55	0.16	0.15	0.02
58272	521903.81	3375991.17	186.20	0.14	0.13	0.01
58273	521912.60	3375999.28	186.02	0.14	0.14	0.01
58274	521921.91	3376007.46	185.83	0.16	0.16	0.02
58275	521931.10	3376016.07	185.61	0.16	0.15	0.02
58276	521939.96	3376024.38	185.43	0.15	0.14	0.01
58277	521949.07	3376032.62	185.11	0.15	0.14	0.01
58278	521958.05	3376040.87	184.94	0.14	0.13	0.01
58279	521966.96	3376048.98	184.68	0.17	0.15	0.02
58280	521975.50	3376057.18	184.49	0.16	0.15	0.01
58281	521984.41	3376065.08	184.21	0.17	0.16	0.02
58282	521995.53	3376075.37	184.09	0.14	0.13	0.01
58283	522004.12	3376083.43	183.85	0.14	0.13	0.01
58284	522012.61	3376091.31	183.62	0.14	0.13	0.01
58285	522021.19	3376099.01	183.39	0.14	0.15	0.01
58286	522029.95	3376107.07	183.17	0.13	0.14	0.01
58287	522038.63	3376114.76	182.93	0.15	0.15	0.01
58288	522046.93	3376122.60	182.67	0.16	0.14	0.01
58289	522055.84	3376130.58	182.36	0.18	0.16	0.01

58290	522064.77	3376138.56	182.10	0.14	0.13	0.01
58291	522073.84	3376146.37	181.92	0.14	0.13	0.01
58292	522082.55	3376154.56	181.68	0.16	0.14	0.01
58293	522091.24	3376162.49	181.40	0.14	0.13	0.01
58294	522099.68	3376170.35	181.08	0.17	0.16	0.02
58295	522108.63	3376178.70	180.76	0.17	0.16	0.02
58296	522117.81	3376187.32	180.59	0.18	0.16	0.02
58297	522127.10	3376195.55	180.42	0.15	0.14	0.01
58298	522135.84	3376203.78	180.11	0.17	0.15	0.01
58299	522144.72	3376211.91	179.90	0.17	0.15	0.01
58300	522153.67	3376220.14	179.71	0.18	0.16	0.02
58301	522162.64	3376228.40	179.41	0.16	0.14	0.01
58302	522171.92	3376236.65	179.14	0.15	0.13	0.01
58303	522181.24	3376245.36	178.93	0.17	0.16	0.02
58304	522190.68	3376253.70	178.60	0.15	0.15	0.02
58305	522199.92	3376262.18	178.32	0.17	0.15	0.02
58306	522209.32	3376270.79	177.91	0.16	0.14	0.01
58307	522218.63	3376279.30	177.59	0.15	0.14	0.01
58308	522227.79	3376287.67	177.24	0.17	0.15	0.01
58309	522237.05	3376296.26	176.98	0.16	0.14	0.01
58310	522246.60	3376304.75	176.71	0.16	0.14	0.01
58311	522255.97	3376313.50	176.38	0.16	0.14	0.01
58312	522265.19	3376321.77	176.06	0.18	0.16	0.02
58313	522274.66	3376330.37	175.65	0.14	0.13	0.01
58314	522284.29	3376339.55	175.30	0.17	0.14	0.01
58315	522293.78	3376348.60	175.11	0.17	0.15	0.01
58316	522303.72	3376357.39	174.77	0.17	0.15	0.01
58317	522313.58	3376366.22	174.54	0.16	0.15	0.01
58318	522320.98	3376372.97	174.36	0.15	0.14	0.01
58319	522330.39	3376381.59	174.26	0.16	0.14	0.01
58320	522338.00	3376388.30	173.97	0.17	0.15	0.01
58321	522345.52	3376395.18	173.86	0.16	0.14	0.01
58322	522354.82	3376403.91	173.58	0.14	0.13	0.01
58323	522364.31	3376412.58	173.39	0.14	0.13	0.01
58324	522373.75	3376421.30	173.08	0.15	0.14	0.01
58325	522382.86	3376429.65	172.98	0.15	0.13	0.01
58326	522392.36	3376438.34	172.66	0.18	0.15	0.01

58327	522401.64	3376446.86	172.49	0.17	0.15	0.01
58328	522410.71	3376455.32	172.33	0.15	0.14	0.01
58329	522420.21	3376463.94	172.02	0.14	0.14	0.02
58330	522429.29	3376472.46	171.96	0.16	0.16	0.02
58331	522438.39	3376480.77	171.88	0.16	0.14	0.01
58332	522447.45	3376488.89	171.71	0.18	0.15	0.01
58333	522456.34	3376497.30	171.60	0.18	0.15	0.01
58334	522465.50	3376505.81	171.48	0.16	0.14	0.01
58335	522474.44	3376513.80	171.29	0.19	0.17	0.02
58336	522483.77	3376522.40	171.20	0.19	0.17	0.02
58337	522492.96	3376530.69	171.11	0.19	0.17	0.02
58338	522502.12	3376538.93	170.99	0.16	0.14	0.01
58339	522511.22	3376547.07	170.89	0.18	0.15	0.01
58340	522520.20	3376555.32	170.84	0.19	0.17	0.02
58341	522529.22	3376563.64	170.80	0.16	0.14	0.01
58342	522538.66	3376572.17	170.78	0.18	0.15	0.02
58343	522547.85	3376580.75	170.60	0.19	0.17	0.02
58344	522557.23	3376589.48	170.61	0.18	0.15	0.02
58345	522566.39	3376597.52	170.63	0.16	0.14	0.01
58346	522575.58	3376605.80	170.60	0.16	0.14	0.01
58347	522584.88	3376614.15	170.57	0.18	0.16	0.02
58348	522593.61	3376621.97	170.57	0.16	0.14	0.01
58349	522602.87	3376630.30	170.54	0.19	0.16	0.02
58350	522611.77	3376638.48	170.65	0.19	0.16	0.02
58351	522621.02	3376647.01	170.67	0.16	0.14	0.01
58352	522632.76	3376657.63	170.72	0.16	0.14	0.01
58353	522641.76	3376665.84	170.88	0.18	0.15	0.01
58354	522650.49	3376673.79	170.83	0.16	0.14	0.01
58355	522659.68	3376681.95	170.90	0.18	0.15	0.01
58356	522668.59	3376690.15	170.94	0.18	0.15	0.02
58357	522677.77	3376698.46	171.03	0.19	0.17	0.02
58358	522686.62	3376706.60	171.08	0.18	0.15	0.02
58359	522695.69	3376714.73	171.25	0.19	0.17	0.02
58360	522704.90	3376723.02	171.38	0.19	0.17	0.02
58361	522714.24	3376731.15	171.44	0.17	0.14	0.01
58362	522723.21	3376739.78	171.51	0.19	0.17	0.02

58363	522732.48	3376747.99	171.68	0.18	0.16	0.02
58364	522741.97	3376756.75	171.84	0.17	0.14	0.01
58365	522751.21	3376765.19	171.85	0.17	0.14	0.01
58366	522760.46	3376773.50	172.11	0.17	0.14	0.01
58367	522769.65	3376781.88	172.31	0.19	0.17	0.02
58368	522778.62	3376789.83	172.43	0.17	0.14	0.01
58369	522787.66	3376797.93	172.55	0.18	0.16	0.02
58370	522797.15	3376806.18	172.77	0.17	0.14	0.01
58371	522806.46	3376814.61	172.92	0.19	0.17	0.02
58372	522816.12	3376823.25	173.13	0.17	0.15	0.01
58373	522825.39	3376831.49	173.26	0.17	0.15	0.01
58374	522834.69	3376839.46	173.50	0.19	0.17	0.02
58375	522844.08	3376847.73	173.62	0.19	0.17	0.02
58376	522853.58	3376855.91	173.80	0.18	0.16	0.02
58377	522862.67	3376864.21	174.06	0.17	0.15	0.01
58378	522872.04	3376872.42	174.27	0.19	0.17	0.02
58379	522881.50	3376880.69	174.53	0.17	0.15	0.01
58380	522890.96	3376888.94	174.74	0.19	0.17	0.02
58381	522900.53	3376897.35	174.96	0.17	0.15	0.01
58382	522910.05	3376905.43	175.17	0.19	0.17	0.02
58383	522919.54	3376913.72	175.30	0.17	0.17	0.02
58384	522928.70	3376921.65	175.58	0.18	0.19	0.02
58385	522938.19	3376929.77	175.84	0.20	0.18	0.02
58386	522949.79	3376939.82	176.10	0.18	0.15	0.01
58387	522961.61	3376950.21	176.36	0.19	0.16	0.02
58388	522971.11	3376958.75	176.58	0.20	0.17	0.02
58389	522980.52	3376967.03	176.83	0.18	0.18	0.02
58390	522990.24	3376975.23	177.06	0.20	0.18	0.02
58391	523000.13	3376983.62	177.31	0.20	0.17	0.02
58392	523009.96	3376992.04	177.51	0.17	0.15	0.01
58393	523019.58	3377000.10	177.73	0.20	0.17	0.02
58394	523029.00	3377008.46	177.88	0.20	0.17	0.02
58395	523038.52	3377016.78	178.12	0.19	0.16	0.02
58396	523047.85	3377024.79	178.42	0.20	0.17	0.02
58397	523057.34	3377032.88	178.62	0.19	0.17	0.02
58398	523066.72	3377041.20	178.73	0.17	0.15	0.01
58399	523076.18	3377049.13	179.02	0.17	0.15	0.01

58400	523085.90	3377057.45	179.19	0.18	0.16	0.02
58401	523096.02	3377065.61	179.34	0.18	0.16	0.02
58402	523105.90	3377073.86	179.52	0.18	0.16	0.02
58403	523115.69	3377082.18	179.76	0.17	0.15	0.01
58404	523125.51	3377090.37	179.90	0.17	0.15	0.01
58405	523135.26	3377098.42	180.06	0.17	0.15	0.01
58406	523144.88	3377106.54	180.19	0.20	0.17	0.02
58407	523154.59	3377115.01	180.43	0.20	0.17	0.02
58408	523164.21	3377122.60	180.52	0.18	0.16	0.02
58409	523173.67	3377130.18	180.79	0.20	0.17	0.02
58410	523183.11	3377137.97	180.88	0.20	0.17	0.02
58411	523192.68	3377145.78	181.03	0.18	0.16	0.02
58412	523202.54	3377153.91	181.12	0.20	0.17	0.02
58413	523212.11	3377161.86	181.16	0.17	0.15	0.01
58414	523221.90	3377169.74	181.27	0.18	0.16	0.02
58415	523231.39	3377177.59	181.41	0.19	0.18	0.02
58416	523241.10	3377185.81	181.56	0.16	0.15	0.01
58417	523251.12	3377193.78	181.64	0.17	0.15	0.02
58418	523260.82	3377201.68	181.85	0.15	0.14	0.01
58419	523270.79	3377209.68	182.07	0.15	0.14	0.01
58420	523280.55	3377217.48	182.22	0.18	0.16	0.02
58421	523290.67	3377225.75	182.26	0.13	0.14	0.01
58422	523300.79	3377234.00	182.44	0.13	0.14	0.01
58423	523308.71	3377240.29	182.56	0.13	0.14	0.01
58424	523318.99	3377248.59	182.75	0.15	0.16	0.02
58425	523326.79	3377254.85	182.87	0.15	0.16	0.02
58426	523336.97	3377263.20	182.97	0.15	0.16	0.02
58427	523345.82	3377270.33	183.06	0.15	0.16	0.02
58428	523353.67	3377276.74	183.26	0.15	0.16	0.02

APPENDIX K

Control Survey Listing MVRM Calibration Site - Dist. 61a

East bound I-10 bridge over the Whiskey Bay Outlet

Date & Time 3/23/2014 7:18 AM

Coordinate System U.S. State Plane 1983 **Zone** Louisiana South 1702

Project Datum (NAD 83) **Vertical Datum** (NAVD 88) **Geoid Model** GEOID12A

Coordinate Unit U.S. Survey Foot **Distance Unit** U.S. Survey Foot **Height Unit** U.S. Survey Foot

Figure 54
MVRM Control – 61a East bound I-10 bridge over the Whiskey Bay Outlet

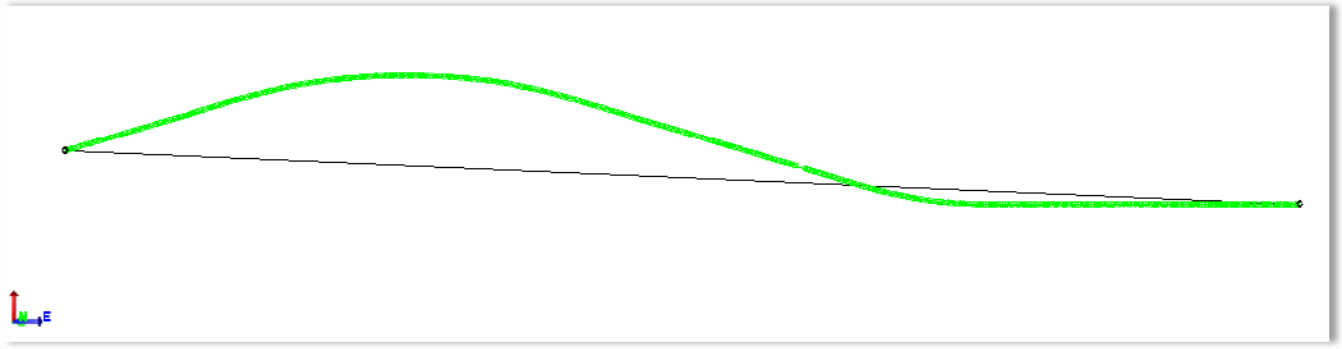


Figure 55
MVRM Control – 61a Profile 10 X vertical

Point ID	Northing	Easting	Elevation	H Prc	V Prc	RMS
6101	677983.33	3183188.49	62.70	0.06	0.07	0.01
6102	679565.83	3188516.26	38.89	0.10	0.14	0.03
61001	677983.63	3183188.99	62.91	0.15	0.13	0.01
61002	677986.94	3183200.40	63.22	0.14	0.12	0.01
61003	677990.55	3183212.57	63.58	0.13	0.11	0.01
61004	677993.84	3183223.04	63.89	0.15	0.13	0.01
61005	677996.66	3183232.64	64.23	0.14	0.12	0.01
61006	677999.75	3183242.23	64.48	0.15	0.13	0.01
61007	678002.78	3183251.82	64.80	0.14	0.12	0.01
61008	678006.56	3183264.43	65.21	0.15	0.13	0.02
61009	678009.67	3183274.22	65.48	0.14	0.12	0.01
61010	678013.14	3183284.92	65.89	0.14	0.12	0.01
61011	678016.07	3183294.48	66.15	0.16	0.14	0.02
61012	678019.06	3183304.32	66.38	0.15	0.13	0.01
61013	678022.24	3183314.56	66.75	0.15	0.13	0.01
61014	678025.56	3183325.09	67.04	0.14	0.12	0.01
61015	678028.83	3183335.22	67.32	0.16	0.14	0.02
61016	678032.12	3183345.09	67.77	0.16	0.14	0.02
61017	678035.32	3183355.36	68.10	0.17	0.14	0.02
61018	678038.53	3183365.70	68.37	0.15	0.13	0.01
61019	678041.90	3183376.23	68.66	0.18	0.15	0.02
61020	678045.10	3183387.13	69.03	0.16	0.14	0.02
61021	678048.55	3183397.80	69.30	0.16	0.14	0.02
61022	678052.06	3183409.10	69.75	0.15	0.13	0.01
61023	678055.42	3183419.76	70.04	0.16	0.14	0.02
61024	678058.90	3183430.61	70.46	0.15	0.13	0.02
61025	678062.28	3183441.21	70.80	0.14	0.12	0.01
61026	678065.52	3183451.74	71.11	0.16	0.14	0.02
61027	678068.65	3183462.33	71.45	0.16	0.14	0.02
61028	678072.04	3183473.20	71.76	0.10	0.11	0.01
61029	678075.59	3183484.52	72.11	0.10	0.11	0.01
61030	678079.04	3183495.34	72.47	0.10	0.12	0.01
61031	678082.46	3183506.79	72.82	0.10	0.11	0.01
61032	678086.00	3183517.94	73.17	0.11	0.13	0.02
61033	678089.45	3183528.75	73.52	0.10	0.11	0.01
61034	678092.80	3183539.50	73.83	0.11	0.13	0.02

61035	678097.00	3183553.28	74.26	0.10	0.11	0.01
61036	678100.46	3183564.43	74.57	0.10	0.11	0.01
61037	678104.86	3183578.81	75.04	0.10	0.11	0.01
61038	678108.28	3183590.47	75.34	0.09	0.11	0.01
61039	678111.82	3183602.00	75.72	0.10	0.11	0.01
61040	678115.59	3183613.46	76.03	0.10	0.11	0.01
61041	678119.19	3183625.04	76.44	0.11	0.12	0.02
61042	678123.56	3183639.35	76.85	0.11	0.13	0.02
61043	678126.88	3183650.73	77.20	0.12	0.13	0.02
61044	678130.47	3183662.05	77.62	0.10	0.11	0.01
61045	678133.86	3183673.50	77.88	0.11	0.13	0.02
61046	678137.39	3183684.59	78.23	0.09	0.10	0.01
61047	678141.07	3183695.57	78.60	0.11	0.12	0.01
61048	678144.55	3183707.70	78.96	0.11	0.12	0.01
61049	678148.10	3183718.67	79.32	0.09	0.10	0.01
61050	678151.62	3183730.45	79.72	0.11	0.12	0.02
61051	678155.13	3183741.61	80.09	0.10	0.11	0.01
61052	678158.41	3183752.90	80.51	0.10	0.11	0.01
61053	678161.84	3183763.78	80.82	0.09	0.10	0.01
61054	678165.22	3183774.96	81.25	0.09	0.10	0.01
61055	678168.85	3183786.38	81.53	0.09	0.10	0.01
61056	678172.34	3183797.93	82.00	0.11	0.12	0.01
61057	678176.00	3183810.16	82.40	0.10	0.11	0.01
61058	678179.93	3183822.66	82.79	0.09	0.10	0.01
61059	678183.52	3183834.15	83.16	0.10	0.11	0.01
61060	678187.20	3183845.87	83.53	0.09	0.10	0.01
61061	678190.85	3183857.61	83.86	0.09	0.10	0.01
61062	678194.48	3183869.66	84.24	0.11	0.12	0.01
61063	678198.40	3183882.01	84.64	0.11	0.12	0.01
61064	678202.29	3183894.52	85.07	0.09	0.10	0.01
61065	678206.08	3183906.73	85.45	0.10	0.11	0.01
61066	678209.70	3183918.72	85.77	0.11	0.12	0.01
61067	678213.32	3183930.50	86.14	0.09	0.10	0.01
61068	678217.00	3183942.48	86.47	0.10	0.11	0.01
61069	678220.68	3183954.41	86.78	0.11	0.12	0.01
61070	678225.30	3183969.71	87.13	0.10	0.11	0.01

61071	678229.36	3183981.99	87.54	0.11	0.12	0.01
61072	678232.92	3183993.59	87.84	0.11	0.12	0.02
61073	678236.76	3184005.80	88.12	0.11	0.12	0.02
61074	678240.66	3184018.01	88.44	0.10	0.11	0.01
61075	678244.27	3184030.07	88.78	0.11	0.12	0.01
61076	678248.49	3184042.66	89.09	0.10	0.11	0.01
61077	678251.41	3184052.31	89.32	0.10	0.11	0.01
61078	678255.22	3184064.78	89.75	0.11	0.12	0.01
61079	678259.21	3184077.43	90.01	0.10	0.11	0.01
61080	678263.05	3184089.98	90.29	0.10	0.11	0.01
61081	678266.99	3184102.30	90.68	0.10	0.12	0.01
61082	678270.85	3184114.81	90.90	0.09	0.10	0.01
61083	678273.97	3184124.83	91.21	0.10	0.12	0.01
61084	678277.85	3184137.33	91.49	0.10	0.11	0.01
61085	678281.90	3184150.02	91.74	0.09	0.10	0.01
61086	678285.83	3184162.81	92.02	0.09	0.10	0.01
61087	678288.86	3184172.47	92.22	0.10	0.12	0.01
61088	678292.88	3184185.13	92.41	0.09	0.10	0.01
61089	678296.71	3184197.41	92.71	0.09	0.10	0.01
61090	678300.51	3184209.83	92.95	0.10	0.12	0.01
61091	678304.26	3184222.21	93.09	0.10	0.11	0.01
61092	678307.91	3184234.75	93.34	0.10	0.11	0.01
61093	678311.66	3184247.07	93.55	0.09	0.10	0.01
61094	678315.58	3184259.68	93.85	0.10	0.11	0.01
61095	678319.40	3184272.26	93.99	0.10	0.12	0.01
61096	678323.23	3184284.63	94.16	0.10	0.11	0.01
61097	678326.27	3184294.32	94.24	0.10	0.12	0.01
61098	678330.31	3184307.14	94.48	0.09	0.10	0.01
61099	678334.30	3184319.60	94.68	0.10	0.11	0.01
61100	678338.96	3184334.83	94.86	0.09	0.10	0.01
61101	678342.81	3184347.11	95.02	0.09	0.10	0.01
61102	678346.34	3184358.67	95.12	0.10	0.11	0.01
61103	678349.85	3184370.35	95.22	0.09	0.10	0.01
61104	678353.47	3184382.63	95.46	0.10	0.12	0.01
61105	678357.15	3184394.64	95.58	0.09	0.10	0.01
61106	678360.85	3184406.64	95.67	0.09	0.10	0.01
61107	678364.41	3184418.51	95.74	0.10	0.11	0.01

