FINAL REPORT ON GEOPHYSICAL SURVEY SERVICES

WBV-14C. 2 – WESTWEGO TO HARVEY CANAL
WESTWEGO, LOUISIANA

TASK ORDER 0079
CONTRACT NO. W912P8-10-D-0017

DEPARMENT OF ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS

FEBRUARY 2012

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Geotechnical Consultants

Report No. 0017-0079
February 10, 2012

Department of Army
New Orleans District, Corps of Engineers
PO Box 60267
New Orleans
Louisiana 70160-0267

Attention: Mr. Mark Woodward

Draft Report on Geophysical Survey Services
WBV-14c.2 – Westwego to Harvey Canal
Westwego, Louisiana

FFEB JV, L.L.LC. (FFEB) is pleased to present this technical report on geophysical survey services conducted in relation to the WBV-14c.2 Westwego to Harvey Canal project in Westwego, Louisiana. These services were authorized under Task Order 0079 of the existing contract between FFEB and the Department of the Army (Contract No. W912P8-10-D-0017). We performed our services in general accordance with our proposal, dated August 30, 2011 (Proposal No. 0017-0079 Revision No. 01).

This technical report provides a brief summary of our understanding of the project; a description of the geophysical techniques employed; the scope of work conducted and presents the findings of our services.

We appreciate this opportunity of providing geophysical survey services and look forward to working with you throughout this and other exciting projects in the New Orleans area. Please contact the undersigned if you have any questions or comments regarding this report or when we may be of further assistance.

Sincerely
FFEB, JV L.L.C.

for David Valintine, P.G.
Senior Geophysics Manager

Blake E. Cotton, P.E.
Program Director

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EXECUTIVE SUMMARY

This report relates to geophysical survey services conducted in relation to the assessment of the Westwego to Harvey Canal Levee in Westwego, Louisiana. The purpose of this study was to seek to evaluate the possible presence of large pieces of wood and miscellaneous debris (such as concrete, steel, masses of small debris, and other large non-soil objects) within the top portion (upper 3 – 5 ft) of the fill material within the levee and berms using geophysical methods.

The scope of the study encompassed the entire extent of the new levee and flood- and protected-side berms of the Westwego to Harvey Canal levee. This totals an area measuring some 3.2 miles in length and approximately 300 ft in width.

Based on the information made available to FFEB prior to the field exploration, the following geophysical techniques were selected:

- Electromagnetic Mapping (Frequency Domain); and
- Ground Penetrating Radar.

For this survey, a Geonics EM38 Mk2 Ground Conductivity meter was employed to acquire the Electromagnetic Mapping data. The instrument has two receiver coils, spaced 0.5 m and 1.0 m from the transmitter, allowing simultaneous measurements of the subsurface conditions down to approximately 0.75 m (2.5 ft) and 1.5 m (5 ft). Data was collected along a series of profiles, parallel to the centerline of the new levee, at 5-ft centers across the flood-side berm, levee and protected-side berm.

For this survey, we employed a GSSI SIR20 radar system with a 400 MHz antenna, which was set to sample for two-way travel time of 40 ns (nanoseconds). Under the ground conditions expected on site, this was anticipated to equate to a depth penetration between 4 ft and 6 ft. It was noted on site that the Ground Penetrating Radar data acquired during the initial phases of site work (between station 070+00 and 090+00) was of lower than anticipated quality. After conducting off-site data processing and analysis, the decision was made to abort the collection of additional Ground Penetrating Radar data.

From the Electromagnetic Mapping data, it is apparent that the fill material used in the construction of the levee contains some, discrete, isolated anomalies. Through correlation with the limited intrusive information made available to date, it has been noted that the presence of

Anomaly Type 1A and 1B tends to be consistent with the presence of metallic objects within the subsurface has been noted.

With regards to inferring the presence of wooden debris, a relatively lower level of confidence has been obtained as through correlation with the limited intrusive data, both anomalously low and high Quadrature Response anomalies (*Anomaly Types 2A, 2B, 3A and 3B*) can be attributed to such objects. It is also worth noting that several pieces of wooden debris were identified at dig sites that displayed *Anomaly Type 1 and 2*, and therefore the presence of the inferred metallic objects may be masking the presence of *Anomaly Types 2A, 2B, 3A and 3B*.

1.0 INTRODUCTION

1.1 Project Description

We understand that the Department of the Army, New Orleans District Corps of Engineers are in the process of constructing the Westwego to Harvey Canal levee in Westwego, Louisiana. This construction involves a flood-side shift and raising of an existing levee and the construction of both flood- and protected-side levee berms. The extents of this construction are bounded by the New Westwego Pump Station at the westernmost limit and the intersection of the Westminster East-West Levee and the Orleans Village Levee at the easternmost limit. This covers an approximate length of 3.2 miles. The width of the levee and berms is approximately 300 feet.

1.2 Purpose and Scope

The purpose of this study was to seek to evaluate the possible presence of large pieces of wood and miscellaneous debris (such as concrete, steel, masses of small debris, and other large non-soil objects) within the top portion (upper 3 – 5 ft) of the fill material within the levee and berms using geophysical methods.

The scope of the study encompassed the entire extent of the new levee and flood- and protected-side berms of the Westwego to Harvey Canal levee. This totals an area measuring some 3.2 miles in length and approximately 300 ft in width.

Based on the information made available to FFEB prior to the field exploration, the following geophysical techniques were selected:

- Electromagnetic Mapping (Frequency Domain); and
- Ground Penetrating Radar.

It should be noted that the use of geophysical methods to identify utilities and other subsurface discontinuities has limitations and we refer to the attached '*Standard Limitations – Geophysical Survey Services*'.

The methodologies adopted for data acquisition, processing and interpretation, all detailed within this report, have been developed under the supervision of Mr. David Valintine P.G.,

Geophysical Services Manager for Fugro Consultants, Inc. Mr. Valintine's resume is included in Appendix C as testament of his background, education, experience and hence suitability for performing such duties.

1.3 Applicability of Report

The Geophysical Survey services, including data collection, data processing and interpretation presented in this report were selected or developed based on our understanding of the project as described above and in later sections of this report. If pertinent details of the project have changed or otherwise differ from our descriptions, and as additional ground-truth data becomes available, we request that we be notified and engaged to review the changes and to modify our interpretations, if needed.

We have prepared this report exclusively for the Department of the Army, New Orleans District Corps of Engineering. We intend for this report, including all illustrations and appendices, to be used in its entirety as one of many approaches in evaluating the presence for foreign objects within the levee and berms. This report is not intended to be used for any other purpose. Fugro makes no claim or representation concerning any activity or condition falling outside the specified purposes to which this report is directed. The observations, interpretations and conclusions presented in this report may not apply to locations not explored by geophysical techniques conducted for this study. This information should be made available to others for information only, and should not be considered as a warranty of the presence or absence of foreign object within the levee and berms.