61108	678367.96	3184429.83	95.84	0.09	0.10	0.01
61109	678371.71	3184442.02	95.95	0.10	0.12	0.01
61110	678375.48	3184454.57	96.13	0.10	0.11	0.01
61111	678379.45	3184466.92	96.25	0.10	0.11	0.01
61112	678383.22	3184479.25	96.31	0.10	0.12	0.01
61113	678387.18	3184491.76	96.36	0.10	0.11	0.01
61114	678391.06	3184503.78	96.43	0.10	0.12	0.01
61115	678394.90	3184515.74	96.47	0.10	0.12	0.01
61116	678398.55	3184528.01	96.60	0.10	0.11	0.01
61117	678402.06	3184540.36	96.58	0.10	0.11	0.01
61118	678405.69	3184552.35	96.61	0.09	0.10	0.01
61119	678410.37	3184567.25	96.69	0.09	0.10	0.01
61120	678414.11	3184579.20	96.70	0.10	0.12	0.01
61121	678417.76	3184591.51	96.71	0.10	0.11	0.01
61122	678421.70	3184603.99	96.78	0.09	0.10	0.01
61123	678425.62	3184616.57	96.78	0.09	0.10	0.01
61124	678428.52	3184626.18	96.81	0.10	0.12	0.01
61125	678431.55	3184635.80	96.86	0.10	0.11	0.01
61126	678435.29	3184647.93	96.78	0.09	0.10	0.01
61127	678439.04	3184660.25	96.80	0.09	0.10	0.01
61128	678442.96	3184672.72	96.83	0.09	0.10	0.01
61129	678447.06	3184685.32	96.83	0.10	0.11	0.01
61130	678450.93	3184697.36	96.88	0.09	0.10	0.01
61131	678454.60	3184709.49	96.80	0.09	0.10	0.01
61132	678458.43	3184721.40	96.80	0.10	0.12	0.01
61133	678462.15	3184733.49	96.74	0.09	0.10	0.01
61134	678466.06	3184744.94	96.65	0.09	0.10	0.01
61135	678469.74	3184756.77	96.64	0.10	0.12	0.01
61136	678473.53	3184768.82	96.57	0.09	0.10	0.01
61137	678477.24	3184780.80	96.53	0.09	0.10	0.01
61138	678480.95	3184793.32	96.52	0.09	0.10	0.01
61139	678483.64	3184802.95	96.52	0.10	0.11	0.01
61140	678487.60	3184815.65	96.37	0.10	0.11	0.01
61141	678491.29	3184828.07	96.34	0.10	0.12	0.01
61142	678495.24	3184840.65	96.18	0.10	0.12	0.01
61143	678498.29	3184850.61	96.17	0.10	0.11	0.01

61144	678501.44	3184860.55	96.08	0.09	0.10	0.01
61145	678505.28	3184873.16	95.97	0.09	0.10	0.01
61146	678509.26	3184885.73	95.88	0.10	0.12	0.01
61147	678513.18	3184898.25	95.75	0.10	0.12	0.01
61148	678516.84	3184910.21	95.61	0.10	0.11	0.01
61149	678520.89	3184922.28	95.49	0.09	0.10	0.01
61150	678524.40	3184934.08	95.32	0.10	0.12	0.01
61151	678527.95	3184945.83	95.25	0.09	0.10	0.01
61152	678532.80	3184961.10	95.08	0.10	0.12	0.01
61153	678536.71	3184973.46	94.94	0.09	0.10	0.01
61154	678540.37	3184985.89	94.77	0.09	0.10	0.01
61155	678543.88	3184997.84	94.65	0.10	0.12	0.01
61156	678547.73	3185010.32	94.51	0.10	0.12	0.01
61157	678551.40	3185022.77	94.31	0.09	0.10	0.01
61158	678555.28	3185035.21	94.12	0.10	0.12	0.01
61159	678558.23	3185045.12	94.00	0.10	0.11	0.01
61160	678561.43	3185054.79	93.84	0.09	0.10	0.01
61161	678565.42	3185067.66	93.59	0.10	0.12	0.01
61162	678569.33	3185079.80	93.41	0.09	0.10	0.01
61163	678573.07	3185092.15	93.16	0.09	0.10	0.01
61164	678576.91	3185104.16	92.95	0.10	0.12	0.01
61165	678580.90	3185116.72	92.67	0.10	0.12	0.01
61166	678584.68	3185128.85	92.39	0.10	0.11	0.01
61167	678588.31	3185140.91	92.16	0.09	0.10	0.01
61168	678591.92	3185153.51	91.85	0.10	0.12	0.01
61169	678594.81	3185163.21	91.72	0.10	0.11	0.01
61170	678598.72	3185175.40	91.38	0.10	0.12	0.01
61171	678602.29	3185187.14	91.14	0.10	0.11	0.01
61172	678606.25	3185199.37	90.87	0.10	0.11	0.01
61173	678609.93	3185211.48	90.53	0.10	0.11	0.01
61174	678614.83	3185226.94	90.26	0.09	0.10	0.01
61175	678618.62	3185239.07	89.90	0.10	0.11	0.01
61176	678622.43	3185251.14	89.61	0.10	0.11	0.01
61177	678626.32	3185263.18	89.31	0.09	0.10	0.01
61178	678630.06	3185275.57	88.90	0.10	0.11	0.01
61179	678633.76	3185287.37	88.63	0.10	0.11	0.01
61180	678637.61	3185299.49	88.36	0.09	0.10	0.01

61181	678641.37	3185311.95	88.04	0.09	0.10	0.01
61182	678645.15	3185324.79	87.64	0.09	0.10	0.01
61183	678649.04	3185337.43	87.30	0.10	0.12	0.01
61184	678651.92	3185347.28	87.03	0.09	0.10	0.01
61185	678655.83	3185359.91	86.65	0.10	0.12	0.01
61186	678660.75	3185375.17	86.24	0.09	0.10	0.01
61187	678664.48	3185387.62	85.90	0.10	0.11	0.01
61188	678668.54	3185400.01	85.49	0.10	0.12	0.01
61189	678672.49	3185412.50	85.16	0.10	0.12	0.01
61190	678675.40	3185422.08	84.88	0.10	0.11	0.01
61191	678679.40	3185434.76	84.46	0.10	0.12	0.01
61192	678682.33	3185444.34	84.14	0.10	0.12	0.01
61193	678685.38	3185453.87	83.86	0.10	0.11	0.01
61194	678689.11	3185466.27	83.47	0.10	0.12	0.01
61195	678692.91	3185478.61	83.13	0.10	0.11	0.01
61196	678695.90	3185488.31	82.81	0.10	0.12	0.01
61197	678699.68	3185500.95	82.45	0.10	0.11	0.01
61198	678703.60	3185513.86	81.99	0.10	0.11	0.01
61199	678707.52	3185526.10	81.63	0.09	0.10	0.01
61200	678711.17	3185537.94	81.15	0.09	0.10	0.01
61201	678714.86	3185549.84	80.75	0.09	0.10	0.01
61202	678717.87	3185559.41	80.52	0.10	0.11	0.01
61203	678720.96	3185569.21	80.22	0.10	0.11	0.01
61204	678724.76	3185581.57	79.80	0.09	0.10	0.01
61205	678727.64	3185591.21	79.44	0.10	0.12	0.01
61206	678731.50	3185603.87	79.06	0.09	0.10	0.01
61207	678736.45	3185619.79	78.51	0.10	0.12	0.01
61208	678740.75	3185633.19	78.05	0.10	0.12	0.01
61209	678744.67	3185645.85	77.72	0.09	0.11	0.01
61210	678747.50	3185655.61	77.37	0.09	0.10	0.01
61211	678750.25	3185665.58	77.07	0.09	0.11	0.01
61212	678753.43	3185675.65	76.80	0.09	0.11	0.01
61213	678756.70	3185685.70	76.48	0.10	0.12	0.01
61214	678759.73	3185695.49	76.17	0.09	0.11	0.01
61215	678763.87	3185707.87	75.75	0.09	0.11	0.01
61216	678767.03	3185717.75	75.48	0.09	0.10	0.01

61217	678771.09	3185730.52	75.03	0.09	0.10	0.01
61218	678774.12	3185740.45	74.75	0.10	0.11	0.01
61219	678777.32	3185750.32	74.39	0.09	0.10	0.01
61220	678780.46	3185759.97	74.17	0.10	0.11	0.01
61221	678783.56	3185769.97	73.90	0.10	0.12	0.01
61222	678786.55	3185779.68	73.59	0.09	0.10	0.01
61223	678789.71	3185789.63	73.30	0.09	0.10	0.01
61224	678792.68	3185799.70	72.95	0.09	0.10	0.01
61225	678795.81	3185810.15	72.65	0.10	0.12	0.01
61226	678798.77	3185820.06	72.41	0.10	0.12	0.01
61227	678801.91	3185830.40	72.13	0.10	0.11	0.01
61228	678804.96	3185840.33	71.78	0.10	0.11	0.01
61229	678807.92	3185850.53	71.46	0.09	0.10	0.01
61230	678810.96	3185860.64	71.17	0.09	0.10	0.01
61231	678814.15	3185870.71	70.85	0.09	0.10	0.01
61232	678817.40	3185881.05	70.45	0.10	0.11	0.01
61233	678820.66	3185891.39	70.15	0.10	0.12	0.01
61234	678823.89	3185901.30	69.80	0.10	0.11	0.01
61235	678827.02	3185911.44	69.52	0.09	0.10	0.01
61236	678829.99	3185921.34	69.17	0.10	0.12	0.01
61237	678832.98	3185931.41	68.89	0.10	0.12	0.01
61238	678836.04	3185941.38	68.54	0.10	0.12	0.01
61239	678839.36	3185951.83	68.16	0.10	0.11	0.01
61240	678842.69	3185962.29	67.85	0.10	0.12	0.01
61241	678845.69	3185972.55	67.49	0.10	0.11	0.01
61242	678848.90	3185982.97	67.16	0.09	0.10	0.01
61243	678852.06	3185993.25	66.82	0.09	0.10	0.01
61244	678855.03	3186003.18	66.49	0.09	0.10	0.01
61245	678858.10	3186013.80	66.15	0.09	0.10	0.01
61246	678861.24	3186024.15	65.84	0.10	0.12	0.01
61247	678864.27	3186034.64	65.40	0.10	0.11	0.01
61248	678867.45	3186045.51	65.18	0.09	0.10	0.01
61249	678870.64	3186055.93	64.84	0.10	0.11	0.01
61250	678873.60	3186066.05	64.48	0.09	0.10	0.01
61251	678876.62	3186076.52	64.17	0.09	0.10	0.01
61252	678879.70	3186086.82	63.86	0.10	0.11	0.01
61253	678882.77	3186096.97	63.60	0.09	0.10	0.01

61254	678886.82	3186110.93	63.04	0.10	0.11	0.01
61255	678890.26	3186121.66	62.74	0.10	0.12	0.01
61256	678893.54	3186132.30	62.47	0.10	0.12	0.01
61257	678897.07	3186142.78	62.13	0.09	0.10	0.01
61258	678900.35	3186153.07	61.78	0.10	0.11	0.01
61259	678903.68	3186163.79	61.53	0.10	0.11	0.01
61260	678906.77	3186173.81	61.12	0.10	0.12	0.01
61261	678910.17	3186184.91	60.78	0.09	0.10	0.01
61262	678913.16	3186195.16	60.45	0.10	0.12	0.01
61263	678916.51	3186205.61	60.07	0.09	0.10	0.01
61264	678919.89	3186215.73	59.72	0.10	0.11	0.01
61265	678923.10	3186225.97	59.47	0.10	0.12	0.01
61266	678926.01	3186235.76	59.13	0.10	0.12	0.01
61267	678928.98	3186245.50	58.78	0.09	0.10	0.01
61268	678933.10	3186258.81	58.46	0.09	0.10	0.01
61269	678936.96	3186271.52	58.03	0.10	0.12	0.01
61270	678939.72	3186281.28	57.77	0.10	0.11	0.01
61271	678942.75	3186291.41	57.41	0.09	0.10	0.01
61272	678945.50	3186301.20	57.13	0.10	0.12	0.01
61273	678948.26	3186311.15	56.79	0.10	0.11	0.01
61274	678951.13	3186320.90	56.46	0.09	0.10	0.01
61275	678954.32	3186330.48	56.17	0.08	0.11	0.01
61276	678966.95	3186373.79	54.84	0.10	0.11	0.01
61277	678969.91	3186383.90	54.62	0.10	0.13	0.01
61278	678972.83	3186394.46	54.20	0.09	0.12	0.01
61279	678976.06	3186405.73	53.81	0.09	0.12	0.01
61280	678979.44	3186418.22	53.45	0.10	0.13	0.01
61281	678983.04	3186430.78	53.08	0.10	0.13	0.01
61282	678985.96	3186440.35	52.76	0.10	0.12	0.01
61283	678988.82	3186450.25	52.42	0.10	0.11	0.01
61284	678991.60	3186459.90	52.12	0.09	0.12	0.01
61285	678994.42	3186469.69	51.76	0.09	0.12	0.01
61286	678998.25	3186482.52	51.55	0.11	0.14	0.01
61287	679001.50	3186492.66	51.14	0.11	0.15	0.01
61288	679004.67	3186503.32	50.83	0.10	0.13	0.01
61289	679007.63	3186513.29	50.46	0.11	0.14	0.01

61290	679010.66	3186523.39	50.20	0.11	0.15	0.01
61291	679013.44	3186533.26	49.82	0.12	0.15	0.01
61292	679016.24	3186543.03	49.46	0.10	0.13	0.01
61293	679019.30	3186553.19	49.15	0.10	0.13	0.01
61294	679022.35	3186563.14	48.88	0.11	0.14	0.01
61295	679025.01	3186572.82	48.59	0.12	0.15	0.01
61296	679027.84	3186582.50	48.29	0.10	0.13	0.01
61297	679030.64	3186592.48	48.00	0.11	0.15	0.01
61298	679034.24	3186605.07	47.56	0.11	0.15	0.01
61299	679036.75	3186614.84	47.30	0.11	0.14	0.01
61300	679039.63	3186624.78	47.00	0.11	0.15	0.01
61301	679042.32	3186634.41	46.66	0.10	0.14	0.01
61302	679045.05	3186644.06	46.35	0.11	0.15	0.01
61303	679048.64	3186656.81	45.99	0.10	0.14	0.01
61304	679051.25	3186666.47	45.83	0.11	0.15	0.01
61305	679054.25	3186676.40	45.56	0.11	0.15	0.01
61306	679057.78	3186689.45	45.13	0.11	0.15	0.01
61307	679060.52	3186699.13	44.90	0.09	0.12	0.01
61308	679063.51	3186708.89	44.66	0.10	0.13	0.01
61309	679066.89	3186721.81	44.37	0.11	0.15	0.01
61310	679070.54	3186734.46	43.96	0.09	0.12	0.01
61311	679074.00	3186746.91	43.73	0.11	0.15	0.01
61312	679077.29	3186758.79	43.51	0.11	0.14	0.01
61313	679080.41	3186770.26	43.26	0.10	0.13	0.01
61314	679083.69	3186782.71	42.92	0.10	0.13	0.01
61315	679087.37	3186795.42	42.69	0.10	0.13	0.01
61316	679090.10	3186805.26	42.50	0.09	0.12	0.01
61317	679092.76	3186815.15	42.26	0.11	0.14	0.01
61318	679095.39	3186824.84	42.14	0.11	0.14	0.01
61319	679098.88	3186837.51	41.90	0.09	0.12	0.01
61320	679101.57	3186847.18	41.69	0.09	0.12	0.01
61321	679105.13	3186859.93	41.48	0.10	0.13	0.01
61322	679108.78	3186872.53	41.24	0.10	0.13	0.01
61323	679112.20	3186885.00	40.97	0.09	0.12	0.01
61324	679115.53	3186897.16	40.79	0.09	0.12	0.01
61325	679119.02	3186909.67	40.62	0.11	0.14	0.01
61326	679122.30	3186922.17	40.46	0.11	0.14	0.01

61327	679125.51	3186934.48	40.29	0.10	0.13	0.01
61328	679128.26	3186944.27	40.18	0.09	0.12	0.01
61329	679130.88	3186954.25	40.09	0.11	0.14	0.01
61330	679133.58	3186963.99	39.93	0.11	0.14	0.01
61331	679136.25	3186973.97	39.85	0.09	0.12	0.01
61332	679138.91	3186983.80	39.80	0.10	0.13	0.01
61333	679141.51	3186993.57	39.71	0.10	0.13	0.01
61334	679144.97	3187006.32	39.63	0.09	0.12	0.01
61335	679148.42	3187019.08	39.50	0.10	0.13	0.01
61336	679151.74	3187031.49	39.34	0.10	0.14	0.01
61337	679155.29	3187044.46	39.34	0.10	0.14	0.01
61338	679158.78	3187057.37	39.24	0.09	0.12	0.01
61339	679161.59	3187067.22	39.22	0.10	0.14	0.01
61340	679164.34	3187077.31	39.17	0.09	0.13	0.01
61341	679166.91	3187087.29	39.16	0.09	0.11	0.01
61342	679169.41	3187097.05	39.05	0.09	0.11	0.01
61343	679172.12	3187107.15	39.03	0.09	0.11	0.01
61344	679174.87	3187117.21	39.01	0.09	0.11	0.01
61345	679177.33	3187127.25	39.03	0.10	0.14	0.01
61346	679179.98	3187137.02	39.00	0.10	0.14	0.01
61347	679182.65	3187147.17	38.95	0.10	0.14	0.01
61348	679185.29	3187157.32	38.93	0.09	0.13	0.01
61349	679187.96	3187167.53	39.01	0.10	0.14	0.01
61350	679190.58	3187177.64	38.96	0.09	0.13	0.01
61351	679193.40	3187187.56	38.94	0.10	0.14	0.01
61352	679196.09	3187197.46	39.01	0.09	0.13	0.01
61353	679198.77	3187207.79	39.07	0.10	0.14	0.01
61354	679201.59	3187218.15	39.01	0.09	0.11	0.01
61355	679204.40	3187228.42	39.07	0.10	0.14	0.01
61356	679206.90	3187238.30	38.95	0.10	0.14	0.01
61357	679209.38	3187248.30	38.96	0.10	0.14	0.01
61358	679212.55	3187261.20	38.98	0.10	0.14	0.01
61359	679214.98	3187270.96	38.99	0.09	0.13	0.01
61360	679218.37	3187283.95	39.02	0.09	0.11	0.01
61361	679220.76	3187293.82	38.97	0.09	0.13	0.01
61362	679223.41	3187303.69	38.98	0.09	0.13	0.01

61363	679226.20	3187313.86	39.05	0.10	0.14	0.01
61364	679228.76	3187323.76	38.99	0.10	0.14	0.01
61365	679231.44	3187333.58	39.00	0.10	0.14	0.01
61366	679233.83	3187343.34	39.02	0.09	0.13	0.01
61367	679236.26	3187353.07	38.96	0.09	0.11	0.01
61368	679238.86	3187362.88	38.98	0.10	0.14	0.01
61369	679241.35	3187372.77	39.06	0.09	0.13	0.01
61370	679244.10	3187382.71	39.05	0.09	0.11	0.01
61371	679246.43	3187392.44	39.01	0.09	0.13	0.01
61372	679249.97	3187404.89	39.01	0.09	0.12	0.01
61373	679252.99	3187417.27	38.99	0.09	0.12	0.01
61374	679256.31	3187429.87	39.03	0.09	0.12	0.01
61375	679259.43	3187442.24	39.09	0.09	0.13	0.01
61376	679262.62	3187454.62	39.02	0.09	0.12	0.01
61377	679265.92	3187467.43	39.00	0.09	0.13	0.01
61378	679269.38	3187479.97	38.98	0.09	0.13	0.01
61379	679272.56	3187492.65	38.96	0.09	0.12	0.01
61380	679276.00	3187505.24	38.88	0.09	0.12	0.01
61381	679279.52	3187518.28	38.95	0.10	0.14	0.01
61382	679283.84	3187533.94	38.94	0.10	0.14	0.01
61383	679287.21	3187546.19	38.93	0.09	0.13	0.01
61384	679289.59	3187556.00	38.91	0.10	0.14	0.01
61385	679292.14	3187565.74	38.94	0.10	0.14	0.01
61386	679295.72	3187578.50	38.96	0.09	0.13	0.01
61387	679298.33	3187588.29	38.92	0.09	0.12	0.01
61388	679301.05	3187598.12	38.96	0.10	0.14	0.01
61389	679304.36	3187610.60	38.93	0.10	0.14	0.01
61390	679307.68	3187623.07	38.90	0.09	0.13	0.01
61391	679310.85	3187635.44	39.03	0.09	0.12	0.01
61392	679314.16	3187648.13	38.90	0.09	0.13	0.01
61393	679317.62	3187660.97	38.99	0.09	0.12	0.01
61394	679320.37	3187670.64	39.04	0.09	0.12	0.01
61395	679323.91	3187683.40	39.02	0.09	0.12	0.01
61396	679326.67	3187693.17	38.94	0.09	0.12	0.01
61397	679329.23	3187703.00	38.94	0.09	0.12	0.01
61398	679331.91	3187712.76	39.11	0.09	0.13	0.01
61399	679335.50	3187725.23	39.00	0.09	0.13	0.01

61400	679338.89	3187738.07	39.04	0.09	0.13	0.01
61401	679341.51	3187747.76	39.00	0.09	0.12	0.01
61402	679345.09	3187760.73	39.04	0.09	0.13	0.01
61403	679348.71	3187773.44	39.08	0.10	0.14	0.01
61404	679351.42	3187783.66	39.08	0.10	0.14	0.01
61405	679355.32	3187797.00	39.04	0.09	0.13	0.01
61406	679358.87	3187809.68	39.03	0.10	0.14	0.01
61407	679362.32	3187822.62	39.06	0.10	0.14	0.01
61408	679364.92	3187832.34	39.03	0.10	0.14	0.01
61409	679367.73	3187842.03	39.03	0.09	0.13	0.01
61410	679370.69	3187852.10	38.99	0.10	0.14	0.01
61411	679373.62	3187861.86	39.05	0.10	0.14	0.01
61412	679377.35	3187874.97	39.02	0.09	0.13	0.01
61413	679380.14	3187884.91	39.01	0.09	0.12	0.01
61414	679383.65	3187897.55	39.01	0.10	0.14	0.01
61415	679387.11	3187909.99	38.99	0.09	0.13	0.01
61416	679390.63	3187922.48	39.05	0.09	0.12	0.01
61417	679393.55	3187932.20	38.95	0.09	0.12	0.01
61418	679396.14	3187941.90	38.98	0.09	0.13	0.01
61419	679399.57	3187954.55	38.96	0.09	0.13	0.01
61420	679402.96	3187966.95	38.93	0.09	0.13	0.01
61421	679406.42	3187979.68	38.86	0.10	0.14	0.01
61422	679409.89	3187992.42	38.84	0.09	0.12	0.01
61423	679412.75	3188002.10	38.87	0.09	0.12	0.01
61424	679416.43	3188014.90	38.84	0.09	0.12	0.01
61425	679419.45	3188024.46	38.92	0.09	0.13	0.01
61426	679422.17	3188034.20	38.97	0.10	0.14	0.01
61427	679424.93	3188044.15	38.91	0.09	0.12	0.01
61428	679427.81	3188054.09	38.97	0.09	0.12	0.01
61429	679430.68	3188063.99	38.95	0.09	0.12	0.01
61430	679434.36	3188076.79	38.96	0.10	0.14	0.01
61431	679437.30	3188086.51	38.89	0.10	0.14	0.01
61432	679440.14	3188096.11	38.92	0.09	0.12	0.01
61433	679443.02	3188105.81	38.91	0.09	0.13	0.01
61434	679446.63	3188118.45	38.93	0.09	0.12	0.01
61435	679450.27	3188131.22	38.93	0.10	0.14	0.01

61436	679453.15	3188140.95	38.95	0.09	0.12	0.01
61437	679455.99	3188150.78	38.83	0.10	0.14	0.01
61438	679459.64	3188163.34	38.95	0.09	0.13	0.01
61439	679463.06	3188175.67	38.93	0.10	0.13	0.01
61440	679465.96	3188185.26	38.93	0.09	0.13	0.01
61441	679469.62	3188197.23	38.99	0.09	0.12	0.01
61442	679473.13	3188209.42	38.92	0.09	0.12	0.01
61443	679476.63	3188221.46	38.96	0.09	0.13	0.01
61444	679480.27	3188233.80	38.96	0.10	0.14	0.01
61445	679483.99	3188246.15	38.93	0.11	0.15	0.01
61446	679487.62	3188258.18	38.88	0.09	0.13	0.01
61447	679491.22	3188270.41	38.93	0.09	0.13	0.01
61448	679494.83	3188282.92	38.93	0.10	0.13	0.01
61449	679498.62	3188295.45	38.97	0.12	0.16	0.02
61450	679502.32	3188308.00	38.91	0.11	0.16	0.02
61451	679506.01	3188320.53	38.96	0.13	0.17	0.02
61452	679509.63	3188333.12	38.88	0.12	0.16	0.02
61453	679514.29	3188348.82	38.94	0.12	0.17	0.02
61454	679517.13	3188358.43	38.85	0.10	0.14	0.01
61455	679520.93	3188371.00	38.89	0.12	0.17	0.02
61456	679524.86	3188383.59	38.85	0.11	0.16	0.02
61457	679527.96	3188393.41	38.79	0.13	0.17	0.02
61458	679531.71	3188405.54	38.83	0.11	0.15	0.01
61459	679535.39	3188417.96	38.87	0.12	0.16	0.02
61460	679539.20	3188430.50	38.80	0.11	0.15	0.01
61461	679542.96	3188442.99	38.87	0.12	0.16	0.02
61462	679546.92	3188455.71	38.87	0.11	0.15	0.01
61463	679550.59	3188467.81	38.87	0.11	0.15	0.01
61464	679554.30	3188479.50	38.78	0.11	0.16	0.02
61465	679557.85	3188491.56	38.83	0.13	0.18	0.02
61466	679561.56	3188503.62	38.85	0.13	0.18	0.02
61467	679565.22	3188515.61	38.82	0.13	0.17	0.02

APPENDIX L

Control Survey Listing MVRM Calibration Site - Dist. 61b

West bound South I-10 Frontage Road at Lobdell

Date & Time 2/28/2014 10:15 AM

Coordinate System U.S. State Plane 1983 **Zone** Louisiana South 1702

Project Datum (NAD 83) **Vertical Datum** (NAVD 88) **Geoid Model** GEOID12A

Coordinate Unit U.S. Survey Foot **Distance Unit** U.S. Survey Foot **Height Unit** U.S. Survey Foot

Figure 56
MVRM Control – 61b West bound South I-10 Frontage Road at Lobdell

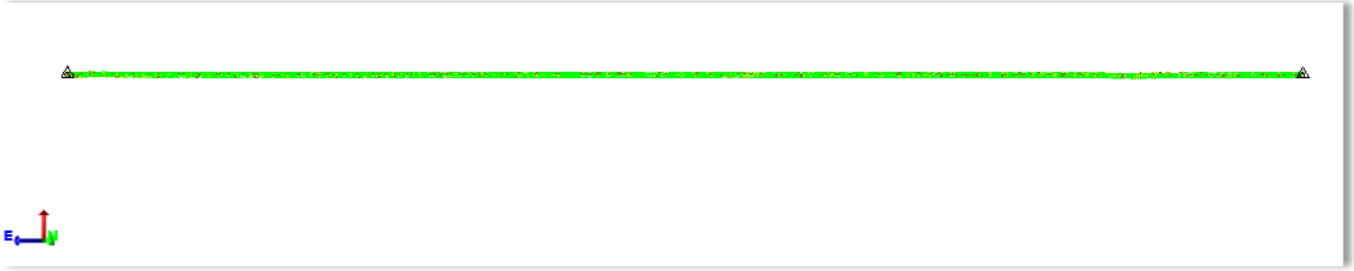


Figure 57
MVRM Control – 61b Profile 10 X vertical

Point ID	Northing	Easting	Elevation	H Prc	V Prc	RMS
1001	708591.25	3306883.34	17.58	0.05	0.08	0.01
1002	709874.71	3302302.32	17.34	0.06	0.09	0.02
10001	708591.15	3306883.49	17.60	0.06	0.09	0.01
10002	708594.35	3306872.67	17.63	0.05	0.07	0.01
10003	708598.83	3306858.80	17.59	0.05	0.07	0.01
10004	708602.16	3306847.75	17.61	0.05	0.08	0.01
10005	708605.65	3306836.63	17.65	0.06	0.09	0.01
10006	708608.55	3306826.88	17.67	0.06	0.09	0.01
10007	708612.09	3306814.78	17.70	0.05	0.08	0.01
10008	708615.06	3306804.97	17.72	0.06	0.09	0.01
10009	708617.94	3306794.83	17.72	0.07	0.10	0.01
10010	708621.09	3306784.26	17.76	0.07	0.10	0.01
10011	708623.85	3306773.23	17.72	0.07	0.10	0.01
10012	708626.98	3306762.09	17.73	0.07	0.11	0.02
10013	708630.23	3306750.99	17.74	0.07	0.10	0.01
10014	708633.17	3306740.35	17.74	0.07	0.11	0.01
10015	708636.18	3306729.67	17.70	0.07	0.10	0.01
10016	708640.19	3306716.35	17.68	0.08	0.12	0.02
10017	708643.58	3306704.98	17.66	0.08	0.11	0.02
10018	708646.95	3306693.21	17.66	0.07	0.10	0.01
10019	708650.12	3306681.63	17.67	0.08	0.12	0.02
10020	708653.39	3306669.99	17.65	0.08	0.11	0.02
10021	708656.84	3306658.90	17.62	0.07	0.11	0.02
10022	708660.21	3306647.47	17.62	0.09	0.13	0.02
10023	708663.26	3306635.98	17.61	0.09	0.13	0.02
10024	708666.58	3306624.90	17.57	0.08	0.12	0.02
10025	708669.39	3306614.11	17.60	0.09	0.14	0.02
10026	708672.35	3306602.90	17.60	0.09	0.14	0.02
10027	708675.74	3306591.59	17.55	0.09	0.13	0.02
10028	708678.94	3306579.52	17.54	0.09	0.13	0.02
10029	708682.52	3306567.67	17.54	0.09	0.13	0.02
10030	708685.58	3306556.35	17.47	0.09	0.14	0.02
10031	708688.79	3306544.65	17.47	0.09	0.14	0.02
10032	708691.91	3306533.83	17.47	0.10	0.15	0.02
10033	708695.00	3306522.90	17.48	0.09	0.14	0.02

10034	708697.88	3306512.13	17.54	0.10	0.15	0.02
10035	708701.13	3306501.94	17.51	0.09	0.14	0.02
10036	708703.95	3306490.90	17.52	0.09	0.14	0.02
10037	708707.26	3306480.04	17.56	0.09	0.14	0.02
10038	708710.32	3306469.38	17.54	0.09	0.13	0.02
10039	708713.99	3306456.12	17.56	0.10	0.15	0.02
10040	708717.89	3306442.52	17.48	0.10	0.15	0.02
10041	708720.88	3306431.36	17.53	0.10	0.15	0.02
10042	708724.04	3306420.21	17.55	0.09	0.14	0.02
10043	708726.79	3306409.20	17.55	0.09	0.14	0.02
10044	708730.01	3306397.92	17.56	0.10	0.15	0.02
10045	708733.14	3306386.68	17.53	0.10	0.15	0.02
10046	708736.43	3306375.93	17.53	0.09	0.14	0.02
10047	708739.47	3306364.80	17.50	0.10	0.16	0.02
10048	708742.88	3306353.40	17.45	0.10	0.15	0.02
10049	708746.05	3306342.52	17.44	0.10	0.16	0.02
10050	708749.09	3306331.22	17.41	0.10	0.16	0.02
10051	708751.90	3306320.01	17.45	0.10	0.16	0.02
10052	708755.08	3306308.79	17.45	0.11	0.16	0.02
10053	708758.19	3306297.74	17.44	0.10	0.14	0.02
10054	708761.59	3306286.88	17.49	0.10	0.15	0.02
10055	708764.73	3306275.96	17.52	0.10	0.15	0.02
10056	708768.03	3306264.72	17.49	0.10	0.16	0.02
10057	708771.20	3306253.28	17.51	0.10	0.15	0.02
10058	708773.90	3306241.65	17.53	0.10	0.15	0.02
10059	708777.11	3306229.60	17.55	0.11	0.17	0.02
10060	708780.29	3306218.15	17.56	0.11	0.16	0.02
10061	708783.36	3306206.52	17.57	0.11	0.16	0.02
10062	708786.12	3306194.86	17.54	0.10	0.15	0.02
10063	708790.48	3306180.56	17.55	0.11	0.16	0.02
10064	708794.10	3306168.51	17.57	0.11	0.16	0.02
10065	708797.52	3306156.24	17.54	0.12	0.17	0.02
10066	708800.83	3306145.15	17.53	0.11	0.17	0.02
10067	708803.70	3306135.27	17.52	0.12	0.18	0.02
10068	708806.77	3306124.72	17.52	0.12	0.17	0.02
10069	708809.47	3306114.35	17.50	0.11	0.17	0.02
10070	708812.25	3306103.90	17.49	0.12	0.18	0.02

10071	708815.28	3306093.54	17.49	0.11	0.17	0.02
10072	708818.36	3306082.95	17.52	0.12	0.18	0.02
10073	708821.42	3306072.21	17.49	0.12	0.17	0.02
10074	708824.22	3306061.42	17.49	0.11	0.16	0.02
10075	708827.20	3306051.19	17.51	0.11	0.16	0.02
10076	708830.30	3306040.25	17.47	0.12	0.17	0.02
10077	708833.29	3306028.94	17.48	0.11	0.16	0.02
10078	708836.58	3306017.62	17.48	0.12	0.18	0.02
10079	708840.88	3306003.22	17.49	0.11	0.17	0.02
10080	708843.90	3305992.39	17.45	0.12	0.17	0.02
10081	708847.08	3305981.50	17.43	0.11	0.17	0.02
10082	708850.26	3305970.70	17.41	0.12	0.18	0.02
10083	708853.46	3305959.39	17.43	0.13	0.19	0.02
10084	708857.23	3305945.94	17.44	0.12	0.18	0.02
10085	708860.11	3305934.55	17.42	0.13	0.19	0.02
10086	708863.06	3305923.60	17.46	0.12	0.18	0.02
10087	708866.07	3305912.46	17.50	0.13	0.19	0.03
10088	708869.26	3305901.66	17.44	0.13	0.18	0.02
10089	708872.19	3305890.50	17.47	0.13	0.18	0.02
10090	708875.15	3305879.45	17.47	0.12	0.18	0.02
10091	708878.22	3305867.78	17.47	0.12	0.18	0.02
10092	708881.61	3305855.96	17.45	0.13	0.20	0.03
10093	708884.99	3305844.28	17.47	0.13	0.20	0.03
10094	708888.10	3305832.70	17.46	0.13	0.20	0.03
10095	708891.58	3305820.90	17.50	0.13	0.19	0.02
10096	708894.71	3305809.05	17.54	0.13	0.18	0.02
10097	708897.65	3305797.37	17.52	0.13	0.18	0.02
10098	708900.55	3305785.75	17.52	0.13	0.19	0.03
10099	708903.87	3305774.23	17.55	0.13	0.19	0.03
10100	708907.06	3305762.39	17.50	0.13	0.19	0.03
10101	708910.45	3305750.54	17.54	0.12	0.18	0.02
10102	708913.79	3305738.36	17.52	0.13	0.19	0.03
10103	708916.93	3305726.65	17.50	0.13	0.19	0.03
10104	708920.15	3305715.15	17.50	0.12	0.18	0.03
10105	708923.52	3305703.66	17.46	0.12	0.18	0.02
10106	708927.11	3305691.93	17.46	0.13	0.20	0.03

10107	708930.43	3305679.94	17.44	0.13	0.19	0.03
10108	708933.82	3305668.41	17.39	0.13	0.19	0.03
10109	708937.04	3305656.60	17.45	0.13	0.20	0.03
10110	708940.45	3305645.00	17.47	0.13	0.20	0.03
10111	708943.97	3305632.74	17.49	0.12	0.18	0.03
10112	708947.09	3305621.10	17.49	0.13	0.20	0.03
10113	708950.88	3305609.14	17.48	0.12	0.18	0.03
10114	708954.46	3305596.92	17.43	0.12	0.18	0.03
10115	708957.65	3305584.82	17.42	0.13	0.19	0.03
10116	708960.54	3305573.59	17.39	0.13	0.20	0.03
10117	708963.89	3305562.06	17.38	0.13	0.20	0.03
10118	708966.80	3305551.26	17.45	0.13	0.20	0.03
10119	708969.70	3305540.26	17.43	0.13	0.20	0.03
10120	708973.92	3305525.95	17.42	0.13	0.18	0.02
10121	708976.75	3305514.72	17.46	0.14	0.20	0.02
10122	708980.14	3305502.83	17.42	0.13	0.19	0.02
10123	708983.43	3305490.88	17.46	0.15	0.21	0.02
10124	708987.95	3305475.46	17.45	0.12	0.18	0.03
10125	708991.54	3305462.85	17.48	0.14	0.20	0.03
10126	708994.75	3305450.44	17.47	0.14	0.20	0.03
10127	708998.34	3305438.41	17.44	0.13	0.20	0.03
10128	709002.14	3305426.01	17.40	0.13	0.19	0.03
10129	709005.20	3305414.13	17.41	0.13	0.19	0.03
10130	709008.42	3305402.47	17.43	0.13	0.19	0.03
10131	709011.83	3305390.39	17.35	0.14	0.20	0.03
10132	709015.32	3305378.07	17.40	0.14	0.21	0.03
10133	709018.63	3305365.93	17.40	0.14	0.21	0.03
10134	709021.97	3305354.21	17.40	0.13	0.20	0.03
10135	709025.54	3305341.98	17.42	0.14	0.20	0.03
10136	709028.91	3305329.77	17.45	0.12	0.18	0.03
10137	709032.30	3305317.00	17.46	0.13	0.19	0.03
10138	709034.82	3305307.26	17.50	0.12	0.18	0.03
10139	709037.75	3305297.47	17.51	0.13	0.19	0.03
10140	709040.34	3305287.81	17.53	0.13	0.19	0.03
10141	709043.24	3305278.02	17.50	0.13	0.19	0.03
10142	709046.21	3305267.78	17.51	0.13	0.19	0.03
10143	709048.74	3305257.92	17.51	0.12	0.18	0.03

10144	709051.64	3305247.79	17.51	0.13	0.20	0.03
10145	709055.51	3305234.55	17.48	0.13	0.19	0.03
10146	709058.40	3305224.79	17.43	0.13	0.20	0.03
10147	709061.53	3305214.47	17.37	0.13	0.20	0.03
10148	709064.02	3305204.76	17.38	0.13	0.19	0.03
10149	709066.83	3305194.78	17.37	0.13	0.19	0.03
10150	709070.92	3305181.28	17.35	0.12	0.18	0.03
10151	709073.91	3305171.19	17.38	0.12	0.18	0.03
10152	709077.06	3305158.22	17.38	0.13	0.19	0.03
10153	709079.97	3305147.86	17.35	0.12	0.19	0.03
10154	709082.44	3305137.56	17.38	0.13	0.19	0.03
10155	709085.06	3305127.36	17.40	0.14	0.20	0.03
10156	709087.66	3305117.14	17.40	0.13	0.19	0.03
10157	709090.64	3305107.12	17.40	0.13	0.19	0.03
10158	709093.56	3305097.00	17.45	0.14	0.20	0.03
10159	709096.40	3305086.88	17.47	0.14	0.20	0.03
10160	709099.17	3305076.51	17.47	0.13	0.20	0.03
10161	709101.91	3305066.28	17.48	0.14	0.20	0.03
10162	709104.97	3305056.52	17.50	0.13	0.20	0.03
10163	709107.99	3305046.49	17.48	0.14	0.20	0.03
10164	709110.91	3305036.28	17.51	0.13	0.20	0.03
10165	709113.84	3305026.64	17.52	0.14	0.20	0.03
10166	709116.35	3305016.82	17.48	0.13	0.20	0.03
10167	709119.12	3305007.05	17.50	0.14	0.21	0.03
10168	709121.84	3304997.40	17.47	0.14	0.21	0.03
10169	709124.58	3304987.41	17.43	0.13	0.20	0.03
10170	709127.35	3304977.70	17.38	0.13	0.20	0.03
10171	709130.75	3304964.95	17.41	0.13	0.19	0.03
10172	709133.30	3304954.98	17.36	0.13	0.19	0.03
10173	709137.82	3304938.84	17.34	0.14	0.21	0.03
10174	709140.56	3304929.15	17.33	0.14	0.21	0.03
10175	709143.67	3304919.29	17.35	0.13	0.20	0.03
10176	709147.43	3304906.08	17.34	0.14	0.21	0.03
10177	709150.53	3304896.33	17.32	0.14	0.20	0.03
10178	709153.34	3304886.56	17.35	0.13	0.19	0.03
10179	709156.86	3304873.87	17.35	0.14	0.20	0.03

10180	709159.47	3304864.21	17.35	0.13	0.19	0.03
10181	709162.08	3304854.35	17.35	0.14	0.21	0.03
10182	709165.72	3304841.92	17.39	0.14	0.21	0.03
10183	709169.58	3304829.35	17.40	0.14	0.20	0.03
10184	709172.72	3304816.59	17.38	0.14	0.20	0.03
10185	709175.96	3304804.09	17.40	0.14	0.21	0.03
10186	709179.54	3304791.80	17.36	0.14	0.21	0.03
10187	709182.05	3304782.09	17.34	0.13	0.20	0.02
10188	709184.72	3304772.44	17.35	0.13	0.20	0.02
10189	709187.53	3304762.50	17.32	0.15	0.22	0.02
10190	709190.30	3304752.24	17.33	0.16	0.22	0.02
10191	709192.99	3304742.13	17.31	0.16	0.22	0.02
10192	709195.73	3304732.15	17.33	0.15	0.21	0.02
10193	709198.52	3304722.52	17.37	0.15	0.21	0.02
10194	709201.32	3304712.45	17.37	0.15	0.21	0.02
10195	709204.40	3304702.26	17.35	0.13	0.20	0.03
10196	709207.12	3304692.28	17.37	0.14	0.22	0.03
10197	709210.97	3304678.93	17.43	0.14	0.21	0.03
10198	709215.06	3304664.65	17.36	0.14	0.21	0.03
10199	709218.11	3304654.12	17.39	0.13	0.20	0.03
10200	709220.87	3304644.11	17.34	0.15	0.22	0.03
10201	709223.64	3304633.49	17.38	0.14	0.21	0.03
10202	709226.47	3304622.78	17.39	0.13	0.20	0.03
10203	709229.30	3304611.95	17.39	0.13	0.20	0.03
10204	709232.76	3304601.26	17.38	0.15	0.22	0.03
10205	709235.78	3304591.14	17.38	0.15	0.22	0.03
10206	709238.39	3304580.73	17.37	0.14	0.21	0.03
10207	709241.19	3304570.13	17.36	0.14	0.21	0.03
10208	709243.73	3304559.58	17.37	0.14	0.21	0.03
10209	709246.81	3304549.09	17.36	0.14	0.20	0.03
10210	709250.16	3304538.30	17.36	0.14	0.20	0.03
10211	709253.37	3304528.34	17.37	0.14	0.21	0.03
10212	709256.48	3304517.50	17.38	0.14	0.20	0.03
10213	709259.51	3304507.05	17.36	0.14	0.21	0.03
10214	709262.49	3304496.59	17.35	0.14	0.20	0.03
10215	709265.32	3304486.59	17.37	0.14	0.21	0.03
10216	709267.94	3304476.40	17.46	0.14	0.21	0.03