2.0 SURVEY RATIONALE

2.1 Overview

In order to design and implement a geophysical survey to fulfill the objectives as outlined above, one must first obtain a conceptual understanding of the anticipated background conditions and the likely nature of the anomalous conditions that will be generated by the target features. Based on this knowledge, geophysical survey technique(s) can then be selected and the appropriate survey configuration(s) determined. The following sections of this report provide an overview of this process that was adopted for this study and provide an overview of the theory behind the geophysical techniques utilized.

2.2 Anticipated Site Conditions

Based on the information provided to FFEB prior to the geophysical survey, it was anticipated that the shallow subsurface soils on site comprise relatively uniform, homogeneous clay-rich material that has been placed and compacted in a series of 6 to 12-inch lifts. It was understood that the levee was up to 15 ft in height, and that the majority of the levee was constructed using fill material imported from offsite borrow pits. It was anticipated that due to the engineered nature, the physical properties (composition, density, porosity, moisture content and chemistry, and hence therefore the electrical properties) of the fill material would be relatively consistent along the entire length and breadth of the levee and berms.

Based on the above understanding developed prior to the field exploration, it was anticipated that the presence of non-soil objects would represent significant perturbations to both the physical properties and the layering within the top portion (upper 3 – 5 ft) of the levee and berms. It was on this understanding that the selection of the Electromagnetic Mapping (Frequency Domain) and Ground Penetrating Radar techniques were selected.

This selection of geophysical techniques is in general agreement with the following references;

- Department of the Army, US Army Corps of Engineers – Engineering Manual 1110-1-1802 *'Geophysical Exploration for Engineering and Environmental Investigations'* – Table 2-1 Decision Matrix of Surficial Geophysical Methods for Specific Investigations; and

- American Society for Testing and Material (ASTM) standard D6429-99(06) 'Standard Guide for Selecting Surface Geophysical Methods' – Table 1 Selection of Geophysical Methods for Common Applications.

2.3 Electromagnetic Mapping (Frequency Domain)

This geophysical technique is based on the principal that when a conductive body is placed in an electromagnetic field, 'eddy currents' are induced within that body. In turn, those 'eddy currents' generate their own, secondary electromagnetic field. The most common parameter deduced from the Electromagnetic Mapping technique is the average bulk conductivity of the subsurface, which is proportional to the ratio of primary and secondary electromagnetic field strengths. This is known as the Quadrature response and is expressed in terms of milli-Seimens per meter.

A second parameter that is usually inferred is the In-Phase response which is related to the difference in the phase of the primary and secondary electromagnetic fields. This measurement is commonly associated with the presence of metallic features within the subsurface, which cause the secondary field to be "out of phase" with the primary field, resulting in non-zero in-phase responses, which are measured in parts per thousand.

For this survey, a Geonics EM38 Mk2 Ground Conductivity meter was employed, which generates a 14.6 kHz electromagnetic field. The instrument has two receiver coils, spaced 0.5 m and 1.0 m from the transmitter, allowing simultaneous measurements of the subsurface conditions down to approximately 0.75 m (2.5 ft) and 1.5 m (5 ft). Further information relating to the Geonics EM38 Mk2 can be provided upon request.

Data from the Electromagnetic Mapping technique is typically acquired along a series of closely spaced profiles and presented as a series of contour plots. From these contour plots, the plan extents of any anomalies can be inferred. Estimates regarding the depth of the causative features of these anomalies are limited to the sampling depth of the equipment (i.e. within 2.5 ft or 5 ft of the ground surface for the Geonics EM38 Mk2).

It was anticipated that the presence of non-soil objects within the shallow subsurface would represent a perturbation to an otherwise uniform average bulk conductivity distribution (Quadrature response). The nature of this perturbation would be dependent upon the characteristics and dimensions of the non-soil object. For example, the presence of dry wood,

mass concrete or masonry are likely to represent relative insulators within the subsurface and, given sufficient object dimensions, would therefore manifest as anomalies with relatively low Quadrature response values. In contrast, metallic objects (including reinforced concrete) and saturated objects are likely to represent conductors and, given sufficient object dimensions, would therefore manifest as anomalies with relatively high Quadrature response values. It was also anticipated that inferring the presence of metallic objects and their differentiation with non-metallic objects could also be achieved through analysis of their respective In-Phase responses.

2.4 Ground Penetrating Radar

This geophysical technique utilizes a short duration, high frequency electromagnetic impulse that is transmitted into the subsurface. Whenever a contrast in dielectric properties of the subsurface is encountered, some of the transmitted impulse is reflected back to the surface. The strength of the reflected signal is proportional to the magnitude of the contrast in dielectric properties. The propagation (and reflection) of the radar impulse depends on the properties of the subsurface and is greatly influenced by the moisture content and the presence of clay-rich minerals. In general, the depth penetration and resolution of the data is largely dependent upon the conductivity and moisture content of the ground. An increase in depth penetration and resolution is generally expected within dry, electrically resistive ground.

The other factor that influences the depth penetration and resolution of the data is the frequency of the impulse. Low frequency radar impulses are generally attenuated less by the electrical properties, and therefore penetrate to greater depths. However, with this increase in depth penetration comes a decrease in resolution. For example, a 400 MHz antenna may sample to a depth of 4 to 6 ft (under ideal ground conditions) with a resolution suitable for detecting utilities, services (etc), but a 1500 MHz antenna will only sample to 1 to 2 ft, with a vertical and lateral resolution suitable for detecting small diameter reinforcement.

For this survey, we employed a GSSI SIR20 radar system with a 400 MHz antenna, which was set to sample for two-way travel time of 40 ns (nanoseconds). Under the ground conditions expected on site, this was anticipated to equate to a depth penetration between 4 ft and 6 ft.

Ground Penetrating Radar data is generally acquired along individual traverses or profiles. The resulting radargram recorded along each profile is in the form of a pseudo-depth section, with the horizontal axis denoting distance and the vertical axis denoting the two-way travel time.

This two-way travel time can be converted to an estimated depth, if the dielectric properties of the subsurface are known. Anomalous features within the radargrams can be identified as both changes in the reflection amplitude and appearance. The locations and approximate depths of these features are then transposed onto plans of the survey area, from which interpretations regarding the subsurface conditions can be inferred.

It was anticipated that the presence of a non-soil object might manifest in the Ground Penetrating Radar data as a variation in reflection amplitude (due to contrasting properties) and / or a discrete reflection (due to the limited lateral extent of the non-soil object with respect to the anticipated layering / homogeneous nature of the fill material).