10217	709270.86	3304465.77	17.50	0.15	0.20	0.02
10218	709273.52	3304455.15	17.51	0.15	0.20	0.02
10219	709276.67	3304444.51	17.56	0.15	0.20	0.02
10220	709281.21	3304429.74	17.53	0.14	0.21	0.03
10221	709283.98	3304419.13	17.56	0.14	0.20	0.03
10222	709286.67	3304409.05	17.57	0.16	0.22	0.02
10223	709290.50	3304394.79	17.52	0.15	0.20	0.02
10224	709293.66	3304384.41	17.49	0.15	0.20	0.02
10225	709297.13	3304369.69	17.48	0.16	0.22	0.02
10226	709301.76	3304354.64	17.41	0.15	0.21	0.02
10227	709305.75	3304339.54	17.38	0.15	0.21	0.02
10228	709310.36	3304324.09	17.33	0.14	0.21	0.03
10229	709314.17	3304309.92	17.32	0.15	0.23	0.03
10230	709317.18	3304299.82	17.35	0.15	0.23	0.03
10231	709319.95	3304289.62	17.34	0.15	0.23	0.03
10232	709322.66	3304279.96	17.32	0.13	0.18	0.03
10233	709325.01	3304270.11	17.36	0.13	0.18	0.03
10234	709328.80	3304257.64	17.37	0.14	0.19	0.03
10235	709331.84	3304248.09	17.40	0.14	0.19	0.03
10236	709334.64	3304238.20	17.43	0.15	0.18	0.02
10237	709337.80	3304227.71	17.38	0.14	0.19	0.03
10238	709340.75	3304218.16	17.37	0.14	0.19	0.03
10239	709343.74	3304208.38	17.33	0.14	0.19	0.03
10240	709346.61	3304198.14	17.31	0.14	0.17	0.02
10241	709348.92	3304187.93	17.40	0.14	0.17	0.02
10242	709351.21	3304177.95	17.37	0.14	0.18	0.02
10243	709353.58	3304167.53	17.37	0.14	0.18	0.02
10244	709356.52	3304156.80	17.38	0.14	0.18	0.03
10245	709359.76	3304146.55	17.42	0.13	0.18	0.03
10246	709363.83	3304132.82	17.37	0.14	0.19	0.03
10247	709366.70	3304122.33	17.35	0.13	0.18	0.03
10248	709369.67	3304112.46	17.40	0.13	0.18	0.03
10249	709372.19	3304102.29	17.40	0.14	0.19	0.03
10250	709374.63	3304092.45	17.41	0.14	0.19	0.03
10251	709376.92	3304082.44	17.44	0.14	0.19	0.03
10252	709380.21	3304071.57	17.45	0.14	0.19	0.03

10253	709384.65	3304057.42	17.44	0.14	0.19	0.03
10254	709387.64	3304046.77	17.43	0.14	0.19	0.03
10255	709390.68	3304036.19	17.40	0.13	0.18	0.03
10256	709394.98	3304021.71	17.40	0.13	0.18	0.03
10257	709397.88	3304011.49	17.41	0.13	0.18	0.03
10258	709400.34	3304001.15	17.39	0.13	0.18	0.03
10259	709403.24	3303990.58	17.37	0.14	0.19	0.03
10260	709406.13	3303979.73	17.35	0.14	0.19	0.03
10261	709409.16	3303969.58	17.38	0.13	0.18	0.03
10262	709412.17	3303959.04	17.38	0.13	0.18	0.03
10263	709414.85	3303949.09	17.40	0.13	0.18	0.03
10264	709417.68	3303938.74	17.37	0.13	0.18	0.03
10265	709420.87	3303928.37	17.38	0.13	0.18	0.03
10266	709424.01	3303917.62	17.37	0.13	0.18	0.03
10267	709426.83	3303906.96	17.41	0.14	0.19	0.03
10268	709429.95	3303896.11	17.39	0.13	0.18	0.03
10269	709433.35	3303885.50	17.41	0.14	0.19	0.03
10270	709435.90	3303875.20	17.41	0.13	0.18	0.03
10271	709438.73	3303864.65	17.39	0.14	0.19	0.03
10272	709441.67	3303854.36	17.39	0.14	0.19	0.03
10273	709443.99	3303843.99	17.41	0.13	0.18	0.03
10274	709446.94	3303834.04	17.41	0.13	0.18	0.03
10275	709449.83	3303824.40	17.38	0.13	0.18	0.03
10276	709452.96	3303814.23	17.41	0.13	0.18	0.03
10277	709455.65	3303804.18	17.41	0.14	0.19	0.03
10278	709459.83	3303790.52	17.44	0.14	0.19	0.03
10279	709462.35	3303780.27	17.44	0.14	0.19	0.03
10280	709465.46	3303770.06	17.43	0.14	0.19	0.03
10281	709468.58	3303759.49	17.42	0.14	0.19	0.03
10282	709472.63	3303745.31	17.44	0.14	0.19	0.03
10283	709476.65	3303731.37	17.42	0.13	0.18	0.03
10284	709479.38	3303721.19	17.39	0.13	0.18	0.03
10285	709483.14	3303707.88	17.45	0.13	0.19	0.03
10286	709485.71	3303697.65	17.43	0.13	0.18	0.03
10287	709489.75	3303682.68	17.40	0.13	0.19	0.03
10288	709493.37	3303670.33	17.42	0.13	0.17	0.03
10289	709496.77	3303657.85	17.37	0.14	0.19	0.03

10290	709500.25	3303645.26	17.34	0.14	0.19	0.03
10291	709503.10	3303635.34	17.36	0.14	0.19	0.03
10292	709506.36	3303622.52	17.37	0.14	0.20	0.03
10293	709509.44	3303612.61	17.35	0.13	0.18	0.03
10294	709512.32	3303602.27	17.34	0.13	0.19	0.03
10295	709515.20	3303591.42	17.35	0.13	0.19	0.03
10296	709518.21	3303580.62	17.39	0.14	0.20	0.03
10297	709521.16	3303569.96	17.43	0.14	0.19	0.03
10298	709524.08	3303559.09	17.45	0.14	0.19	0.03
10299	709526.97	3303548.42	17.46	0.14	0.19	0.03
10300	709529.95	3303537.69	17.49	0.14	0.20	0.03
10301	709533.08	3303527.07	17.51	0.15	0.21	0.03
10302	709536.10	3303516.96	17.45	0.15	0.21	0.03
10303	709538.89	3303506.75	17.46	0.15	0.21	0.03
10304	709541.97	3303495.58	17.39	0.15	0.21	0.03
10305	709545.17	3303484.30	17.38	0.15	0.21	0.03
10306	709548.28	3303473.71	17.35	0.15	0.21	0.03
10307	709551.44	3303463.11	17.33	0.15	0.21	0.03
10308	709554.57	3303452.44	17.29	0.14	0.20	0.03
10309	709557.70	3303441.86	17.30	0.14	0.20	0.03
10310	709560.75	3303431.51	17.29	0.14	0.20	0.03
10311	709563.66	3303421.15	17.30	0.14	0.20	0.03
10312	709565.38	3303410.31	17.30	0.14	0.20	0.03
10313	709568.22	3303399.73	17.35	0.14	0.20	0.03
10314	709571.41	3303389.35	17.34	0.14	0.20	0.03
10315	709574.39	3303378.59	17.34	0.14	0.20	0.03
10316	709577.56	3303367.42	17.30	0.16	0.22	0.03
10317	709580.30	3303357.67	17.36	0.16	0.22	0.03
10318	709583.44	3303344.30	17.34	0.15	0.21	0.03
10319	709586.55	3303333.09	17.31	0.14	0.20	0.03
10320	709589.26	3303322.35	17.34	0.14	0.20	0.03
10321	709592.45	3303311.00	17.29	0.15	0.20	0.03
10322	709596.07	3303299.63	17.31	0.16	0.22	0.03
10323	709599.16	3303288.35	17.29	0.16	0.22	0.03
10324	709602.41	3303276.89	17.29	0.16	0.22	0.03
10325	709606.47	3303264.98	17.30	0.16	0.22	0.03

10326	709609.77	3303252.23	17.27	0.15	0.21	0.03
10327	709612.27	3303242.45	17.31	0.15	0.22	0.03
10328	709615.32	3303230.00	17.30	0.14	0.21	0.03
10329	709618.48	3303217.40	17.35	0.14	0.21	0.03
10330	709621.38	3303207.40	17.36	0.16	0.22	0.03
10331	709625.49	3303195.32	17.38	0.16	0.22	0.03
10332	709629.23	3303183.18	17.37	0.15	0.22	0.03
10333	709632.88	3303171.14	17.37	0.15	0.22	0.03
10334	709636.05	3303159.27	17.37	0.15	0.22	0.03
10335	709639.36	3303147.25	17.40	0.15	0.22	0.03
10336	709642.86	3303135.14	17.39	0.15	0.22	0.03
10337	709645.68	3303123.54	17.40	0.15	0.21	0.03
10338	709648.80	3303111.76	17.38	0.14	0.21	0.03
10339	709652.32	3303099.60	17.35	0.16	0.23	0.03
10340	709655.22	3303087.17	17.37	0.16	0.23	0.03
10341	709658.65	3303074.30	17.36	0.16	0.23	0.03
10342	709661.28	3303064.39	17.34	0.15	0.22	0.03
10343	709664.09	3303054.20	17.31	0.15	0.22	0.03
10344	709666.96	3303044.04	17.32	0.15	0.22	0.03
10345	709669.93	3303034.04	17.27	0.15	0.22	0.03
10346	709672.89	3303023.82	17.18	0.15	0.21	0.03
10347	709675.71	3303014.05	17.16	0.15	0.21	0.03
10348	709678.25	3303004.34	17.18	0.15	0.21	0.03
10349	709681.27	3302994.62	17.11	0.15	0.21	0.03
10350	709683.76	3302984.68	17.12	0.15	0.21	0.03
10351	709686.73	3302974.65	17.12	0.16	0.23	0.03
10352	709689.44	3302964.24	17.14	0.16	0.23	0.03
10353	709692.46	3302953.86	17.13	0.16	0.23	0.03
10354	709695.47	3302943.26	17.13	0.16	0.23	0.03
10355	709698.53	3302932.67	17.12	0.16	0.23	0.03
10356	709701.18	3302921.99	17.11	0.15	0.22	0.03
10357	709704.26	3302911.53	17.12	0.15	0.22	0.03
10358	709707.09	3302901.57	17.14	0.15	0.22	0.03
10359	709709.82	3302891.73	17.15	0.15	0.22	0.03
10360	709712.50	3302882.03	17.15	0.15	0.22	0.03
10361	709715.46	3302872.35	17.19	0.15	0.22	0.03
10362	709718.69	3302859.34	17.11	0.15	0.21	0.03

10363	709720.78	3302849.32	17.20	0.15	0.21	0.03
10364	709723.45	3302838.80	17.24	0.15	0.21	0.03
10365	709726.28	3302828.18	17.21	0.16	0.23	0.03
10366	709729.53	3302818.18	17.24	0.16	0.23	0.03
10367	709733.66	3302805.48	17.21	0.16	0.23	0.03
10368	709737.24	3302792.91	17.25	0.16	0.23	0.03
10369	709741.35	3302780.53	17.25	0.15	0.22	0.03
10370	709744.20	3302770.73	17.27	0.15	0.22	0.03
10371	709747.43	3302758.00	17.25	0.15	0.22	0.03
10372	709750.69	3302745.24	17.31	0.15	0.22	0.03
10373	709753.30	3302735.23	17.28	0.15	0.22	0.03
10374	709756.74	3302725.16	17.32	0.15	0.22	0.03
10375	709759.62	3302715.13	17.31	0.15	0.22	0.03
10376	709762.30	3302705.33	17.29	0.15	0.22	0.03
10377	709765.08	3302695.05	17.31	0.15	0.22	0.03
10378	709768.03	3302685.26	17.30	0.15	0.22	0.03
10379	709770.92	3302675.16	17.29	0.15	0.22	0.03
10380	709773.49	3302665.12	17.30	0.15	0.21	0.03
10381	709776.10	3302654.95	17.29	0.15	0.21	0.03
10382	709779.00	3302645.20	17.33	0.16	0.23	0.03
10383	709781.87	3302635.04	17.32	0.15	0.22	0.03
10384	709786.02	3302621.28	17.31	0.15	0.21	0.03
10385	709788.85	3302611.20	17.31	0.16	0.23	0.03
10386	709791.50	3302601.01	17.37	0.16	0.23	0.03
10387	709794.41	3302590.59	17.39	0.16	0.23	0.03
10388	709797.21	3302580.34	17.36	0.16	0.23	0.03
10389	709800.76	3302566.27	17.40	0.15	0.22	0.03
10390	709803.55	3302556.33	17.41	0.15	0.22	0.03
10391	709807.53	3302542.98	17.40	0.14	0.21	0.03
10392	709810.51	3302532.72	17.35	0.14	0.21	0.03
10393	709813.91	3302522.49	17.35	0.14	0.21	0.03
10394	709816.53	3302511.97	17.38	0.14	0.21	0.03
10395	709819.50	3302501.91	17.38	0.16	0.22	0.03
10396	709822.09	3302491.40	17.39	0.15	0.22	0.03
10397	709825.15	3302481.13	17.38	0.15	0.22	0.03
10398	709827.97	3302470.25	17.43	0.15	0.22	0.03

10399	709830.90	3302459.22	17.46	0.15	0.22	0.03
10400	709833.86	3302448.49	17.48	0.15	0.22	0.03
10401	709837.14	3302437.98	17.46	0.15	0.22	0.03
10402	709840.05	3302427.50	17.45	0.14	0.21	0.03
10403	709842.74	3302417.17	17.44	0.14	0.21	0.03
10404	709846.17	3302406.68	17.44	0.14	0.21	0.03
10405	709848.72	3302396.01	17.44	0.14	0.21	0.03
10406	709852.00	3302385.46	17.42	0.14	0.21	0.03
10407	709854.97	3302375.18	17.45	0.14	0.21	0.03
10408	709857.79	3302364.68	17.45	0.15	0.22	0.03
10409	709860.79	3302354.24	17.39	0.15	0.22	0.03
10410	709863.47	3302343.09	17.40	0.15	0.22	0.03
10411	709866.41	3302332.26	17.39	0.15	0.22	0.03
10412	709869.46	3302321.86	17.35	0.15	0.22	0.03
10413	709872.52	3302311.57	17.30	0.15	0.22	0.03
12128	708597.65	3306858.27	17.65	0.24	0.33	0.04
12129	708615.41	3306797.83	17.73	0.24	0.32	0.04
12130	708632.96	3306737.43	17.70	0.25	0.33	0.04
12131	708650.32	3306676.90	17.68	0.25	0.33	0.04
12132	708667.55	3306616.27	17.61	0.23	0.32	0.04
12133	708684.56	3306555.50	17.52	0.23	0.32	0.04
12134	708701.52	3306494.68	17.56	0.24	0.33	0.04
12135	708718.66	3306434.04	17.55	0.25	0.34	0.04
12136	708735.65	3306373.57	17.50	0.25	0.34	0.04
12137	708752.56	3306313.15	17.41	0.25	0.33	0.04
12138	708769.52	3306252.74	17.49	0.24	0.32	0.04
12139	708786.62	3306192.32	17.46	0.25	0.34	0.04
12140	708803.65	3306131.71	17.44	0.26	0.35	0.05
12141	708820.67	3306070.99	17.45	0.26	0.35	0.05
12142	708837.67	3306010.21	17.42	0.25	0.33	0.04
12143	708854.65	3305949.46	17.39	0.25	0.34	0.04
12144	708871.70	3305888.76	17.43	0.25	0.34	0.05
12145	708888.76	3305828.13	17.44	0.25	0.33	0.04
12146	708905.67	3305767.44	17.43	0.25	0.33	0.04
12147	708922.59	3305706.73	17.44	0.25	0.33	0.04
12148	708956.50	3305585.50	17.27	0.24	0.33	0.05
12149	708973.36	3305524.93	17.28	0.24	0.34	0.05

12150	708990.27	3305464.42	17.30	0.25	0.34	0.04
12151	709007.11	3305403.93	17.42	0.23	0.32	0.04
12152	709023.94	3305343.44	17.44	0.23	0.32	0.04
12153	709040.84	3305282.94	17.53	0.23	0.32	0.04
12154	709057.75	3305222.46	17.43	0.23	0.32	0.04
12155	709074.61	3305161.85	17.42	0.22	0.30	0.04
12156	709091.64	3305101.20	17.45	0.22	0.31	0.04
12157	709125.96	3304979.91	17.49	0.22	0.31	0.04
12158	709143.02	3304919.24	17.39	0.23	0.32	0.04
12159	709176.83	3304797.92	17.45	0.25	0.31	0.04
12160	709210.26	3304676.70	17.47	0.24	0.30	0.04
12161	709244.00	3304555.68	17.44	0.23	0.31	0.04
12162	709260.89	3304495.07	17.50	0.23	0.31	0.04
12163	709277.88	3304434.41	17.61	0.23	0.31	0.04
12164	709295.01	3304373.71	17.53	0.22	0.29	0.04
12165	709312.22	3304313.00	17.42	0.22	0.30	0.04
12166	709329.29	3304252.30	17.43	0.22	0.30	0.04
12167	709363.19	3304131.25	17.44	0.22	0.29	0.04
12168	709380.27	3304070.77	17.50	0.22	0.29	0.04
12169	709397.31	3304010.27	17.47	0.22	0.29	0.04
12170	709414.38	3303949.74	17.44	0.21	0.28	0.04
12171	709431.35	3303889.14	17.47	0.20	0.27	0.04
12172	709448.24	3303828.59	17.43	0.21	0.29	0.04
12173	709465.03	3303768.00	17.53	0.21	0.29	0.04
12174	709481.94	3303707.47	17.49	0.21	0.28	0.04
12175	709498.81	3303646.78	17.43	0.21	0.28	0.04
12176	709515.77	3303586.03	17.47	0.20	0.28	0.04
12177	709549.61	3303464.63	17.42	0.21	0.29	0.04
12178	709566.59	3303403.91	17.39	0.20	0.28	0.04
12179	709583.63	3303343.18	17.43	0.21	0.29	0.04
12180	709600.51	3303282.45	17.43	0.20	0.27	0.04
12181	709617.39	3303221.75	17.44	0.19	0.27	0.04
12182	709634.39	3303161.15	17.53	0.21	0.29	0.04
12183	709651.38	3303100.62	17.46	0.21	0.29	0.04
12184	709668.35	3303040.11	17.40	0.21	0.29	0.04
12185	709685.35	3302979.54	17.26	0.21	0.29	0.04

12186	709702.23	3302918.87	17.28	0.21	0.29	0.04
12187	709719.19	3302858.21	17.34	0.21	0.29	0.04
12188	709736.01	3302797.53	17.40	0.21	0.28	0.04
12189	709752.85	3302736.84	17.49	0.23	0.28	0.04
12190	709769.74	3302676.19	17.44	0.24	0.29	0.04
12191	709786.69	3302615.53	17.47	0.24	0.29	0.04
12192	709803.57	3302554.91	17.52	0.23	0.28	0.04
12193	709820.41	3302494.36	17.54	0.22	0.29	0.04
12194	709837.53	3302433.89	17.58	0.22	0.29	0.04
12195	709854.51	3302373.36	17.55	0.22	0.29	0.04
12196	709871.60	3302312.81	17.45	0.21	0.28	0.04
14001	708599.75	3306851.08	17.57	0.10	0.15	0.01
14002	708621.88	3306776.76	17.66	0.10	0.15	0.01
14003	708643.24	3306702.29	17.63	0.11	0.17	0.02
14004	708664.43	3306627.75	17.55	0.09	0.15	0.01
14005	708685.35	3306553.17	17.48	0.11	0.17	0.02
14006	708706.39	3306478.80	17.56	0.09	0.15	0.01
14007	708727.36	3306404.45	17.50	0.11	0.16	0.02
14008	708748.38	3306330.06	17.38	0.10	0.14	0.02
14009	708769.41	3306255.84	17.47	0.10	0.14	0.02
14010	708790.13	3306181.64	17.47	0.10	0.14	0.02
14011	708810.67	3306107.35	17.42	0.11	0.15	0.02
14012	708831.22	3306033.01	17.35	0.11	0.15	0.02
14013	708851.84	3305958.55	17.38	0.11	0.15	0.02
14014	708872.82	3305883.97	17.40	0.11	0.15	0.02
14015	708893.79	3305809.28	17.45	0.10	0.14	0.02
14016	708914.56	3305734.55	17.45	0.10	0.14	0.02
14017	708935.56	3305659.92	17.35	0.09	0.15	0.01
14018	708956.42	3305585.32	17.40	0.10	0.16	0.01
14019	708977.24	3305510.78	17.38	0.10	0.16	0.01
14020	709018.69	3305361.77	17.45	0.10	0.16	0.01
14021	709039.33	3305287.33	17.52	0.09	0.14	0.01
14022	709059.97	3305212.78	17.40	0.09	0.15	0.01
14023	709080.75	3305138.15	17.38	0.09	0.15	0.01
14024	709101.61	3305063.58	17.54	0.09	0.15	0.01
14025	709122.53	3304989.09	17.50	0.09	0.15	0.01
14026	709143.46	3304914.64	17.38	0.09	0.15	0.01

14027	709164.46	3304840.11	17.40	0.10	0.16	0.01
14028	709206.18	3304690.93	17.39	0.10	0.15	0.01
14029	709247.99	3304541.97	17.40	0.09	0.14	0.01
14030	709268.89	3304467.52	17.48	0.11	0.16	0.01
14031	709289.89	3304393.18	17.53	0.09	0.14	0.01
14032	709331.83	3304244.42	17.40	0.09	0.14	0.01
14033	709352.93	3304169.96	17.40	0.09	0.14	0.01
14034	709373.75	3304095.49	17.43	0.11	0.17	0.01
14035	709394.45	3304021.02	17.44	0.09	0.14	0.01
14036	709415.27	3303946.62	17.42	0.11	0.17	0.01
14037	709457.14	3303797.75	17.46	0.10	0.15	0.01
14038	709478.05	3303723.19	17.45	0.10	0.15	0.01
14039	709499.04	3303648.65	17.39	0.11	0.17	0.01
14040	709519.80	3303574.11	17.47	0.10	0.17	0.01
14041	709540.51	3303499.62	17.49	0.09	0.14	0.01
14042	709561.01	3303425.14	17.35	0.09	0.14	0.01
14043	709581.51	3303350.74	17.41	0.10	0.16	0.01
14044	709602.11	3303276.26	17.40	0.09	0.14	0.01
14045	709622.89	3303201.76	17.46	0.10	0.15	0.01
14046	709643.82	3303127.20	17.47	0.10	0.15	0.01
14047	709664.77	3303052.66	17.38	0.09	0.14	0.01
14048	709685.61	3302978.04	17.22	0.09	0.15	0.01
14049	709706.36	3302903.38	17.24	0.09	0.14	0.01
14050	709727.00	3302828.78	17.32	0.10	0.16	0.01
14051	709747.40	3302754.17	17.38	0.10	0.16	0.01
14052	709768.15	3302679.67	17.42	0.10	0.15	0.01
14053	709789.14	3302605.18	17.46	0.10	0.16	0.01
14054	709810.27	3302530.80	17.48	0.10	0.15	0.01
14055	709831.05	3302456.31	17.56	0.10	0.15	0.01
14056	709851.94	3302381.73	17.52	0.09	0.15	0.01
16001	708596.45	3306862.64	17.48	0.12	0.17	0.01
16002	708610.28	3306816.01	17.56	0.14	0.16	0.02
16003	708623.92	3306769.13	17.61	0.13	0.16	0.02
16004	708637.44	3306721.91	17.54	0.14	0.16	0.02
16005	708650.94	3306674.37	17.53	0.15	0.17	0.02
16006	708664.33	3306626.55	17.51	0.14	0.16	0.02

16007	708677.74	3306578.30	17.42	0.15	0.18	0.02
16008	708691.02	3306529.92	17.37	0.15	0.17	0.02
16009	708717.62	3306435.53	17.39	0.16	0.19	0.02
16010	708743.86	3306344.12	17.32	0.16	0.19	0.02
16011	708756.56	3306299.49	17.31	0.15	0.18	0.02
16012	708781.08	3306211.35	17.35	0.15	0.18	0.02
16013	708805.85	3306122.78	17.31	0.16	0.19	0.02
16014	708818.29	3306078.06	17.33	0.17	0.20	0.03
16015	708830.75	3306033.09	17.31	0.17	0.20	0.03
16016	708855.87	3305942.60	17.28	0.16	0.19	0.02
16017	708868.59	3305897.35	17.32	0.16	0.21	0.03
16018	708893.93	3305807.02	17.32	0.16	0.19	0.02
16019	708918.81	3305716.92	17.34	0.16	0.19	0.02
16020	708931.30	3305671.94	17.32	0.18	0.21	0.03
16021	708956.36	3305582.11	17.32	0.17	0.20	0.03
16022	708981.32	3305492.23	17.36	0.16	0.20	0.03
16023	708993.82	3305447.27	17.37	0.17	0.21	0.03
16024	709006.43	3305402.31	17.37	0.17	0.21	0.03
16025	709019.13	3305357.32	17.38	0.18	0.21	0.03
16026	709031.83	3305312.31	17.46	0.17	0.20	0.03
16027	709044.51	3305267.27	17.44	0.17	0.21	0.03
16028	709057.22	3305222.18	17.39	0.17	0.22	0.03
16029	709069.96	3305177.04	17.33	0.18	0.23	0.03
16030	709082.69	3305131.96	17.30	0.18	0.23	0.03
16031	709095.44	3305086.93	17.40	0.18	0.23	0.03
16032	709120.73	3304997.02	17.44	0.18	0.22	0.03
16033	709145.65	3304907.07	17.29	0.17	0.21	0.03
16034	709158.14	3304862.15	17.34	0.18	0.23	0.03
16035	709183.13	3304772.25	17.31	0.19	0.22	0.03
16036	709208.33	3304682.24	17.37	0.19	0.22	0.03
16037	709220.95	3304637.19	17.34	0.19	0.22	0.03
16038	709233.68	3304592.16	17.34	0.19	0.22	0.03
16039	709246.34	3304547.12	17.36	0.19	0.22	0.03
16040	709284.12	3304412.30	17.52	0.19	0.22	0.03
16041	709296.70	3304367.40	17.40	0.19	0.22	0.03
16042	709309.41	3304322.41	17.32	0.18	0.21	0.03
16043	709322.09	3304277.41	17.32	0.19	0.22	0.03

16044	709334.72	3304232.45	17.36	0.19	0.22	0.03
16045	709347.34	3304187.50	17.36	0.18	0.22	0.03
16046	709359.98	3304142.52	17.33	0.19	0.22	0.03
16047	709372.51	3304097.48	17.40	0.18	0.22	0.03
16048	709384.99	3304052.45	17.42	0.20	0.23	0.03
16049	709397.52	3304007.43	17.43	0.19	0.22	0.03
16050	709410.12	3303962.40	17.36	0.20	0.23	0.03
16051	709422.79	3303917.41	17.36	0.20	0.24	0.03
16052	709435.41	3303872.39	17.40	0.19	0.23	0.03
16053	709448.09	3303827.41	17.33	0.18	0.22	0.03
16054	709460.68	3303782.42	17.41	0.19	0.24	0.03
16055	709473.26	3303737.46	17.43	0.18	0.22	0.03
16056	709485.76	3303692.50	17.38	0.18	0.23	0.03
16057	709498.21	3303647.52	17.34	0.19	0.24	0.03
16058	709510.74	3303602.54	17.38	0.19	0.23	0.03
16059	709523.22	3303557.62	17.44	0.19	0.23	0.03
16060	709535.75	3303512.70	17.49	0.19	0.24	0.03
16061	709548.33	3303467.72	17.36	0.18	0.23	0.03
16062	709560.95	3303422.60	17.30	0.19	0.24	0.03
16063	709573.56	3303377.44	17.34	0.18	0.23	0.03
16064	709586.10	3303332.31	17.32	0.19	0.24	0.03
16065	709598.66	3303287.20	17.35	0.18	0.23	0.03
16066	709611.24	3303242.13	17.32	0.19	0.24	0.03
16067	709623.82	3303197.16	17.42	0.19	0.24	0.03
16068	709636.40	3303152.26	17.38	0.19	0.24	0.03
16069	709649.04	3303107.37	17.38	0.19	0.23	0.03
16070	709661.60	3303062.43	17.31	0.19	0.24	0.03
16071	709674.13	3303017.39	17.25	0.19	0.24	0.03
16072	709686.71	3302972.29	17.18	0.19	0.24	0.03
16073	709699.22	3302927.18	17.17	0.19	0.24	0.03
16074	709711.72	3302882.10	17.23	0.19	0.24	0.03
16075	709724.19	3302837.14	17.24	0.19	0.22	0.03
16076	709736.69	3302792.19	17.31	0.19	0.22	0.03
16077	709749.24	3302747.29	17.36	0.19	0.22	0.03
16078	709761.89	3302702.37	17.34	0.19	0.23	0.03
16079	709774.60	3302657.38	17.35	0.19	0.23	0.03

16080	709787.28	3302612.33	17.39	0.21	0.24	0.03
16081	709799.85	3302567.27	17.43	0.19	0.23	0.03
16082	709812.44	3302522.21	17.39	0.21	0.24	0.03
16083	709825.08	3302477.16	17.47	0.19	0.23	0.03
16084	709837.75	3302432.12	17.46	0.21	0.25	0.03
16085	709850.38	3302387.11	17.43	0.21	0.25	0.03
16086	709863.01	3302342.05	17.40	0.19	0.23	0.03
18001	708591.56	3306879.55	17.52	0.15	0.23	0.02
18002	708605.74	3306831.72	17.55	0.15	0.23	0.02
18003	708619.70	3306783.99	17.65	0.15	0.22	0.02
18004	708633.53	3306736.38	17.60	0.16	0.24	0.02
18005	708647.31	3306688.79	17.53	0.17	0.25	0.02
18006	708660.81	3306641.09	17.51	0.17	0.25	0.02
18007	708674.18	3306593.34	17.46	0.15	0.22	0.02
18008	708687.56	3306545.55	17.37	0.15	0.22	0.02
18009	708701.02	3306497.77	17.42	0.15	0.22	0.02
18010	708714.47	3306449.99	17.45	0.16	0.23	0.02
18011	708727.86	3306402.17	17.43	0.15	0.23	0.02
18012	708741.25	3306354.31	17.32	0.14	0.21	0.02
18013	708754.69	3306306.42	17.33	0.16	0.24	0.02
18014	708768.15	3306258.56	17.31	0.15	0.22	0.02
18015	708781.56	3306210.69	17.35	0.16	0.24	0.02
18016	708794.88	3306162.82	17.37	0.14	0.21	0.02
18017	708808.16	3306114.93	17.34	0.15	0.22	0.02
18018	708834.89	3306019.21	17.30	0.15	0.22	0.02
18019	708848.26	3305971.33	17.26	0.15	0.22	0.02
18020	708861.55	3305923.47	17.32	0.16	0.23	0.02
18021	708874.84	3305875.60	17.33	0.16	0.23	0.02
18022	708888.17	3305827.77	17.35	0.14	0.20	0.02
18023	708914.90	3305732.12	17.36	0.14	0.20	0.02
18024	708928.29	3305684.28	17.31	0.14	0.20	0.02
18025	708941.66	3305636.46	17.38	0.14	0.20	0.02
18026	708955.01	3305588.69	17.33	0.14	0.20	0.02
18027	708968.36	3305540.95	17.30	0.14	0.21	0.02
18028	708981.81	3305493.24	17.30	0.13	0.20	0.02
18029	708995.23	3305445.47	17.35	0.15	0.22	0.02
18030	709008.50	3305397.85	17.34	0.13	0.20	0.02

18031	709021.71	3305350.72	17.36	0.14	0.21	0.02
18032	709034.90	3305303.99	17.44	0.15	0.22	0.02
18033	709048.08	3305257.46	17.40	0.15	0.22	0.02
18034	709061.11	3305211.03	17.31	0.14	0.21	0.02
18035	709087.18	3305118.52	17.35	0.15	0.22	0.02
18036	709100.20	3305072.41	17.41	0.15	0.22	0.02
18037	709125.83	3304979.96	17.39	0.15	0.22	0.02
18038	709151.62	3304886.89	17.27	0.16	0.24	0.02
18039	709164.71	3304840.15	17.36	0.15	0.22	0.02
18040	709177.75	3304793.36	17.32	0.17	0.24	0.02
18041	709190.75	3304746.56	17.28	0.17	0.24	0.02
18042	709203.68	3304699.84	17.35	0.15	0.22	0.02
18043	709216.63	3304653.31	17.37	0.17	0.25	0.02
18044	709229.56	3304606.90	17.33	0.17	0.25	0.02
18045	709242.50	3304560.58	17.36	0.16	0.24	0.02
18046	709255.43	3304514.28	17.40	0.15	0.23	0.02
18047	709268.47	3304468.04	17.49	0.16	0.23	0.02
18048	709281.51	3304421.79	17.52	0.16	0.23	0.02
18049	709294.54	3304375.43	17.44	0.16	0.24	0.02
18050	709307.57	3304328.93	17.34	0.16	0.24	0.02
18051	709320.61	3304282.32	17.36	0.18	0.27	0.02
18052	709333.61	3304235.69	17.41	0.17	0.25	0.02
18053	709346.65	3304189.12	17.39	0.17	0.25	0.02
18054	709359.71	3304142.56	17.36	0.18	0.27	0.02
18055	709372.74	3304096.07	17.40	0.18	0.26	0.02
18056	709385.71	3304049.62	17.48	0.18	0.26	0.02
18057	709398.74	3304003.23	17.42	0.18	0.27	0.02
18058	709411.79	3303956.85	17.36	0.18	0.26	0.02
18059	709424.87	3303910.48	17.41	0.19	0.29	0.03
18060	709437.99	3303864.11	17.37	0.20	0.30	0.03
18061	709451.11	3303817.65	17.39	0.19	0.28	0.03
18062	709464.09	3303771.12	17.43	0.19	0.29	0.03
18063	709477.10	3303724.56	17.44	0.20	0.30	0.03
18064	709490.19	3303677.97	17.41	0.21	0.31	0.03
18065	709503.23	3303631.34	17.36	0.22	0.32	0.03
18066	709516.33	3303584.80	17.42	0.21	0.32	0.03

18067	709529.38	3303538.33	17.48	0.20	0.30	0.03
18068	709542.23	3303491.85	17.41	0.21	0.31	0.03
18069	709555.04	3303445.33	17.30	0.21	0.32	0.03
18070	709567.95	3303398.79	17.31	0.21	0.31	0.03
18071	709580.80	3303352.26	17.36	0.20	0.29	0.03
18072	709593.75	3303305.81	17.33	0.20	0.29	0.03
18073	709606.67	3303259.36	17.32	0.20	0.30	0.03
18074	709619.54	3303212.92	17.41	0.22	0.33	0.03
18075	709632.51	3303166.49	17.46	0.21	0.32	0.03
18076	709645.54	3303120.05	17.41	0.22	0.32	0.03
18077	709658.52	3303073.56	17.36	0.20	0.30	0.03
18078	709671.30	3303026.98	17.29	0.21	0.30	0.03
18079	709684.17	3302980.38	17.21	0.22	0.33	0.03
18080	709697.18	3302933.84	17.25	0.21	0.31	0.03
18081	709710.23	3302887.39	17.28	0.22	0.32	0.03
18082	709723.19	3302841.01	17.32	0.23	0.34	0.03
18083	709736.07	3302794.64	17.35	0.22	0.33	0.03
18084	709761.96	3302701.82	17.39	0.22	0.32	0.03
18085	709774.92	3302655.27	17.36	0.23	0.34	0.03
18086	709800.85	3302562.07	17.46	0.22	0.33	0.03
18087	709813.85	3302515.57	17.45	0.23	0.34	0.03
18088	709826.86	3302469.12	17.51	0.23	0.34	0.03
18089	709853.03	3302376.22	17.50	0.22	0.33	0.03

APPENDIX M

Control Survey Listing MVRM Calibration Site - Dist. 61c

North bound Burbank Drive at South Kenilworth Parkway

Date & Time 3/10/2014 10:24 AM

Coordinate System U.S. State Plane 1983 **Zone** Louisiana South 1702

Project Datum (NAD 83) **Vertical Datum** (NAVD 88) **Geoid Model** GEOID12A

Coordinate Unit U.S. Survey Foot **Distance Unit** U.S. Survey Foot **Height Unit** U.S. Survey Foot

Figure 58
MVRM Control – 61c North bound Burbank Drive at South Kenilworth Parkway

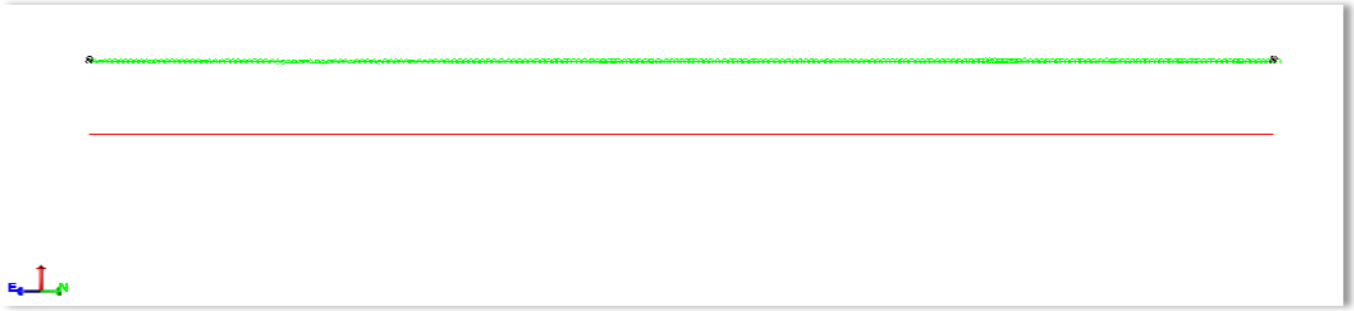


Figure 59
MVRM Control – 61c Profile 10 X vertical

Point ID	Northing	Easting	Elevation	H Prc	V Prc	RMS
2001	683278.976	3340255.869	19.123	0.042	0.079	0.007
2002	685041.066	3338280.636	19.221	0.063	0.121	0.012
20001	683278.928	3340255.941	19.096	0.068	0.110	0.013
20002	683287.657	3340247.343	19.103	0.083	0.130	0.015
20003	683296.755	3340237.743	19.055	0.077	0.121	0.014
20004	683304.353	3340229.852	19.106	0.074	0.120	0.015
20005	683312.164	3340222.141	19.129	0.078	0.126	0.015
20006	683320.046	3340213.848	19.143	0.075	0.113	0.012
20007	683328.461	3340205.487	19.118	0.089	0.133	0.014
20008	683336.746	3340197.299	19.152	0.098	0.147	0.016
20009	683344.712	3340188.992	19.121	0.101	0.152	0.016
20010	683352.844	3340180.550	19.102	0.100	0.150	0.016
20011	683360.732	3340172.297	19.085	0.092	0.139	0.015
20012	683368.462	3340164.077	19.111	0.092	0.138	0.015
20013	683376.219	3340156.047	19.037	0.092	0.139	0.015
20014	683384.149	3340147.681	19.091	0.095	0.144	0.015
20015	683391.912	3340139.576	19.098	0.095	0.143	0.015
20016	683399.960	3340131.304	19.146	0.116	0.175	0.018
20017	683408.016	3340122.878	19.126	0.112	0.169	0.018
20018	683416.335	3340114.631	19.101	0.100	0.158	0.018
20019	683424.728	3340106.141	19.103	0.102	0.154	0.016
20020	683432.800	3340097.551	19.088	0.100	0.151	0.016
20021	683440.845	3340088.638	19.136	0.109	0.165	0.017
20022	683448.778	3340079.984	19.094	0.112	0.169	0.018
20023	683456.890	3340071.775	19.114	0.112	0.169	0.018
20024	683465.174	3340063.209	19.101	0.107	0.161	0.017
20025	683475.388	3340052.647	19.089	0.094	0.142	0.018
20026	683486.092	3340042.331	19.102	0.113	0.171	0.018
20027	683494.236	3340033.249	19.173	0.109	0.165	0.017
20028	683502.927	3340024.252	19.184	0.104	0.157	0.016
20029	683511.291	3340015.192	19.183	0.103	0.155	0.016
20030	683519.683	3340006.488	19.080	0.125	0.188	0.020
20031	683528.116	3339997.990	19.119	0.117	0.176	0.018
20032	683537.086	3339989.141	19.203	0.132	0.199	0.021
20033	683545.707	3339979.955	19.123	0.121	0.183	0.019