3.0 FIELD EXPLORATION

3.1 Geophysical Survey Design

For both the Electromagnetic Mapping and Ground Penetrating Radar techniques, data was collected along a series of profiles, parallel to the centerline of the new levee, at 5-ft centers. It was anticipated that the sampling footprint (the lateral extent of the subsurface sampled) of both techniques would extend of the order of 12 to 18 inches from the centerline of the profile. Although this means that 100% coverage of the subsurface has not been obtained, the extent of the un-sampled subsurface is relatively small in comparison to the anticipated dimensions of the target features being sought. For example, a non-soil object (with dimensions of the order of 12 inches in diameter and 2 – 3 ft in length) would need to be located parallel to, and at the mid-point of, two adjacent profiles to not be sampled.

3.2 Electromagnetic Mapping

The Electromagnetic Mapping data was collected on foot at a moderate walking pace. A sampling rate of 5 Hz was selected, which equates to readings being acquired every 0.5 – 0.8 ft along each profile. At the start of each day of data collection and after replacing the batteries, nulling (to maintain a time-invariant instrument response) and on site calibration of the equipment was performed at pre-selected control stations.

Temporary survey grids were laid out on site using survey markers (installed by others) along the levee centerline. A series of individual survey grids, each 400 ft in length, were acquired with each grid overlapping the adjacent grids by at least 10 ft. This overlap between adjacent grids allowed the individual girds of data to be knitted together to form a single continuous data sets.

3.3 Ground Penetrating Radar

The Ground Penetrating Radar data was collected by mounting the antenna to the underside of a 4-wheel drive vehicle. A series of parallel profiles were then acquired by driving at a slow speed (<5 mph) up and down the levee. Sampling along each of the profiles was controlled by the use of an odeomteter wheel mounted on the rear of the vehicle.

3.4 Spatial Control

During the collection of the geophysical data, a differential Global Positioning System (dGPS) system utilizing a sub-meter OmniStar correction was employed. Positional data from this system was fed directly into both the Electromagnetic Mapping and Ground Penetrating Radar survey equipment and simultaneous with the geophysical data.

The geodetic survey parameters that were used for the collection and post-processing of the spatial data acquired with the dGPS system are summarized in Table 1 below.

Table 1 - Geodetic Survey Parameters	
Global Positioning System	
Datum	WGS 1984
Ellipsoid	WGS 1984
Local Datum (applied during post-processing)	
Datum	NAD 1983
Ellipsoid	Geoid09 (CONUS)
Local Projection (applied during post-processing)	
Grid System	NAD83 State Plane – Louisiana South (FIPS 1702)
Units	US Survey Feet

3.5 Scope of Work Completed

All site works and data acquisition were completed under the supervision of Mr. D. Valintine of Fugro between September 12 and September 29, 2011. Detailed Field Activity Logs, which were submitted on a daily basis, have been included in Appendix A of this report.

Reasonable efforts were made to schedule site work activities so as not to conflict with the contractors construction activities. However, due to the active nature of the survey area (the levee and berms were still under construction during data collection), complete, uninterrupted coverage of the levee and berms was not possible. Notably, localized and discrete areas of stockpiled fill material over 5 ft in height were present on the protected-side berms near stations 008+80, 009+50, 011+80, 019+60, 029+50, 039+60 and 049+50 and data was not collected in

these areas. A much larger and more extensive area of stockpiled material also covered the majority of the protected-side berm between stations 108+00 and 110+50.

Other surface features, associated with the contractors' on-going construction activities, were present between stations 057+00 and 067+00 (in close proximity to the site entrance from Lapalco Blvd), which also hindered data collection across the full extent of the protected-side berm.

Electromagnetic Mapping data was acquired across entire study area, from station 001+00 through to 110+50, and station 120+00 through to 182+50. These extents are denoted by the presence of sheet pile walls associated with the New Westwego Pump Station, the Westminster Pump Station and the sheet pile wall that connected the most eastern reach of the levee with the adjacent New Orleans Village levee.

It was noted on site that the Ground Penetrating Radar data acquired during the initial phases of site work (between station 070+00 and 090+00) was of lower than anticipated quality. After conducting off-site data processing and analysis, the decision was made to abort the collection of additional Ground Penetrating Radar data. The data processing and analysis, along with a more detailed overview of the data that was acquired is discussed in more detail later in this report.

4.0 GEOPHYSICAL DATA PROCESSING AND PRESENTATION

4.1 Overview

The following sections of this report detail the data processing regimes applied, and the presentation of the geophysical data collected during the field exploration.

4.2 Electromagnetic Mapping

The following outlines the processing sequence that was applied to the Electromagnetic Mapping data:

- **File download and conversion**: binary data files recorded by the data logger onsite were downloaded and transferred onto a laptop PC. These files, containing both the EM38 and dGPS data were converted to an ASCII format using the DAT38 software package from Geonics Limited;
- **Database development**: the ASCII files were then imported into individual databases in Geosoft's Oasis montaj environment;
- **Translation and correction of dGPS data**: the recorded WGS84 latitudes and longitudes were converted into eastings and northings in NAD83 Louisiana South (FIPS 1702) coordinate system. Lag and offset corrections were then applied to all of the GPS data to account for: the lateral offset between the dGPS antenna and the EM38; the offset between the dGPS antenna and the midpoint of both the 0.5 m and 1.0 m coil separations; and the latency of the dGPS measurements (determined from field-based quality control tests);
- **Gridding of individual survey grids**: the measured Quadrature and In-Phase responses recorded with the 0.5 m and 1.0 m coil separations were then individually gridded and plotted as contour plots. After an initial review of these individual survey grids, erroneous data was selectively deleted;
- **Compilation of individual survey grids**: all of the individual survey girds were then "knitted" together to form a single plot for the Quadrature and In-Phase responses recorded with the 0.5 m and 1.0 m coil separations. A suitable color scale was then adopted to highlight the range of values recorded. In all instances, green and yellow shading typically denotes the assumed background conditions, with blue shading

denoting the lowest recorded values, and red and pink shading denoting the highest recorded values.

Upon completion of the data processing, the vast majority of the Electromagnetic Mapping data is considered to be of acceptable quality. Interpretations derived from the datasets are discussed in more detail later in this report.

4.3 Ground Penetrating Radar Data

The following outlines the processing sequence that was applied to the Ground Penetrating Radar data:

- **Database development, Translation and correction of dGPS data**: the recorded WGS84 latitudes and longitudes were imported into a database in Geosoft's Oasis montaj environment, and converted into eastings and northings in NAD83 Louisiana South (FIPS 1702) coordinate system. Lag and offset corrections were then applied to all of the GPS data to account for: the lateral offset between the dGPS antenna and the Ground Penetrating Radar antenna and the latency of the dGPS measurements (determined from field-based quality control test);
- **Plotting of Profile Locations**: from the converted eastings and northings, a schematic scaled drawing of the locations and extents of the individual Ground Penetrating Radar profiles was plotted. These profiles were also annotated with distance increments to match the distance measured along each profile with the odeometer wheel used for data acquisition;
- **Processing of the Ground Penetrating Radar data**: basic processing was applied to the Ground Penetrating Radar data using the GSSI Radan XP data collection and processing software. Processing steps included the application of high and low pass filtering (to reduce any noise present in the data), and the use of a surface normalization deconvolution subroutine (in an attempt to normalize the arrival time of the surface reflection and reduce the influence of reverberating reflections);
- **Analysis of individual Ground Penetrating Radar profiles**: each of the Ground Penetrating Radar profiles was then individually analyzed. It was anticipated that the presence of any anomalous reflections (both in terms of reflection amplitude and appearance) would then be plotted on the aforementioned plans.

As previously mentioned, after processing and analyzing the Ground Penetrating Radar data collected between station 070+00 and 090+00, it was decided to abort the Ground Penetrating Radar component of the geophysical survey. From the data that was acquired, it was noted that the radargrams were dominated by the presence of low amplitude, continuous, reverberating reflections. Even after applying the surface normalization and deconvolution subroutines outlined above, the processed data still did not display any significant improvement in quality. In some instances, localized, discrete reflections were observed within the processed data. However, through correlation with on site observations and notes recorded during data acquisition, the occurrences of all of these anomalies were correlated with features on the ground surface, which hence precludes their association with possible subsurface features.

As outlined in our proposal and section 2.4 of this report, the depth penetration and resolution of Ground Penetrating Radar data is largely dependent upon the conductivity and moisture content of the ground. It is thought that the fill materials used on this levee are simply too conductive and / or contain too much moisture for the Ground Penetrating Radar technique to be successful. Prior to the field exploration, the possibility of this was discussed and acknowledged by the Department of Army, New Orleans District Corps of Engineers. The decision to proceed with the Ground Penetrating Radar technique was collaboratively made based on the assumption that these conditions are highly site dependant and it is impractical to be able to predict the success of the technique without acquiring data under the specific on-site conditions.

Due to the above, the subsequent data plots and interpretations contained within this report are based solely on the Electromagnetic Mapping technique.

4.4 Data Presentation

The Electromagnetic Mapping data has been presented on Plates 1 through 7 of this report. The following is a narrative of the various plates;

Plate 1A presents the recorded Quadrature Response recorded between stations 000+00 and 026+00, with the uppermost panel containing the data recorded with the shallower sampling 0.5 m coil separation, and the lower panel containing the data recorded with the deeper sampling 1.0 m coil separation. A suitable color scale has been adopted to highlight the trends

observed in the data. The highest recorded values are shaded pink through orange and the lowest recorded values are shaded dark blue to cyan. The general background conditions across the site are shaded green through yellow.

Plate 1B presented the recorded In-Phase Response, again with the upper and lower panels containing data recorded with the 0.5 m and 1.0 m coil separations. Again, a similar color scale as used for the Quadrature response has been adopted.

Plate 1C presents line work associated with the interpretations of the Electromagnetic Mapping data, which is discussed in more detail in the following section of this report.

A similar sequence of plates (2A, 2B, 2C, 3A, etc…) are provided for the remaining sections of the levee.

For all plates presented in this report, the following base data has been used;

- **Centerline of new levee**: line plot of the levee centerline extracted from drawings provided by the Department of Army, New Orleans District Corps of Engineers (file name WBV-14C2_Plan_C_SP.dxf). Also extracted from this drawing are the line plots of the Perpetual Flood Protection Levee Easement, Limit of Construction and Baseline;
- **Approximate crown and toe of levee**: based on the typical levee section between stations 0+69 to 54+05 and 61+51 to 110+59, extracted from drawings provided by Department of Army, New Orleans District Corps of Engineers (file name WBV-14C2_TypicalSection_C_SC.dxf). It should be noted that between stations 54+05 to 61+51 and 110+59 and 182+00, and across areas that were under construction during the field exploration, the actual location of crown and toe of the levee may vary;
- **Extent of flood- / protected-side berms**: based on the typical levee section between stations 0+69 to 54+05 and 61+51 to 110+59, extracted from drawings provided by Department of Army, New Orleans District Corps of Engineers (file name WBV-14C2_TypicalSection_C_SC.dxf). It should be noted that between stations 54+05 to 61+51 and 110+59 and 182+00, and across areas that were under construction during the field exploration, the actual location and extent of the flood- and protected-side berms may vary;

- **Approximate locations of settlement plates**: based on coordinates provided by the contractor. These settlement plates are understood to be metallic and measure either 2 x 2 ft or 4 x 4ft, and are located at various depths;
- **Centerline stationing**: based on coordinates extracted from ASCII text files provided by Mr. Jeremy George (Department of Army, New Orleans District Corps of Engineers) via emails dated September 20 and September 22, 2011.

5.0 INTERPRETATION OF GEOPHYSICAL PROFILES

The following sections of this report provide an overview of the recorded geophysical data, the various different types of anomalies identified, and the correlation with limited intrusive data that has been made available to date along with an interpretation of the data. As previously mentioned, the Ground Penetrating Radar technique proved to be unsuccessful and therefore the following is based solely on the data collected with the Electromagnetic Mapping technique.

5.1 Overview

From the recorded Quadrature Response (presented on Plates 1A, 2A… through 7A) background average bulk conductivities in the range of 100 to 250 mS/m (milli-Seimens per meter) are observed across the study area. These relatively high values have been attributed to the clay-rich fill material used to construct the levee and berms.

In comparison with our initial expectations of the levee being constructed of homogeneous fill material, the range of values of the background average bulk conductivities is relatively large. In some instances, variations of up to 100 mS/m observed over distances as short as 10 – 20 ft and tend to depict linear regions parallel to the levee centerline. Such variations are likely to be attributable to variations related to the fill material, possibly reflecting the different sources used during construction (i.e. existing levee materials or materials import from offsite borrow pits), or possibly reflecting variations in moisture contents (it was often noted that the levee materials appeared less saturated than the material in the berms, which was presumed to be related to topography of the levee increasing the run off / drainage of any surface water).

Interestingly, similar background values are present in the Quadrature Response for both the shallow and deep datasets (recorded with the 0.5 m and 1.0 m coil separations, respectively), suggesting that these variations in the fill material are relatively shallow (within 2.5 ft of the surface). Finally, it should be noted that these variations within the fill material are only with respect to the measured electrical properties and may not necessarily correlate with significant variations in geotechnical properties.

The net effect of the variation in the background average bulk conductivities is that, to a certain degree, the resolution of the survey data may be reduced. For example, if the range in background values was only of the order of 10 – 20 mS/m, it would be possible to identify

anomalies with a magnitude as small as 15 – 30 mS/m. Therefore, due to the background conditions present at this site, the recorded Quadrature response is only suitable for the detection of the relatively larger subsurface features being sought.

The recorded In-Phase Response has been presented on Plates 1B, 2B… through 7B, and in comparison to the Quadrature response, the background values generally appear to be more uniform and in-line with our initial expectations.