20034	683554.126	3339970.851	19.152	0.132	0.200	0.021
20035	683564.775	3339959.846	19.098	0.118	0.178	0.022
20036	683572.525	3339951.439	19.064	0.129	0.195	0.020
20037	683580.774	3339942.551	19.058	0.122	0.184	0.019
20038	683588.885	3339933.747	19.028	0.131	0.198	0.021
20039	683597.971	3339924.566	19.035	0.134	0.202	0.021
20040	683606.927	3339915.160	19.046	0.129	0.195	0.020
20041	683615.919	3339906.304	19.066	0.125	0.190	0.020
20042	683622.963	3339899.167	19.077	0.141	0.213	0.022
20043	683634.004	3339887.362	19.043	0.130	0.204	0.024
20044	683642.698	3339878.003	19.004	0.131	0.206	0.024
20045	683651.809	3339868.167	19.052	0.129	0.194	0.020
20046	683660.344	3339858.732	19.075	0.147	0.221	0.025
20047	683669.356	3339849.276	19.109	0.134	0.203	0.021
20048	683676.294	3339841.971	19.114	0.138	0.209	0.022
20049	683684.402	3339832.534	19.027	0.140	0.212	0.022
20050	683692.847	3339822.891	19.103	0.135	0.204	0.021
20051	683701.806	3339813.499	19.098	0.153	0.231	0.024
20052	683710.503	3339804.360	19.081	0.138	0.209	0.022
20053	683719.034	3339795.160	19.120	0.138	0.209	0.022
20054	683728.156	3339785.791	19.067	0.145	0.220	0.023
20055	683736.730	3339776.120	19.120	0.154	0.233	0.024
20056	683745.455	3339766.717	19.098	0.141	0.214	0.022
20057	683754.249	3339757.639	19.084	0.156	0.236	0.025
20058	683761.289	3339750.505	19.095	0.158	0.239	0.025
20059	683769.678	3339741.090	19.099	0.139	0.219	0.025
20060	683778.195	3339731.830	19.106	0.140	0.220	0.026
20061	683788.308	3339720.554	19.085	0.145	0.219	0.023
20062	683796.965	3339711.223	19.054	0.154	0.234	0.024
20063	683805.518	3339701.870	19.117	0.164	0.248	0.026
20064	683814.196	3339692.625	19.159	0.151	0.229	0.024
20065	683822.491	3339683.220	19.156	0.161	0.243	0.025
20066	683830.760	3339673.961	19.127	0.160	0.243	0.025
20067	683840.963	3339662.470	19.157	0.161	0.244	0.025
20068	683849.330	3339652.858	19.242	0.150	0.235	0.028
20069	683857.571	3339643.793	19.214	0.150	0.234	0.028
20070	683866.361	3339634.526	19.201	0.157	0.245	0.029

20071	683874.858	3339625.194	19.241	0.168	0.250	0.029
20072	683883.926	3339615.385	19.191	0.166	0.226	0.021
20073	683892.923	3339605.912	19.186	0.174	0.239	0.024
20074	683901.509	3339596.717	19.178	0.151	0.227	0.026
20075	683912.173	3339585.219	19.247	0.152	0.223	0.023
20076	683922.407	3339573.496	19.147	0.150	0.223	0.022
20077	683931.062	3339563.352	19.192	0.167	0.248	0.025
20078	683939.457	3339554.308	19.222	0.169	0.251	0.025
20079	683947.693	3339544.840	19.197	0.156	0.231	0.023
20080	683956.167	3339535.605	19.171	0.168	0.254	0.026
20081	683964.699	3339525.786	19.225	0.156	0.236	0.024
20082	683973.634	3339516.259	19.244	0.156	0.237	0.025
20083	683982.298	3339506.542	19.236	0.159	0.241	0.025
20084	683991.244	3339496.834	19.270	0.160	0.243	0.025
20085	683998.477	3339489.257	19.265	0.169	0.257	0.027
20086	684007.360	3339479.615	19.227	0.177	0.269	0.028
20087	684014.114	3339472.233	19.233	0.178	0.270	0.028
20088	684021.039	3339464.518	19.200	0.167	0.249	0.025
20089	684027.728	3339456.927	19.207	0.164	0.256	0.030
20090	684036.190	3339446.896	19.247	0.167	0.254	0.026
20091	684047.160	3339434.340	19.274	0.169	0.256	0.027
20092	684056.119	3339424.717	19.255	0.177	0.269	0.028
20093	684064.490	3339414.930	19.303	0.179	0.271	0.028
20094	684072.861	3339405.182	19.226	0.165	0.251	0.026
20095	684079.765	3339397.806	19.289	0.184	0.275	0.027
20096	684086.573	3339390.281	19.220	0.173	0.261	0.030
20097	684095.075	3339380.822	19.208	0.178	0.247	0.022
20098	684101.709	3339373.213	19.231	0.168	0.251	0.025
20099	684109.767	3339364.185	19.264	0.186	0.257	0.026
20100	684118.227	3339354.232	19.228	0.195	0.271	0.024
20101	684127.007	3339344.689	19.292	0.189	0.263	0.024
20102	684135.369	3339334.712	19.332	0.171	0.255	0.025
20103	684145.652	3339321.860	19.233	0.183	0.275	0.031
20104	684156.744	3339309.807	19.259	0.181	0.275	0.028
20105	684165.268	3339299.845	19.246	0.162	0.255	0.030
20106	684171.696	3339292.023	19.246	0.177	0.278	0.032

20107	684180.604	3339281.954	19.260	0.170	0.257	0.027
20108	684187.366	3339274.457	19.206	0.185	0.281	0.029
20109	684194.194	3339266.504	19.275	0.182	0.272	0.027
20110	684201.139	3339258.684	19.210	0.190	0.285	0.028
20111	684208.323	3339250.546	19.245	0.177	0.265	0.026
20112	684215.454	3339242.852	19.207	0.194	0.290	0.029
20113	684222.130	3339234.832	19.227	0.179	0.268	0.027
20114	684233.032	3339222.700	19.194	0.195	0.292	0.029
20115	684243.650	3339210.359	19.204	0.196	0.294	0.029
20116	684251.941	3339200.569	19.219	0.211	0.295	0.026
20117	684258.664	3339192.949	19.253	0.212	0.298	0.027
20118	684265.350	3339185.333	19.261	0.199	0.298	0.030
20119	684273.645	3339175.531	19.242	0.187	0.283	0.029
20120	684282.136	3339165.686	19.231	0.194	0.294	0.030
20121	684288.912	3339157.842	19.300	0.209	0.294	0.026
20122	684295.585	3339150.377	19.212	0.193	0.272	0.024
20123	684303.445	3339141.350	19.163	0.184	0.275	0.027
20124	684311.529	3339131.999	19.187	0.181	0.275	0.028
20125	684319.501	3339122.559	19.219	0.183	0.275	0.027
20126	684327.727	3339112.401	19.197	0.180	0.274	0.028
20127	684336.008	3339103.386	19.214	0.179	0.272	0.028
20128	684344.811	3339093.763	19.169	0.199	0.295	0.030
20129	684353.377	3339083.932	19.185	0.191	0.286	0.028
20130	684361.900	3339073.780	19.179	0.211	0.298	0.026
20131	684370.382	3339063.739	19.197	0.213	0.301	0.027
20132	684377.299	3339056.147	19.167	0.215	0.303	0.027
20133	684386.019	3339046.316	19.101	0.207	0.292	0.026
20134	684394.254	3339036.834	19.254	0.201	0.285	0.025
20135	684402.503	3339026.842	19.146	0.204	0.289	0.025
20136	684411.065	3339016.709	19.137	0.210	0.298	0.026
20137	684417.721	3339009.141	19.197	0.211	0.299	0.026
20138	684426.501	3338999.200	19.126	0.224	0.304	0.031
20139	684434.995	3338988.950	19.151	0.219	0.310	0.027
20140	684443.449	3338978.724	19.209	0.211	0.295	0.029
20141	684450.326	3338971.248	19.090	0.213	0.302	0.027
20142	684458.500	3338961.491	19.126	0.217	0.308	0.027
20143	684466.427	3338951.633	19.186	0.192	0.291	0.030

20144	684474.163	3338941.421	19.233	0.203	0.308	0.032
20145	684480.714	3338933.830	19.123	0.235	0.320	0.030
20146	684487.729	3338926.207	19.182	0.226	0.308	0.029
20147	684495.125	3338918.778	19.151	0.251	0.342	0.032
20148	684501.821	3338911.102	19.231	0.240	0.328	0.031
20149	684508.381	3338903.537	19.145	0.262	0.357	0.034
20150	684516.079	3338893.914	19.184	0.190	0.286	0.028
20151	684524.368	3338883.886	19.209	0.188	0.282	0.028
20152	684531.184	3338876.384	19.222	0.200	0.301	0.030
20153	684538.149	3338868.736	19.268	0.182	0.275	0.028
20154	684544.877	3338861.142	19.249	0.182	0.276	0.028
20155	684552.922	3338851.167	19.212	0.207	0.281	0.028
20156	684560.541	3338841.379	19.238	0.223	0.303	0.030
20157	684568.527	3338832.251	19.247	0.238	0.322	0.032
20158	684576.868	3338822.519	19.248	0.246	0.334	0.033
20159	684584.767	3338813.184	19.250	0.252	0.341	0.034
20160	684593.047	3338803.416	19.263	0.183	0.277	0.029
20161	684601.589	3338793.473	19.302	0.182	0.276	0.028
20162	684610.047	3338783.415	19.174	0.193	0.293	0.030
20163	684616.750	3338775.917	19.303	0.186	0.282	0.029
20164	684623.859	3338768.399	19.342	0.192	0.291	0.030
20165	684630.437	3338760.620	19.409	0.195	0.295	0.030
20166	684637.500	3338752.628	19.375	0.190	0.287	0.030
20167	684644.398	3338744.538	19.327	0.214	0.290	0.029
20168	684651.032	3338736.890	19.339	0.230	0.312	0.031
20169	684657.422	3338728.911	19.354	0.237	0.321	0.032
20170	684663.809	3338721.193	19.344	0.250	0.339	0.033
20171	684672.264	3338711.418	19.296	0.250	0.338	0.033
20172	684680.694	3338701.610	19.333	0.274	0.346	0.039
20173	684688.566	3338692.256	19.206	0.201	0.285	0.033
20174	684696.632	3338682.719	19.253	0.200	0.284	0.033
20175	684705.223	3338672.903	19.220	0.201	0.285	0.033
20176	684713.655	3338663.248	19.226	0.173	0.257	0.037
20177	684720.380	3338655.578	19.216	0.183	0.261	0.030
20178	684729.044	3338645.494	19.277	0.200	0.259	0.029
20179	684735.914	3338638.222	19.213	0.194	0.250	0.028

20180	684742.493	3338630.435	19.188	0.176	0.243	0.028
20181	684751.062	3338620.555	19.210	0.185	0.263	0.030
20182	684757.660	3338612.550	19.268	0.191	0.264	0.030
20183	684764.413	3338604.804	19.210	0.180	0.249	0.028
20184	684772.482	3338594.845	19.236	0.176	0.251	0.029
20185	684780.858	3338585.032	19.274	0.179	0.266	0.027
20186	684791.429	3338572.892	19.266	0.195	0.283	0.024
20187	684799.787	3338562.800	19.350	0.213	0.277	0.031
20188	684807.808	3338552.882	19.324	0.215	0.280	0.032
20189	684814.140	3338545.035	19.315	0.186	0.270	0.023
20190	684822.601	3338534.663	19.268	0.205	0.299	0.026
20191	684829.607	3338527.395	19.265	0.189	0.275	0.023
20192	684836.642	3338519.455	19.224	0.207	0.302	0.026
20193	684844.953	3338509.283	19.264	0.223	0.291	0.033
20194	684851.950	3338501.379	19.236	0.203	0.279	0.032
20195	684858.781	3338493.507	19.222	0.193	0.275	0.032
20196	684865.982	3338485.239	19.205	0.186	0.271	0.034
20197	684872.615	3338477.564	19.197	0.201	0.278	0.032
20198	684879.915	3338470.117	19.237	0.190	0.258	0.033
20199	684886.691	3338462.704	19.243	0.183	0.273	0.034
20200	684893.245	3338454.993	19.250	0.198	0.269	0.028
20201	684899.939	3338447.027	19.190	0.206	0.280	0.029
20202	684906.633	3338438.888	19.319	0.199	0.271	0.027
20203	684913.614	3338430.808	19.261	0.182	0.267	0.023
20204	684920.711	3338422.430	19.278	0.184	0.270	0.023
20205	684927.486	3338414.150	19.299	0.186	0.272	0.023
20206	684934.575	3338405.868	19.256	0.205	0.300	0.025
20207	684941.630	3338397.616	19.239	0.206	0.302	0.026
20208	684948.490	3338389.304	19.250	0.189	0.285	0.028
20209	684955.147	3338381.757	19.193	0.197	0.297	0.029
20210	684963.425	3338371.704	19.189	0.190	0.286	0.028
20211	684971.180	3338362.436	19.225	0.187	0.282	0.029
20212	684978.973	3338352.766	19.177	0.189	0.285	0.028
20213	684987.331	3338343.351	19.272	0.205	0.301	0.025
20214	684995.089	3338334.219	19.276	0.190	0.279	0.024
20215	685004.831	3338322.821	19.260	0.198	0.292	0.025
20216	685012.368	3338313.861	19.173	0.199	0.292	0.025

20217	685020.042	3338304.851	19.281	0.200	0.294	0.025
20218	685026.971	3338296.385	19.167	0.200	0.295	0.025
20219	685034.397	3338287.592	19.212	0.202	0.297	0.025
20220	685041.300	3338279.380	19.273	0.215	0.317	0.027
20221	685048.699	3338270.782	19.185	0.197	0.297	0.029

APPENDIX N

Control Survey Listing MVRM Calibration Site - Dist. 62
East bound I-10 at Reserve Relief Canal near LaPlace

Date & Time 5/6/2014 10:39 AM

Coordinate System U.S. State Plane 1983 **Zone** Louisiana South 1702

Project Datum (NAD 83) **Vertical Datum** (NAVD 88) **Geoid Model** GEOID12A

Coordinate Unit U.S. Survey Foot **Distance Unit** U.S. Survey Foot **Height Unit** U.S. Survey Foot

Figure 60
MVRM Control - 62 East bound I-10 at Reserve Relief Canal near LaPlace

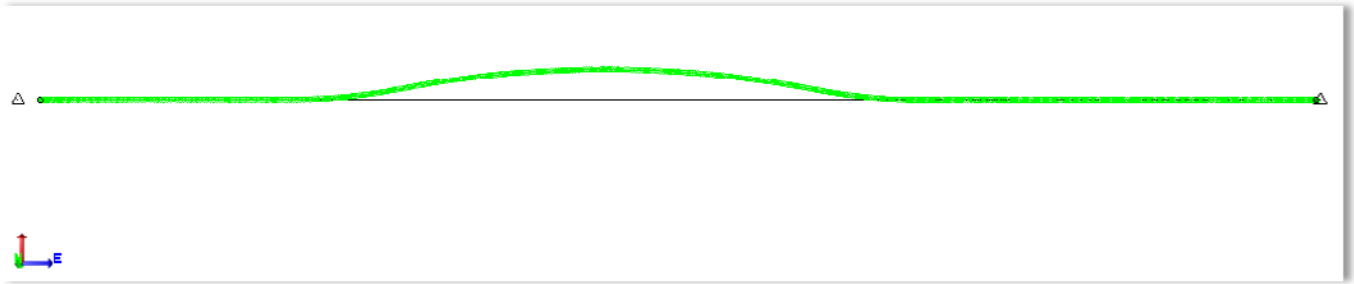


Figure 61
MVRM Control - 62 Profile 10 X vertical

Point ID	Northing	Easting	Elevation	H Prc	V Prc	RMS
6201	586918.631	3527416.402	16.089	0.090	0.109	0.019
6202	586440.141	3532355.492	15.969	0.051	0.066	0.017
62001	586918.815	3527416.413	16.103	0.054	0.066	0.007
62002	586917.675	3527427.891	16.114	0.054	0.065	0.007
62003	586916.642	3527439.077	16.115	0.055	0.066	0.007
62004	586915.449	3527450.787	16.172	0.055	0.067	0.007
62005	586914.516	3527461.487	16.146	0.072	0.088	0.009
62006	586913.380	3527471.911	16.177	0.063	0.077	0.008
62007	586912.425	3527482.637	16.159	0.064	0.078	0.008
62008	586911.286	3527493.334	16.174	0.073	0.089	0.009
62009	586910.278	3527504.503	16.131	0.057	0.069	0.007
62010	586909.346	3527515.681	16.163	0.065	0.080	0.008
62011	586908.173	3527526.947	16.167	0.065	0.079	0.008
62012	586906.852	3527538.521	16.202	0.057	0.069	0.007
62013	586905.801	3527550.284	16.183	0.075	0.092	0.009
62014	586904.484	3527562.021	16.194	0.067	0.081	0.008
62015	586903.396	3527574.359	16.215	0.058	0.070	0.007
62016	586902.297	3527586.074	16.181	0.141	0.084	0.007
62017	586901.210	3527598.436	16.206	0.156	0.093	0.008
62018	586899.849	3527610.809	16.183	0.153	0.091	0.008
62019	586898.733	3527622.720	16.172	0.169	0.101	0.009
62020	586897.522	3527634.943	16.160	0.173	0.103	0.009
62021	586896.412	3527646.780	16.152	0.230	0.137	0.012
62022	586895.313	3527658.719	16.214	0.158	0.094	0.008
62023	586894.089	3527670.699	16.194	0.082	0.100	0.010
62024	586892.795	3527682.959	16.194	0.097	0.119	0.012
62025	586891.565	3527695.154	16.159	0.094	0.115	0.012
62026	586890.466	3527707.609	16.140	0.088	0.107	0.011
62027	586889.213	3527719.701	16.146	0.090	0.110	0.011
62028	586888.067	3527732.200	16.161	0.104	0.128	0.013
62029	586886.728	3527745.969	16.162	0.074	0.102	0.011
62030	586885.489	3527758.457	16.191	0.076	0.105	0.011
62031	586884.376	3527771.027	16.180	0.072	0.099	0.011
62032	586883.311	3527783.608	16.180	0.077	0.094	0.010
62033	586882.116	3527796.111	16.191	0.085	0.104	0.011

62034	586880.849	3527808.804	16.181	0.100	0.122	0.012
62035	586879.581	3527821.673	16.232	0.094	0.115	0.012
62036	586878.738	3527831.707	16.277	0.101	0.124	0.013
62037	586877.315	3527844.634	16.199	0.068	0.084	0.008
62038	586875.952	3527857.884	16.206	0.081	0.099	0.010
62039	586874.628	3527870.680	16.257	0.070	0.086	0.009
62040	586873.497	3527883.447	16.238	0.078	0.096	0.010
62041	586872.341	3527896.081	16.186	0.061	0.074	0.008
62042	586871.168	3527908.481	16.234	0.061	0.075	0.008
62043	586870.141	3527921.225	16.204	0.062	0.076	0.008
62044	586868.766	3527933.803	16.281	0.082	0.102	0.009
62045	586867.609	3527946.836	16.243	0.071	0.087	0.009
62046	586866.246	3527959.390	16.225	0.080	0.098	0.010
62047	586864.847	3527972.316	16.196	0.080	0.098	0.010
62048	586863.705	3527985.280	16.179	0.062	0.076	0.008
62049	586862.463	3527998.146	16.217	0.063	0.077	0.008
62050	586861.170	3528010.575	16.198	0.072	0.088	0.009
62051	586859.894	3528023.473	16.201	0.079	0.096	0.010
62052	586858.749	3528036.298	16.218	0.079	0.097	0.010
62053	586857.402	3528049.481	16.212	0.080	0.098	0.010
62054	586856.067	3528062.255	16.198	0.071	0.087	0.009
62055	586854.922	3528074.669	16.213	0.063	0.077	0.008
62056	586853.858	3528087.101	16.212	0.067	0.079	0.006
62057	586852.500	3528099.591	16.232	0.092	0.100	0.009
62058	586851.263	3528112.320	16.200	0.164	0.098	0.008
62059	586850.312	3528125.394	16.233	0.178	0.106	0.009
62060	586849.069	3528135.487	16.229	0.143	0.085	0.007
62061	586848.018	3528146.389	16.174	0.139	0.085	0.008
62062	586846.871	3528157.155	16.150	0.194	0.116	0.010
62063	586845.846	3528169.692	16.148	0.160	0.096	0.008
62064	586844.398	3528182.627	16.147	0.117	0.070	0.006
62065	586843.181	3528195.755	16.144	0.087	0.095	0.009
62066	586841.885	3528208.503	16.136	0.088	0.096	0.009
62067	586840.605	3528221.463	16.192	0.087	0.107	0.011
62068	586839.202	3528234.341	16.172	0.078	0.095	0.010
62069	586838.016	3528247.277	16.167	0.085	0.104	0.011
62070	586836.750	3528260.420	16.192	0.076	0.093	0.010

62071	586835.480	3528273.310	16.156	0.088	0.108	0.011
62072	586834.116	3528286.459	16.170	0.091	0.112	0.011
62073	586832.976	3528299.648	16.155	0.069	0.084	0.009
62074	586831.859	3528312.839	16.185	0.113	0.070	0.006
62075	586830.854	3528322.795	16.195	0.140	0.086	0.008
62076	586829.940	3528332.777	16.162	0.128	0.078	0.007
62077	586828.687	3528345.786	16.234	0.135	0.083	0.008
62078	586827.534	3528358.727	16.254	0.180	0.111	0.010
62079	586826.300	3528371.815	16.181	0.068	0.084	0.009
62080	586825.062	3528384.734	16.164	0.077	0.094	0.010
62081	586823.777	3528397.777	16.194	0.109	0.067	0.006
62082	586822.471	3528410.673	16.200	0.077	0.094	0.010
62083	586821.250	3528423.889	16.219	0.068	0.083	0.008
62084	586820.224	3528437.028	16.296	0.134	0.083	0.008
62085	586818.800	3528449.951	16.351	0.144	0.089	0.008
62086	586817.316	3528462.845	16.295	0.151	0.093	0.009
62087	586816.298	3528475.970	16.378	0.177	0.109	0.010
62088	586815.103	3528488.894	16.448	0.144	0.089	0.008
62089	586813.963	3528501.206	16.510	0.086	0.105	0.011
62090	586812.490	3528514.305	16.597	0.077	0.095	0.010
62091	586811.504	3528524.324	16.593	0.086	0.105	0.011
62092	586810.552	3528534.473	16.649	0.068	0.084	0.009
62093	586809.513	3528544.741	16.739	0.086	0.106	0.011
62094	586807.800	3528561.119	16.865	0.165	0.100	0.009
62095	586806.730	3528571.223	16.917	0.133	0.081	0.007
62096	586805.758	3528581.562	17.041	0.184	0.111	0.010
62097	586804.950	3528591.676	17.145	0.192	0.116	0.010
62098	586804.001	3528601.904	17.262	0.198	0.120	0.010
62099	586802.972	3528612.391	17.355	0.183	0.113	0.011
62100	586802.035	3528622.564	17.468	0.082	0.100	0.010
62101	586800.959	3528632.822	17.601	0.073	0.090	0.009
62102	586800.026	3528642.952	17.696	0.097	0.120	0.012
62103	586799.004	3528653.537	17.879	0.100	0.123	0.013
62104	586797.590	3528667.867	18.045	0.091	0.112	0.011
62105	586796.599	3528678.396	18.170	0.092	0.113	0.012
62106	586795.526	3528689.267	18.348	0.068	0.095	0.010