It has been noted in some instances that the In-Phase Response does display a slight striping in the data. For example, between stations 012+00 and 016+00 on the protected side berms there appears to be an alternating pattern of yellow and green shading. These variations are likely to be an artifact of the layout of the survey grids and the individual profiles that were conducted. As the magnitude of these variations is negligible compared to the anomalies within the data (typically +/- 0.1 ppt compared to +/- 0.5 ppt), their presence is considered insignificant and no attempts were made to remove their effect from the data.

Of interest, the presence of the settlement plates has generally manifested within the In-Phase response, which highlights the techniques' ability to detect metallic objects within the subsurface. It has been noted that not all of the settlement plates are present within the data – it is anticipated that where the settlement plates have not been detected, they are likely to be located at elevations lower than the depth of investigation.

5.2 Identification of Electromagnetic Mapping Anomalies

After plotting the recorded Quadrature and In-Phase Responses, the data was reveiwed to identify anomalous features that may be indicative of subsurface non-soil objects. This identification process involved identifying locations that display anomalous Quadrature or In-Phase values, in either the shallow or deep datasets, across areas with lateral extents comparable with that anticipated discrete subsurface non-soil objects (generally less than 10 ft in plan).

In some instances, analogous anomalies were identified in both the shallow and deep datasets. Under such conditions, we can infer that the causative feature is located within 2.5 ft of the survey surface and therefore its presence in the deeper dataset was disregarded. Similarly, where analogous In-Phase and Quadrature Response anomalies were identified, the presence of the Quadrature Response anomaly was disregarded under the assumption that it is

attributable to the metallic object that generated the anomaly in the In-Phase Response. Finally, numerous anomalies that are present at locations coincident with the settlement plate locations were also disregarded as these features are considered to be known.

The anomalies identified within the Electromagnetic Mapping data have been classified as follows:

- **Anomaly Type 1A**: regions displaying anomalously high or low In-Phase Response in the shallow data set – such anomalies are likely to be indicative of a metallic object, about 2.5 ft below the survey surface;
- **Anomaly Type 1B**: regions displaying anomalously high or low In-Phase Response in the deep data set – such anomalies are likely to be indicative of a metallic object about 2.5 to 5 ft below the survey surface;
- **Anomaly Type 2A**: regions displaying anomalously high Quadrature Response in the shallow data set – such anomalies are likely to be indicative of a non-metallic, conductive feature within about 2.5 ft below the survey surface;
- **Anomaly Type 2B**: regions displaying anomalously high Quadrature Response in the deep data set – such anomalies are likely to be indicative of a non-metallic, conductive feature between about 2.5 to 5 ft below the survey surface;
- **Anomaly Type 3A**: regions displaying anomalously low Quadrature Response in the shallow data set – such anomalies are likely to be indicative of a relatively resistive feature, within about 2.5 ft below the survey surface;
- **Anomaly Type 3B**: regions displaying anomalously low Quadrature Response in the deep data set – such anomalies are likely to the indicative of a relatively resistive feature, between about 2.5 to 5 ft below the survey surface.

The locations of all the different anomaly types identified within the data have been presented on Plates 1C, 2C … through 7C.

5.3 Correlation of Geophysical and Limited Intrusive Data

During the field exploration, 10 (ten) dig sites were explored on site using trenching methods by the contractor. These dig sites were targeted on anomalies identified during the preliminary on-site analysis of the Electromagnetic Mapping data. The findings from these dig sites were

summarized in a Department of the Army, New Orleans District Corps of Engineers field report, which was provided to FFEB and is included in Appendix B of this report.

From the field report, it has been noted that metallic objects were found at shallow depths at four of the ten digs sites (dig sites 5, 8, 9 and 10). Through correlation with the Electromagnetic Mapping anomalies, the locations of these dig sites are all coincident with *Anomaly Type 1A or 1B*. This confirms the interpretation of this anomaly type being associated with metallic objects within the subsurface.

Dig site 4 revealed the presence of a broken piece of the side wall of a concrete drain pipe, which correlates with the occurrence of an Anomaly Type 3A (indicative of a relatively resistive feature). In comparison to the surrounding clayey fill material, the concrete is relatively resistive, thus adding further correlation between the inferred causative features (of the different anomaly types) and the ground truth data.

From the remainder of the dig sites, a correlation between the interpretations of the geophysical data and the intrusive data exists, but is not as robust. For example, relatively substantial pieces of wood were recovered from dig sites 1, 2, 3 and two of these locations correlate to *Anomaly Type 3A,* suggesting that such debris constitutes a resistive object within the subsurface. However, a piece of wood was also found at dig site 7, which correlates with the occurrence of Anomaly Type 2B, suggesting that wooden debris constitutes a conductive object within the subsurface. This variation in wooden debris constituting resistive and conductive target is probably attributable to the condition of the wooden debris in question. For example, dry wood is likely to result in a resistive target where as saturated wood is likely to be conductive.

5.4 Summary of Geophysical Data

From the Electromagnetic Mapping data, it is apparent that the fill material used in the construction of the levee contains some, discrete, isolated anomalies. Through correlation with the limited intrusive information made available to date, it has been noted that the presence of *Anomaly Type 1A and 1B* tends to be consistent with the presence of metallic objects within the subsurface has been noted.

With regards to inferring the presence of wooden debris, a relatively lower level of confidence has been obtained as through correlation with the limited intrusive data, both anomalously low

and high Quadrature Response anomalies (*Anomaly Types 2A, 2B, 3A and 3B*) can be attributed to such objects. It is also worth noting that several pieces of wooden debris were identified at dig sites that displayed *Anomaly Type 1 and 2*, and therefore the presence of the inferred metallic objects may be masking the presence of *Anomaly Types 2A, 2B, 3A and 3B*.

Using the geophysical techniques as discussed above, reasonable efforts have been made to identify the presence of buried non-soil objects within the levee and berm fill materials. Although the locations and distributions of the geophysical anomalies may not always appear coherent or continuous, they are indicative of some variation in the properties of the subsurface. Associating such variations with subsurface features is based purely on theoretical judgment, experience gained from similar surveys conducted in the past and with limited intrusive data that has been made available to Fugro. It would be prudent to conduct further intrusive investigation in order to corroborate and statistically verify the associations with the geophysical anomalies developed within this report.

STANDARD LIMITATIONS – GEOPHYSICAL SURVEY SERVICES

The Client should appreciate that the relationship of natural geological features and the geophysical responses from other (man-made and natural) subsurface features (that may be present in the survey area) can be extremely complex. Furthermore, the adopted methodologies have limitations with respect to resolution and depth penetration that may preclude determination of the exact targets being sought.

Any recommendations or opinions expressed in this report are based on our interpretation of recorded geophysical data and should not be construed as absolute fact.

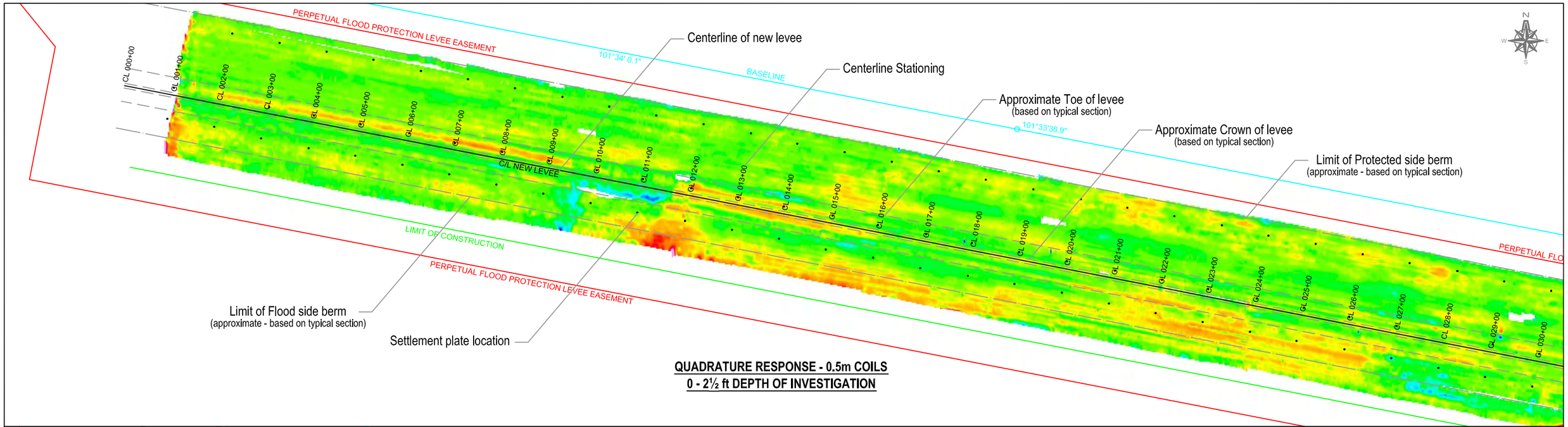
By authorizing this work, the Client acknowledged that they understood and accepted the limitations of our geophysical survey.

We have performed the services specified in this report in a manner consistent with the level of care and skill ordinarily exercised by members of the geophysical profession currently practicing under similar conditions.

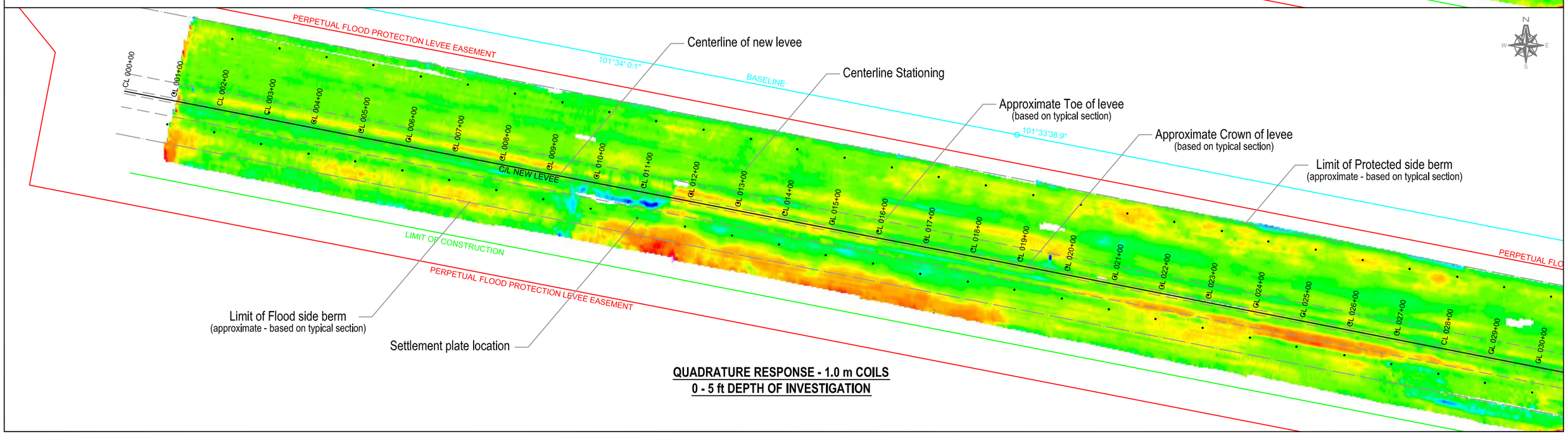
Geophysical data are not meant to be stand-alone; but rather used as an additional tool in evaluating subsurface conditions. It would be prudent to conduct further ground-truthing techniques in order to support geophysical data.

We do not warrant nor guarantee that acquisition, compilation, and analysis of the acquired geophysical data *has fulfilled the aims of the survey*. FFEB will not be held responsible for any damages to the contractor / owner based solely on the findings of this survey.

ILLUSTRATIONS



QUADRATURE RESPONSE - 0.5m COILS
0 - 2½ ft DEPTH OF INVESTIGATION



QUADRATURE RESPONSE - 1.0 m COILS
0 - 5 ft DEPTH OF INVESTIGATION

Scale:

Scale 1" : 200'

0 200 400

Legend:

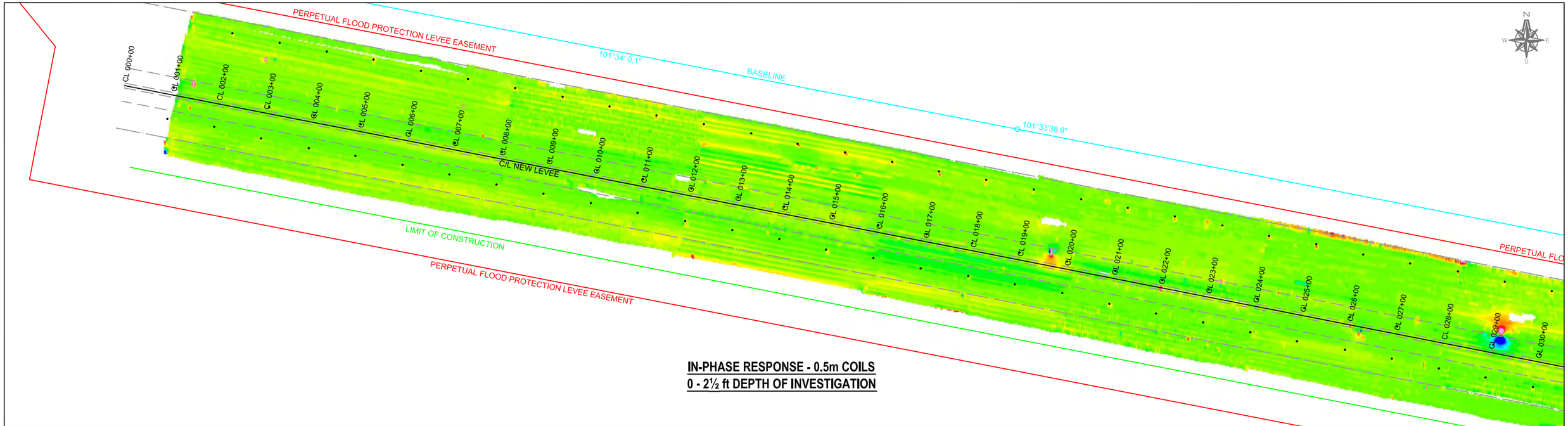
Average Bulk Conductivity (mS/m)