62107	586794.479	3528699.673	18.468	0.068	0.084	0.009
62108	586793.372	3528710.379	18.657	0.102	0.112	0.010
62109	586792.293	3528721.378	18.840	0.108	0.118	0.011
62110	586791.339	3528732.190	18.990	0.102	0.113	0.010
62111	586790.349	3528743.146	19.157	0.089	0.098	0.009
62112	586789.244	3528753.597	19.349	0.090	0.099	0.009
62113	586788.281	3528764.074	19.554	0.096	0.118	0.012
62114	586787.231	3528774.400	19.781	0.082	0.101	0.010
62115	586786.045	3528784.694	19.990	0.088	0.108	0.011
62116	586785.131	3528795.194	20.160	0.094	0.116	0.012
62117	586784.029	3528805.576	20.341	0.107	0.149	0.016
62118	586782.595	3528819.048	20.609	0.243	0.152	0.014
62119	586781.524	3528829.445	20.782	0.226	0.142	0.013
62120	586780.638	3528839.599	21.039	0.261	0.164	0.015
62121	586779.663	3528849.612	21.224	0.291	0.183	0.017
62122	586778.473	3528862.742	21.507	0.284	0.178	0.017
62123	586777.553	3528872.976	21.710	0.128	0.157	0.016
62124	586776.509	3528883.184	21.879	0.147	0.181	0.019
62125	586775.524	3528893.459	22.022	0.142	0.175	0.018
62126	586774.568	3528903.692	22.237	0.133	0.164	0.017
62127	586773.521	3528914.012	22.432	0.154	0.189	0.019
62128	586772.652	3528924.009	22.616	0.135	0.167	0.017
62129	586771.616	3528934.170	22.791	0.138	0.170	0.017
62130	586770.583	3528944.499	22.962	0.140	0.173	0.018
62131	586769.645	3528954.653	23.093	0.144	0.178	0.018
62132	586768.480	3528967.786	23.322	0.145	0.179	0.018
62133	586767.346	3528981.015	23.553	0.157	0.194	0.020
62134	586766.324	3528991.111	23.691	0.101	0.142	0.015
62135	586765.453	3529001.315	23.845	0.085	0.119	0.013
62136	586764.360	3529014.599	23.993	0.070	0.098	0.010
62137	586763.359	3529024.787	24.154	0.075	0.105	0.011
62138	586762.217	3529034.905	24.302	0.084	0.118	0.013
62139	586760.997	3529047.468	24.502	0.071	0.092	0.008
62140	586759.809	3529057.577	24.618	0.076	0.098	0.009
62141	586758.712	3529067.863	24.719	0.079	0.103	0.009
62142	586757.913	3529078.043	24.863	0.103	0.134	0.012
62143	586756.925	3529088.450	24.994	0.109	0.121	0.011

62144	586755.897	3529099.010	25.184	0.117	0.129	0.012
62145	586754.923	3529109.255	25.325	0.087	0.107	0.011
62146	586753.857	3529119.766	25.460	0.091	0.113	0.012
62147	586752.830	3529130.179	25.602	0.082	0.101	0.010
62148	586751.761	3529140.990	25.730	0.074	0.092	0.009
62149	586750.801	3529151.716	25.826	0.073	0.090	0.009
62150	586749.778	3529162.380	25.977	0.082	0.115	0.012
62151	586748.623	3529172.693	26.083	0.066	0.093	0.010
62152	586747.564	3529183.130	26.182	0.073	0.103	0.011
62153	586746.623	3529193.148	26.275	0.059	0.083	0.009
62154	586745.646	3529203.192	26.453	0.066	0.093	0.010
62155	586744.677	3529213.533	26.510	0.066	0.093	0.010
62156	586743.764	3529223.898	26.644	0.059	0.082	0.009
62157	586742.579	3529234.142	26.677	0.058	0.082	0.009
62158	586741.570	3529244.156	26.767	0.065	0.080	0.008
62159	586740.415	3529254.496	26.890	0.076	0.094	0.010
62160	586739.462	3529264.594	26.955	0.070	0.087	0.009
62161	586738.361	3529274.851	27.018	0.077	0.095	0.010
62162	586737.251	3529285.558	27.106	0.081	0.100	0.010
62163	586736.220	3529295.946	27.162	0.080	0.098	0.010
62164	586735.050	3529306.254	27.202	0.073	0.103	0.011
62165	586733.931	3529319.545	27.313	0.060	0.085	0.009
62166	586732.534	3529332.958	27.419	0.065	0.092	0.010
62167	586731.649	3529342.928	27.439	0.075	0.092	0.010
62168	586730.767	3529353.053	27.489	0.067	0.083	0.009
62169	586729.736	3529363.120	27.576	0.075	0.092	0.010
62170	586728.788	3529373.384	27.610	0.088	0.109	0.011
62171	586728.099	3529383.805	27.681	0.082	0.101	0.010
62172	586726.861	3529394.152	27.750	0.093	0.115	0.012
62173	586725.930	3529404.858	27.763	0.077	0.095	0.010
62174	586725.029	3529415.204	27.827	0.075	0.106	0.011
62175	586724.029	3529425.694	27.829	0.068	0.095	0.010
62176	586722.970	3529436.290	27.887	0.086	0.122	0.013
62177	586722.022	3529446.992	27.957	0.099	0.139	0.015
62178	586720.882	3529457.628	27.997	0.074	0.105	0.011
62179	586719.758	3529468.234	28.020	0.082	0.116	0.012

62180	586718.829	3529479.246	28.100	0.083	0.118	0.013
62181	586717.568	3529489.810	28.138	0.079	0.111	0.012
62182	586716.571	3529500.227	28.151	0.074	0.105	0.011
62183	586715.835	3529510.646	28.198	0.078	0.110	0.012
62184	586714.623	3529521.356	28.268	0.071	0.100	0.011
62185	586713.650	3529531.914	28.224	0.081	0.114	0.012
62186	586712.520	3529542.446	28.255	0.070	0.099	0.011
62187	586711.658	3529553.256	28.291	0.076	0.108	0.011
62188	586710.750	3529563.792	28.236	0.077	0.102	0.009
62189	586709.741	3529574.340	28.226	0.085	0.112	0.010
62190	586708.375	3529587.976	28.259	0.066	0.087	0.008
62191	586707.289	3529598.317	28.293	0.073	0.096	0.009
62192	586706.381	3529608.790	28.317	0.083	0.110	0.010
62193	586705.201	3529619.182	28.357	0.071	0.101	0.011
62194	586704.233	3529629.290	28.380	0.071	0.101	0.011
62195	586703.158	3529639.528	28.299	0.058	0.082	0.009
62196	586701.876	3529652.401	28.297	0.057	0.080	0.009
62197	586700.843	3529662.429	28.243	0.064	0.091	0.010
62198	586699.624	3529672.762	28.247	0.064	0.091	0.010
62199	586698.655	3529683.096	28.183	0.064	0.091	0.010
62200	586697.727	3529693.302	28.176	0.071	0.101	0.011
62201	586696.299	3529709.803	28.095	0.072	0.101	0.011
62202	586695.162	3529722.678	28.109	0.072	0.102	0.011
62203	586693.805	3529735.552	28.041	0.064	0.079	0.008
62204	586692.520	3529748.662	28.016	0.081	0.100	0.010
62205	586691.551	3529758.863	27.996	0.082	0.101	0.010
62206	586690.448	3529769.187	27.922	0.073	0.090	0.009
62207	586689.391	3529779.398	27.891	0.065	0.080	0.008
62208	586687.814	3529796.064	27.776	0.071	0.101	0.011
62209	586686.809	3529806.026	27.806	0.064	0.091	0.010
62210	586685.854	3529816.236	27.742	0.071	0.101	0.011
62211	586684.910	3529826.668	27.646	0.079	0.104	0.009
62212	586684.029	3529837.523	27.660	0.070	0.093	0.008
62213	586682.838	3529848.695	27.535	0.063	0.089	0.009
62214	586681.798	3529859.906	27.486	0.070	0.100	0.011
62215	586680.866	3529870.607	27.406	0.056	0.079	0.008
62216	586679.734	3529881.710	27.403	0.071	0.100	0.011

62217	586678.796	3529892.387	27.288	0.063	0.090	0.010
62218	586677.801	3529902.857	27.227	0.063	0.090	0.010
62219	586676.470	3529917.304	27.065	0.056	0.080	0.008
62220	586675.397	3529927.718	26.993	0.071	0.100	0.011
62221	586674.459	3529938.138	26.941	0.059	0.079	0.007
62222	586672.858	3529951.992	26.843	0.063	0.090	0.010
62223	586671.848	3529962.323	26.785	0.071	0.100	0.011
62224	586670.817	3529972.582	26.654	0.067	0.075	0.007
62225	586669.622	3529983.111	26.616	0.058	0.082	0.009
62226	586668.643	3529993.663	26.500	0.056	0.079	0.008
62227	586667.185	3530007.891	26.301	0.077	0.103	0.009
62228	586666.274	3530018.373	26.257	0.060	0.079	0.007
62229	586665.373	3530028.819	26.069	0.079	0.105	0.009
62230	586664.404	3530039.119	25.988	0.061	0.081	0.007
62231	586663.564	3530049.881	25.842	0.062	0.082	0.007
62232	586662.555	3530060.521	25.806	0.082	0.092	0.008
62233	586661.586	3530071.286	25.608	0.072	0.089	0.009
62234	586660.576	3530081.719	25.501	0.063	0.090	0.010
62235	586659.373	3530092.440	25.324	0.056	0.080	0.008
62236	586658.206	3530103.345	25.215	0.080	0.098	0.010
62237	586657.091	3530114.442	25.048	0.080	0.099	0.010
62238	586655.973	3530125.337	24.934	0.072	0.089	0.009
62239	586654.876	3530136.668	24.754	0.081	0.100	0.010
62240	586653.743	3530147.566	24.606	0.073	0.090	0.009
62241	586652.815	3530158.398	24.495	0.065	0.080	0.008
62242	586651.854	3530169.506	24.301	0.073	0.091	0.009
62243	586650.847	3530180.287	24.170	0.065	0.080	0.008
62244	586649.778	3530190.936	23.962	0.065	0.081	0.008
62245	586648.870	3530201.595	23.871	0.082	0.102	0.011
62246	586647.846	3530212.027	23.734	0.083	0.102	0.011
62247	586646.863	3530222.385	23.582	0.074	0.092	0.010
62248	586645.747	3530232.624	23.410	0.074	0.092	0.010
62249	586644.749	3530242.984	23.230	0.057	0.080	0.009
62250	586643.474	3530255.332	23.076	0.079	0.100	0.011
62251	586642.503	3530265.562	22.915	0.071	0.090	0.010
62252	586641.596	3530276.117	22.741	0.080	0.101	0.011

62253	586640.480	3530286.403	22.544	0.133	0.089	0.009
62254	586639.619	3530296.664	22.385	0.121	0.081	0.008
62255	586638.551	3530307.119	22.211	0.108	0.072	0.007
62256	586637.501	3530317.518	21.995	0.112	0.075	0.007
62257	586636.490	3530327.896	21.819	0.115	0.077	0.008
62258	586635.469	3530338.188	21.633	0.074	0.092	0.010
62259	586634.470	3530348.454	21.412	0.068	0.097	0.010
62260	586633.698	3530358.618	21.223	0.066	0.081	0.009
62261	586632.122	3530372.657	20.935	0.082	0.101	0.011
62262	586631.097	3530383.008	20.721	0.073	0.090	0.009
62263	586629.922	3530396.939	20.520	0.065	0.080	0.008
62264	586628.768	3530407.359	20.274	0.065	0.080	0.008
62265	586627.692	3530417.841	20.044	0.064	0.091	0.010
62266	586626.846	3530428.119	19.886	0.071	0.101	0.011
62267	586625.738	3530438.704	19.703	0.078	0.105	0.009
62268	586624.531	3530449.029	19.535	0.069	0.077	0.007
62269	586623.553	3530459.576	19.304	0.080	0.107	0.009
62270	586622.609	3530470.209	19.098	0.062	0.083	0.007
62271	586621.506	3530480.498	18.954	0.062	0.084	0.007
62272	586620.507	3530490.940	18.822	0.094	0.106	0.009
62273	586619.546	3530500.915	18.625	0.064	0.078	0.008
62274	586618.667	3530510.913	18.483	0.081	0.100	0.010
62275	586617.683	3530521.036	18.343	0.073	0.090	0.009
62276	586616.727	3530531.704	18.157	0.065	0.080	0.008
62277	586615.861	3530541.835	17.964	0.065	0.080	0.008
62278	586614.873	3530551.974	17.859	0.071	0.101	0.011
62279	586613.917	3530562.228	17.750	0.071	0.101	0.011
62280	586612.746	3530572.649	17.623	0.057	0.081	0.009
62281	586611.790	3530582.958	17.466	0.071	0.101	0.011
62282	586610.773	3530593.230	17.330	0.064	0.091	0.010
62283	586609.677	3530604.176	17.189	0.071	0.101	0.011
62284	586608.715	3530614.949	17.070	0.057	0.081	0.009
62285	586607.680	3530625.398	16.964	0.057	0.081	0.009
62286	586606.671	3530635.889	16.869	0.073	0.089	0.009
62287	586605.621	3530646.378	16.847	0.065	0.080	0.008
62288	586604.227	3530660.522	16.709	0.069	0.078	0.007
62289	586603.147	3530671.042	16.609	0.093	0.105	0.009

62290	586602.047	3530681.688	16.482	0.094	0.106	0.009
62291	586601.036	3530692.412	16.426	0.095	0.107	0.009
62292	586599.462	3530706.400	16.361	0.072	0.097	0.008
62293	586598.610	3530716.521	16.305	0.094	0.106	0.009
62294	586597.898	3530727.205	16.294	0.081	0.100	0.011
62295	586596.736	3530737.829	16.229	0.073	0.090	0.009
62296	586595.848	3530748.614	16.209	0.082	0.101	0.011
62297	586594.768	3530759.422	16.226	0.065	0.080	0.008
62298	586593.549	3530769.942	16.174	0.082	0.101	0.011
62299	586592.447	3530780.516	16.164	0.066	0.081	0.009
62300	586591.528	3530791.095	16.163	0.128	0.088	0.009
62301	586590.408	3530801.924	16.118	0.117	0.080	0.008
62302	586589.551	3530812.935	16.103	0.121	0.083	0.008
62303	586588.261	3530824.157	16.109	0.108	0.074	0.007
62304	586587.151	3530835.153	16.091	0.111	0.076	0.008
62305	586585.851	3530846.229	16.129	0.130	0.089	0.009
62306	586584.890	3530857.079	16.130	0.119	0.079	0.007
62307	586583.853	3530867.889	16.093	0.084	0.095	0.008
62308	586583.165	3530878.452	16.118	0.105	0.070	0.006
62309	586582.108	3530889.221	16.082	0.086	0.097	0.008
62310	586581.082	3530899.953	16.070	0.075	0.085	0.007
62311	586579.861	3530910.577	16.087	0.063	0.085	0.007
62312	586578.902	3530921.618	16.096	0.057	0.081	0.009
62313	586577.834	3530932.695	16.112	0.071	0.101	0.011
62314	586576.610	3530943.741	16.117	0.057	0.081	0.009
62315	586575.356	3530954.547	16.107	0.072	0.102	0.011
62316	586574.267	3530965.678	16.097	0.065	0.092	0.010
62317	586573.485	3530976.571	16.186	0.082	0.101	0.011
62318	586572.464	3530987.326	16.154	0.113	0.078	0.008
62319	586571.579	3530998.256	16.184	0.118	0.081	0.008
62320	586570.654	3531009.423	16.194	0.105	0.073	0.007
62321	586569.680	3531020.556	16.162	0.124	0.086	0.009
62322	586568.567	3531031.648	16.176	0.127	0.088	0.009
62323	586567.628	3531042.545	16.159	0.114	0.078	0.008
62324	586566.410	3531053.474	16.144	0.147	0.102	0.010
62325	586565.202	3531064.298	16.167	0.149	0.103	0.010

62326	586564.267	3531075.074	16.184	0.135	0.093	0.009
62327	586563.356	3531085.701	16.160	0.121	0.083	0.008
62328	586562.188	3531096.341	16.127	0.138	0.095	0.010
62329	586561.152	3531107.100	16.203	0.123	0.085	0.009
62330	586560.128	3531117.551	16.116	0.075	0.094	0.010
62331	586558.999	3531128.194	16.161	0.129	0.089	0.009
62332	586558.054	3531138.928	16.082	0.124	0.083	0.007
62333	586557.073	3531149.675	16.095	0.110	0.074	0.006
62334	586555.968	3531160.570	16.077	0.152	0.102	0.009
62335	586554.725	3531171.184	16.064	0.118	0.079	0.007
62336	586553.651	3531182.145	16.026	0.159	0.107	0.009
62337	586552.470	3531192.823	16.052	0.098	0.112	0.010
62338	586551.413	3531203.799	16.060	0.072	0.102	0.011
62339	586550.243	3531214.857	16.052	0.065	0.092	0.010
62340	586549.144	3531225.900	16.104	0.057	0.081	0.009
62341	586547.954	3531236.831	16.090	0.072	0.102	0.011
62342	586546.956	3531248.067	16.089	0.072	0.102	0.011
62343	586546.036	3531259.228	16.085	0.072	0.102	0.011
62344	586544.933	3531270.276	16.102	0.058	0.082	0.009
62345	586543.773	3531281.595	16.081	0.066	0.093	0.010
62346	586542.730	3531292.803	16.082	0.060	0.081	0.007
62347	586541.677	3531304.436	16.133	0.079	0.108	0.009
62348	586540.449	3531315.836	16.115	0.080	0.109	0.009
62349	586539.528	3531327.436	16.103	0.072	0.097	0.008
62350	586538.476	3531338.823	16.145	0.082	0.111	0.010
62351	586537.454	3531349.791	16.129	0.064	0.086	0.007
62352	586536.549	3531360.977	16.122	0.073	0.104	0.011
62353	586535.369	3531371.900	16.162	0.073	0.104	0.011
62354	586534.314	3531383.139	16.141	0.081	0.102	0.011
62355	586533.137	3531394.272	16.162	0.073	0.092	0.010
62356	586532.056	3531405.515	16.146	0.082	0.103	0.011
62357	586530.832	3531417.009	16.146	0.113	0.079	0.008
62358	586529.713	3531428.593	16.116	0.117	0.082	0.008
62359	586528.735	3531439.856	16.141	0.105	0.073	0.007
62360	586527.633	3531451.261	16.133	0.123	0.086	0.009
62361	586526.480	3531462.591	16.124	0.126	0.088	0.009
62362	586525.457	3531473.928	16.134	0.128	0.090	0.009

62363	586524.321	3531485.170	16.101	0.087	0.106	0.011
62364	586523.318	3531496.384	16.104	0.087	0.106	0.011
62365	586522.203	3531507.703	16.072	0.070	0.086	0.009
62366	586521.010	3531518.845	16.052	0.074	0.084	0.007
62367	586519.661	3531530.072	16.081	0.075	0.085	0.007
62368	586518.688	3531540.907	16.075	0.081	0.110	0.010
62369	586517.672	3531551.627	16.081	0.083	0.095	0.008
62370	586516.522	3531562.588	16.104	0.086	0.098	0.008
62371	586515.530	3531573.055	16.067	0.075	0.086	0.007
62372	586514.643	3531583.564	16.088	0.087	0.099	0.009
62373	586513.386	3531594.225	16.105	0.077	0.088	0.008
62374	586512.474	3531605.483	16.057	0.078	0.088	0.008
62375	586511.397	3531616.179	16.022	0.075	0.102	0.009
62376	586510.503	3531626.627	16.001	0.085	0.116	0.010
62377	586509.497	3531637.333	16.056	0.067	0.091	0.008
62378	586508.474	3531647.697	16.066	0.076	0.093	0.010
62379	586507.372	3531658.483	16.027	0.099	0.070	0.007
62380	586506.282	3531669.121	16.050	0.133	0.094	0.010
62381	586505.463	3531680.128	16.046	0.060	0.085	0.009
62382	586504.560	3531690.811	16.055	0.060	0.085	0.009
62383	586503.614	3531701.572	16.073	0.060	0.085	0.009
62384	586502.485	3531712.564	16.050	0.082	0.104	0.011
62385	586501.434	3531723.747	16.043	0.127	0.090	0.009
62386	586500.338	3531734.884	16.048	0.131	0.093	0.009
62387	586499.375	3531745.914	16.055	0.134	0.095	0.010
62388	586498.228	3531756.893	16.110	0.137	0.097	0.010
62389	586496.946	3531768.022	16.071	0.140	0.099	0.010
62390	586495.907	3531778.928	16.043	0.127	0.090	0.009
62391	586494.890	3531789.789	16.074	0.129	0.092	0.009
62392	586493.589	3531801.295	16.017	0.116	0.082	0.008
62393	586492.691	3531812.590	16.029	0.148	0.105	0.011
62394	586491.559	3531824.126	16.072	0.134	0.095	0.010
62395	586490.579	3531834.895	16.093	0.150	0.107	0.011
62396	586489.525	3531845.548	16.081	0.151	0.108	0.011
62397	586488.452	3531856.131	16.069	0.083	0.105	0.011
62398	586487.533	3531866.918	16.084	0.067	0.085	0.009

62399	586486.017	3531881.213	16.073	0.139	0.097	0.008
62400	586484.980	3531892.119	16.085	0.090	0.117	0.010
62401	586483.969	3531903.046	16.129	0.107	0.139	0.012
62402	586482.917	3531913.725	16.109	0.151	0.105	0.009
62403	586481.895	3531924.583	16.127	0.138	0.096	0.008
62404	586480.822	3531935.350	16.095	0.162	0.113	0.010
62405	586479.276	3531949.833	16.123	0.132	0.094	0.010
62406	586477.812	3531964.680	16.142	0.130	0.093	0.010
62407	586476.410	3531979.456	16.087	0.145	0.104	0.011
62408	586475.387	3531990.455	16.113	0.146	0.105	0.011
62409	586474.334	3532001.226	16.118	0.076	0.092	0.010
62410	586473.335	3532012.261	16.145	0.072	0.088	0.010
62411	586472.156	3532023.490	16.123	0.089	0.109	0.012
62412	586471.072	3532034.602	16.058	0.089	0.109	0.012
62413	586469.955	3532045.876	16.086	0.082	0.100	0.011
62414	586468.986	3532057.157	16.039	0.068	0.096	0.010
62415	586467.951	3532068.158	16.034	0.068	0.096	0.010
62416	586466.664	3532079.072	16.050	0.061	0.086	0.009
62417	586465.484	3532092.051	16.047	0.067	0.084	0.009
62418	586464.107	3532104.481	16.083	0.112	0.080	0.008
62419	586463.207	3532114.446	16.120	0.131	0.094	0.010
62420	586462.169	3532125.619	16.076	0.120	0.087	0.009
62421	586461.220	3532136.969	16.101	0.080	0.097	0.011
62422	586459.886	3532149.497	16.069	0.116	0.084	0.009
62423	586458.591	3532162.483	16.052	0.105	0.076	0.008
62424	586457.445	3532175.782	16.065	0.068	0.085	0.009
62425	586456.449	3532185.882	16.102	0.128	0.093	0.010
62426	586455.314	3532196.595	16.077	0.084	0.106	0.011
62427	586454.315	3532207.335	16.055	0.075	0.106	0.011
62428	586453.135	3532218.110	16.058	0.068	0.083	0.009
62429	586452.024	3532229.205	16.087	0.086	0.104	0.011
62430	586450.930	3532240.276	16.108	0.086	0.105	0.011
62431	586449.779	3532251.196	16.086	0.078	0.095	0.010
62432	586448.832	3532262.215	16.074	0.087	0.106	0.011
62433	586447.769	3532273.540	16.055	0.079	0.096	0.010
62434	586446.665	3532284.708	16.072	0.061	0.085	0.009
62435	586445.553	3532295.795	16.085	0.061	0.085	0.009

62436	586444.612	3532306.681	16.056	0.068	0.095	0.010
62437	586443.519	3532317.771	16.047	0.075	0.106	0.011
62438	586442.475	3532328.729	16.024	0.075	0.106	0.011
62439	586441.477	3532339.346	16.043	0.068	0.096	0.010
62440	586440.378	3532349.608	16.048	0.061	0.085	0.009
62441	586439.088	3532360.903	16.001	0.061	0.086	0.009

APPENDIX O

Control Survey MVRM Speed Test (Site 61b)

West bound South I-10 Frontage Road at Lobdell

Date & Time 2/28/2014 10:15 AM

Coordinate System U.S. State Plane 1983 **Zone** Louisiana South 1702

Project Datum (NAD 83) **Vertical Datum** (NAVD 88) **Geoid Model** GEOID12A

Coordinate Unit U.S. Survey Foot **Distance Unit** U.S. Survey Foot **Height Unit** U.S. Survey Foot

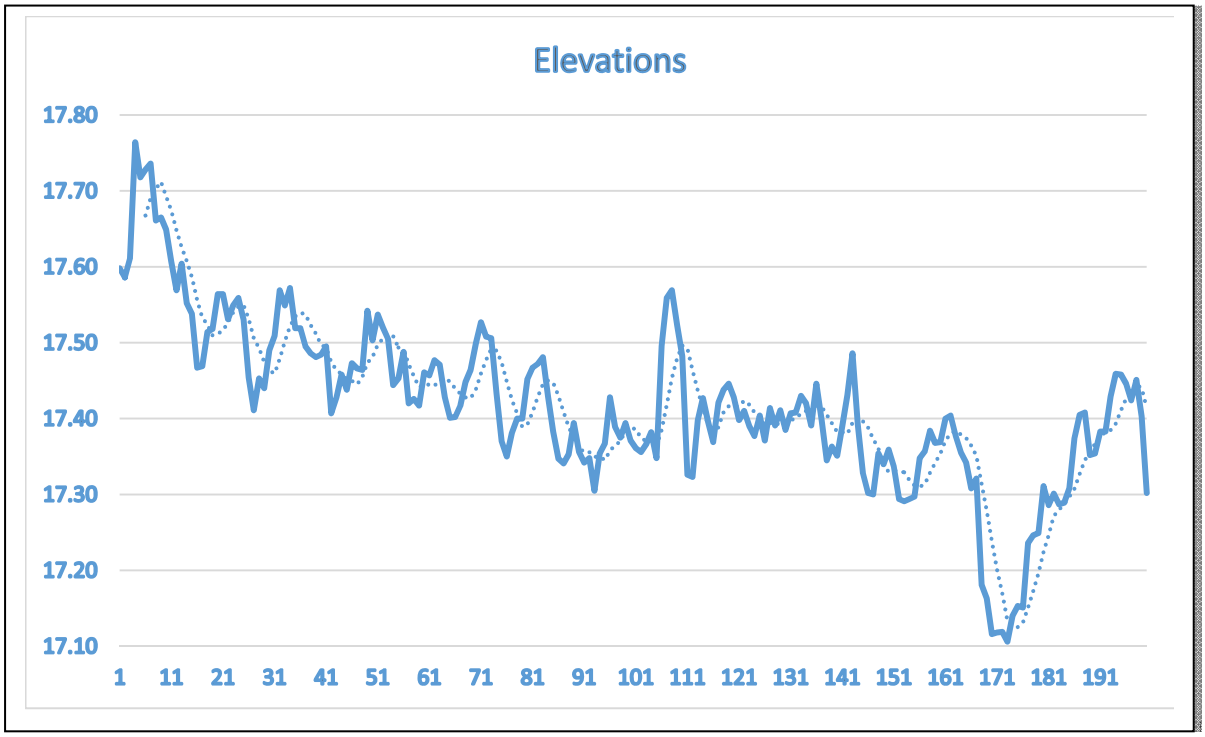
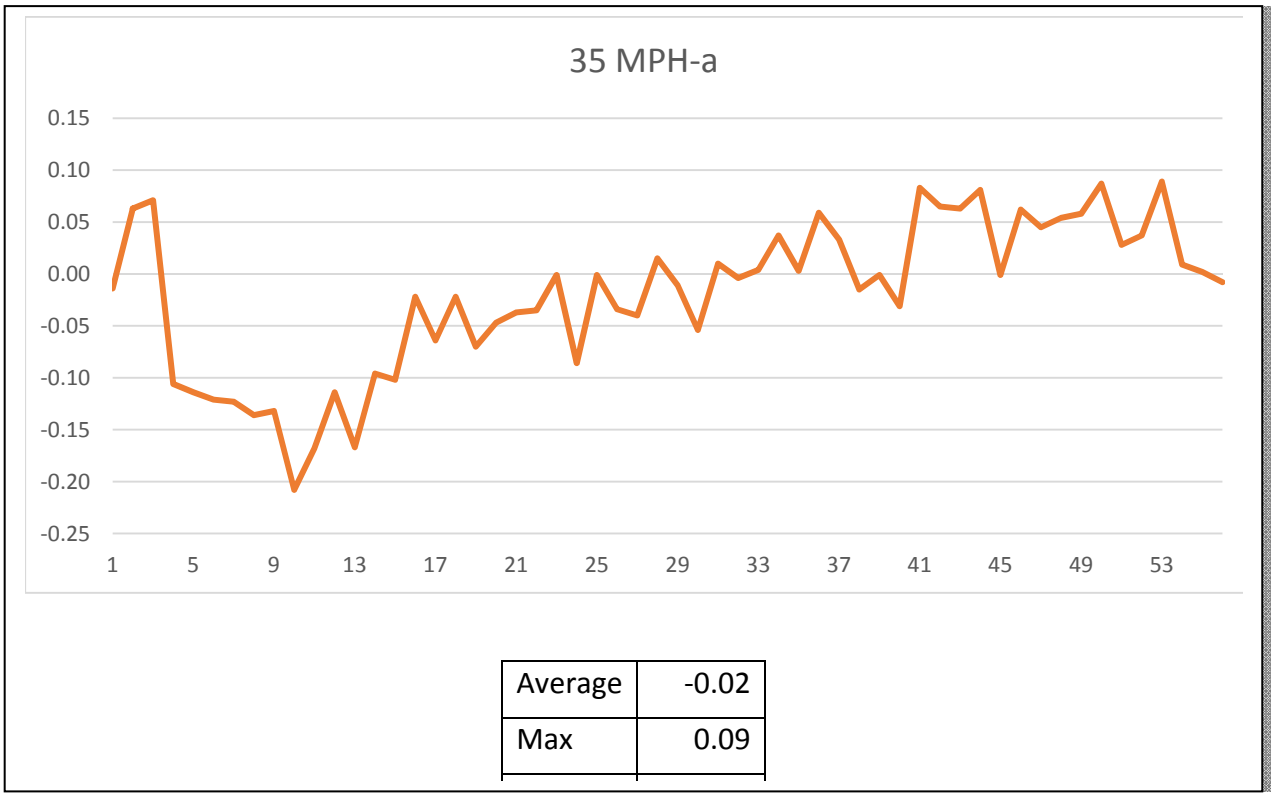
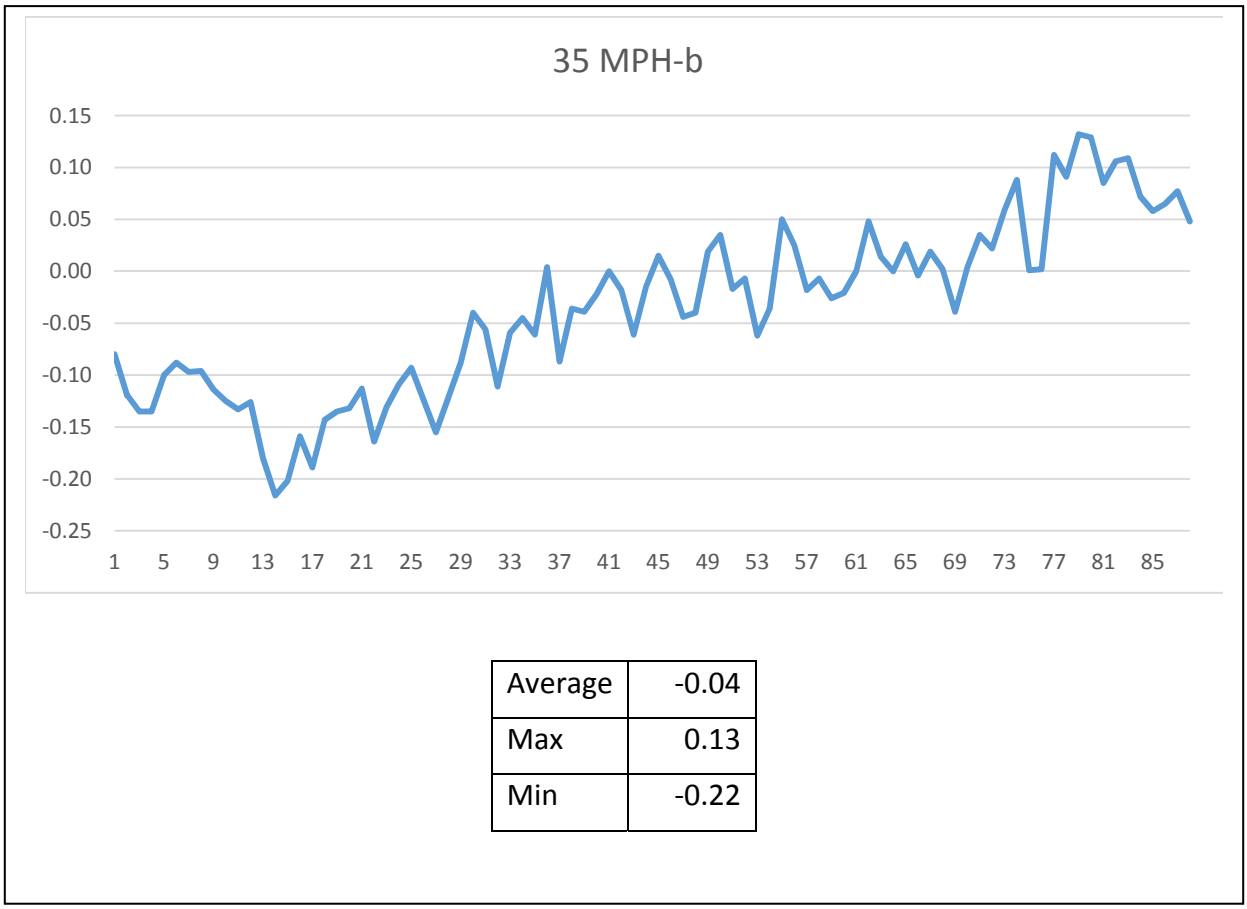


Figure 62
Elevations of MVRM speed test site



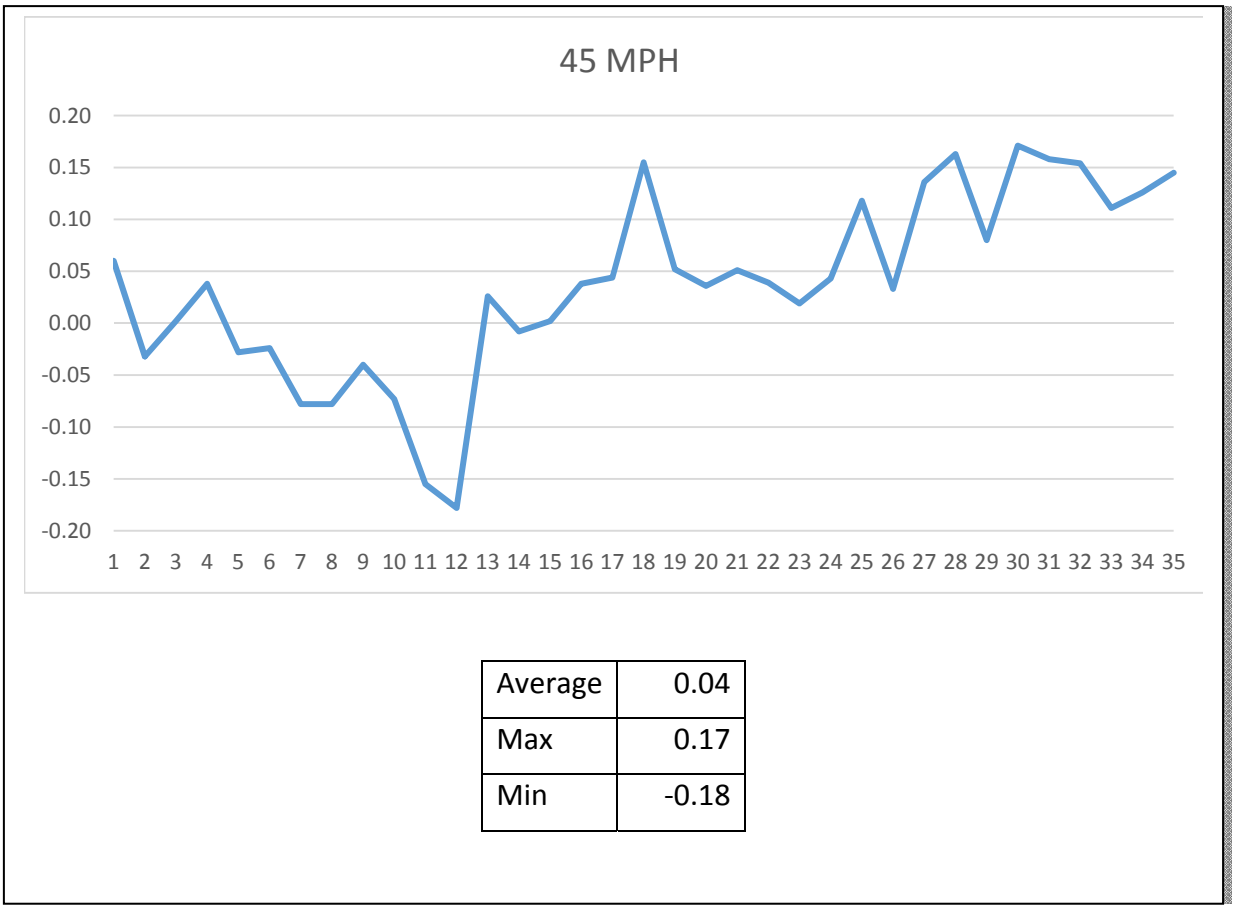
Average	-0.02
Max	0.09

Figure 63
Differences for 35 MPH (first run)



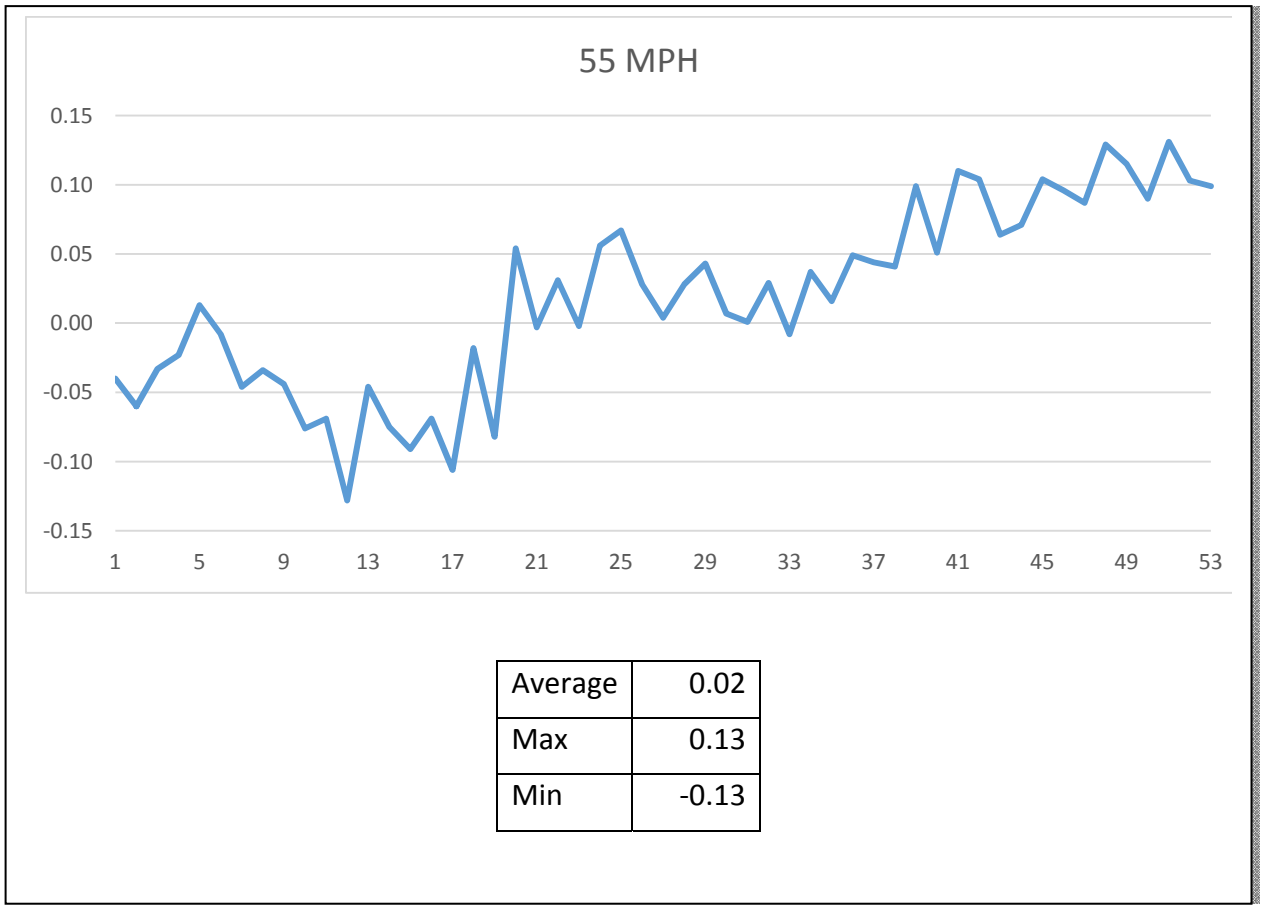
Average	-0.04
Max	0.13
Min	-0.22

Figure 64
Differences for 35 MPH (second run)



Average	0.04
Max	0.17
Min	-0.18

Figure 65
Differences for 45 MPH



Average	0.02
Max	0.13
Min	-0.13

Figure 66
Differences for 55 MPH

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