58 73 88 104 127 150 173 196 219 242 265 288 312 335

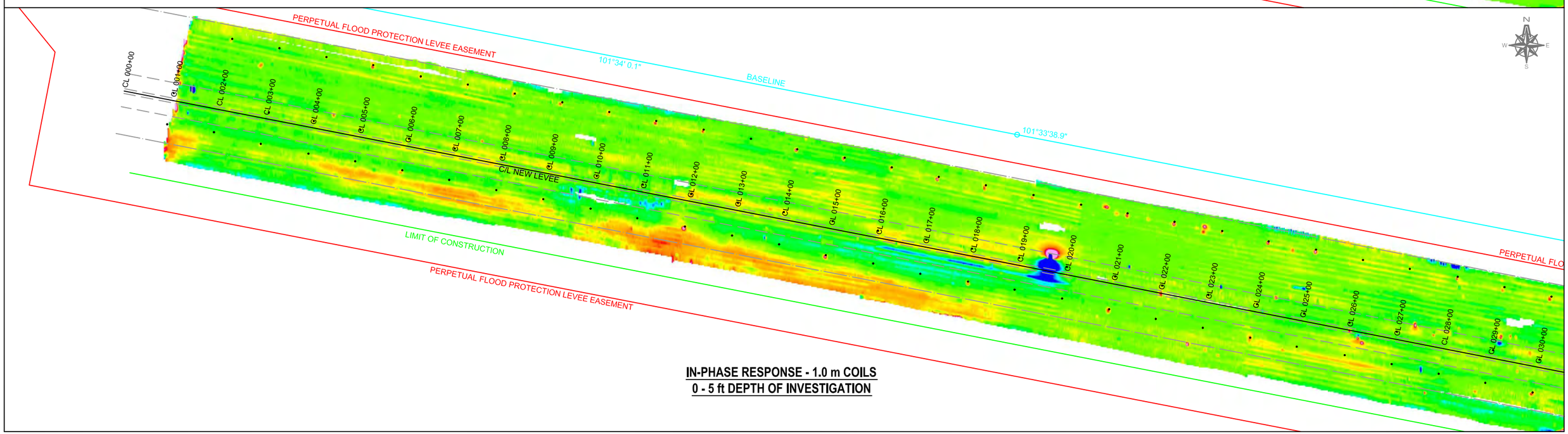
- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- + CL###+## Centerline stationing (data provided by USACE)

ELECTROMAGNETIC MAPPING SURVEY RESULTS - QUADRATURE RESPONSE
WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT
USACE NEW ORLEANS DISTRICT

PLATE 1A



IN-PHASE RESPONSE - 0.5m COILS
0 - 2½ ft DEPTH OF INVESTIGATION



IN-PHASE RESPONSE - 1.0 m COILS
0 - 5 ft DEPTH OF INVESTIGATION

Scale:

Scale 1" : 200'

0 200 400

Legend:

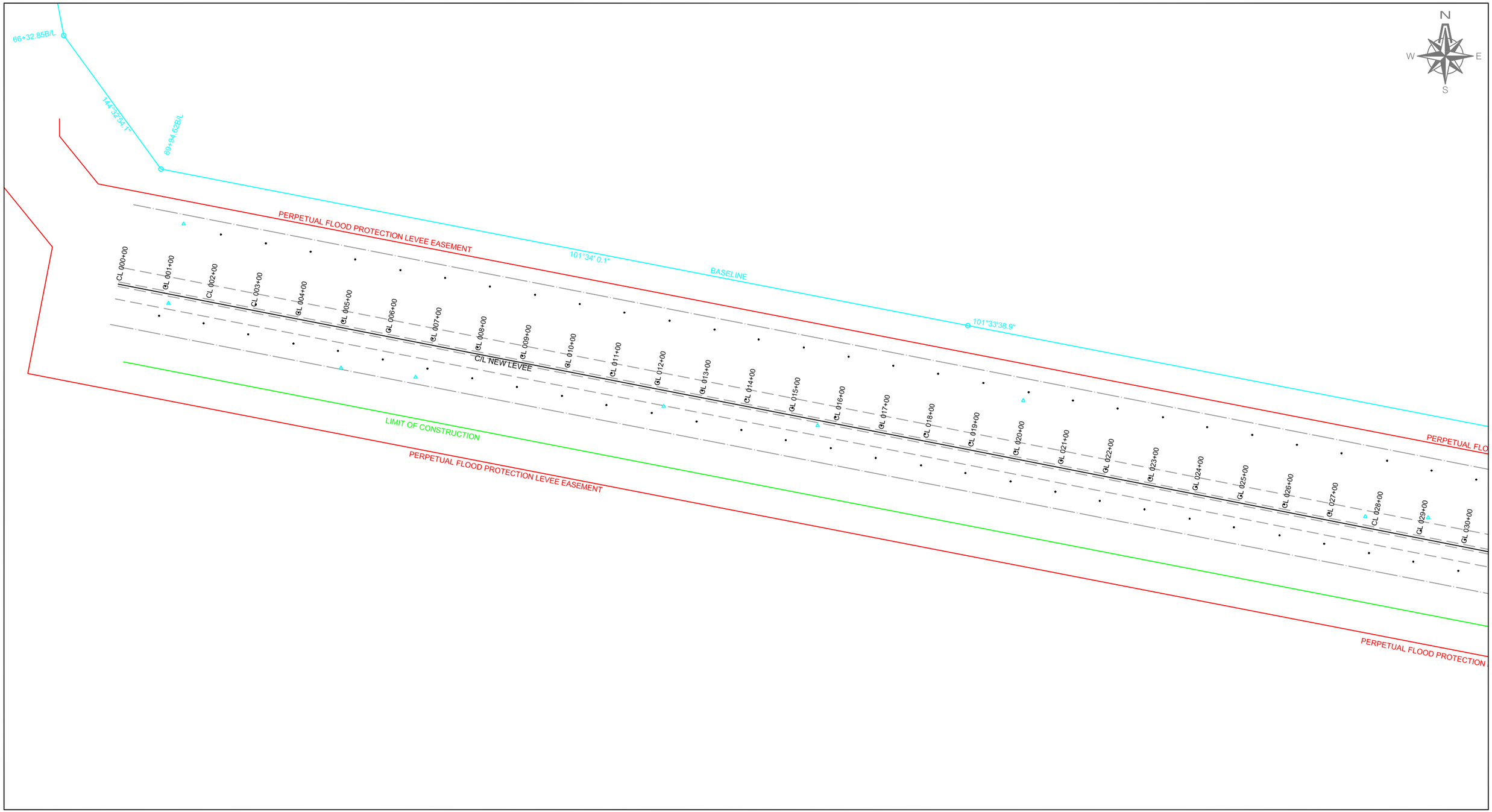
In-Phase Response (ppt)

-1.1 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.1 -0.0 0.1 0.2 0.2 0.3

- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- + CL###+## Centerline stationing (data provided by USACE)

ELECTROMAGNETIC MAPPING SURVEY RESULTS - IN-PHASE RESPONSE
WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT
USACE NEW ORLEANS DISTRICT

PLATE 1B



Scale:

Scale 1" : 200'

0 200 400

Legend:

- Anomaly Type 1A - Inferred metallic target - less than about 2.5 ft depth
- Anomaly Type 1B - Inferred metallic target - about 2.5 to 5 ft depth
- Anomaly Type 2A - Inferred conductive target - less than about 2.5 ft depth
- Anomaly Type 2B - Inferred conductive target - about 2.5 to 5 ft depth
- Anomaly Type 3A - Inferred resistive target - less than about 2.5 ft depth
- Anomaly Type 3B - Inferred resistive target - about 2.5 to 5 ft depth
- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- CL###+## Centerline stationing (data provided by USACE)

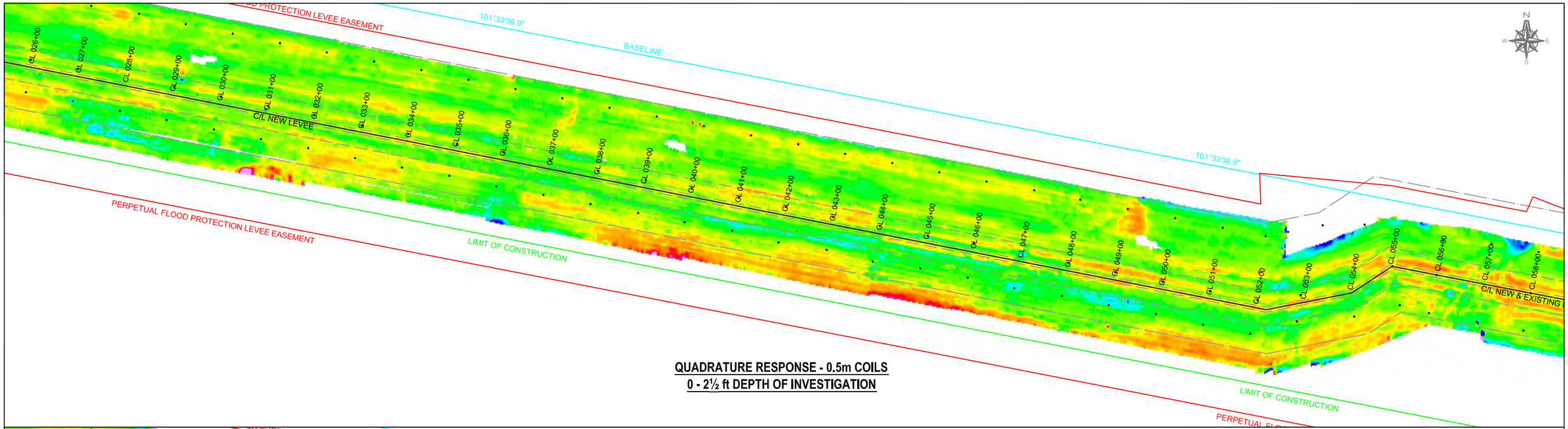
ELECTROMAGNETIC MAPPING SURVEY RESULTS - INTERPRETED ANOMALY LOCATIONS

WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT

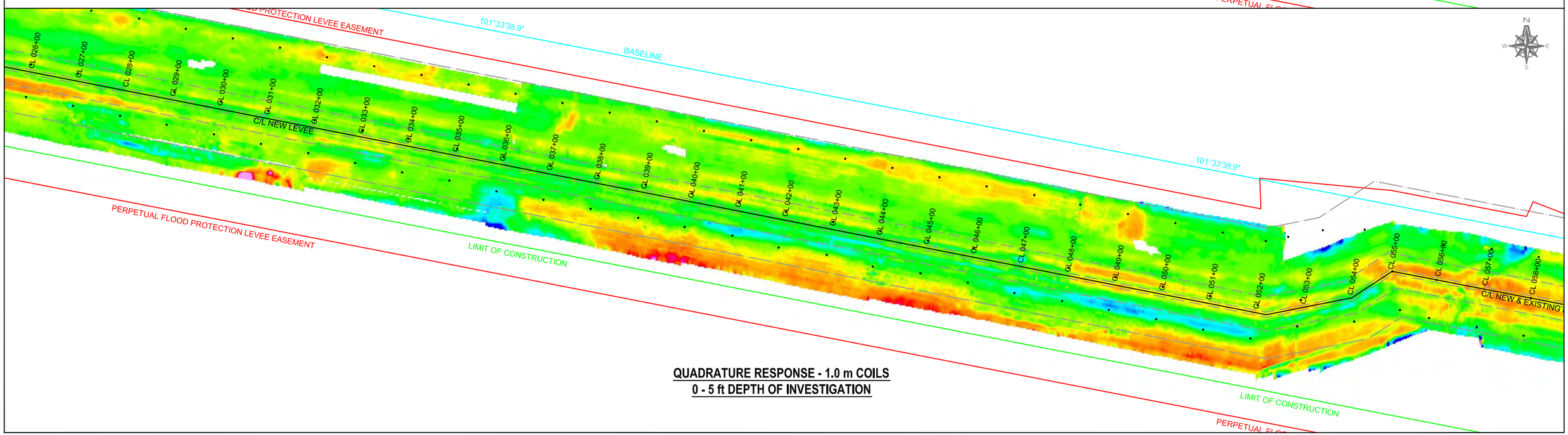
USACE NEW ORLEANS DISTRICT

PLATE 1C

FFEB Geotechnical Consultants



QUADRATURE RESPONSE - 0.5m COILS
0 - 2½ ft DEPTH OF INVESTIGATION



QUADRATURE RESPONSE - 1.0 m COILS
0 - 5 ft DEPTH OF INVESTIGATION

Scale:

Scale 1" : 200'

0 200 400

Legend:

Average Bulk Conductivity (mS/m)

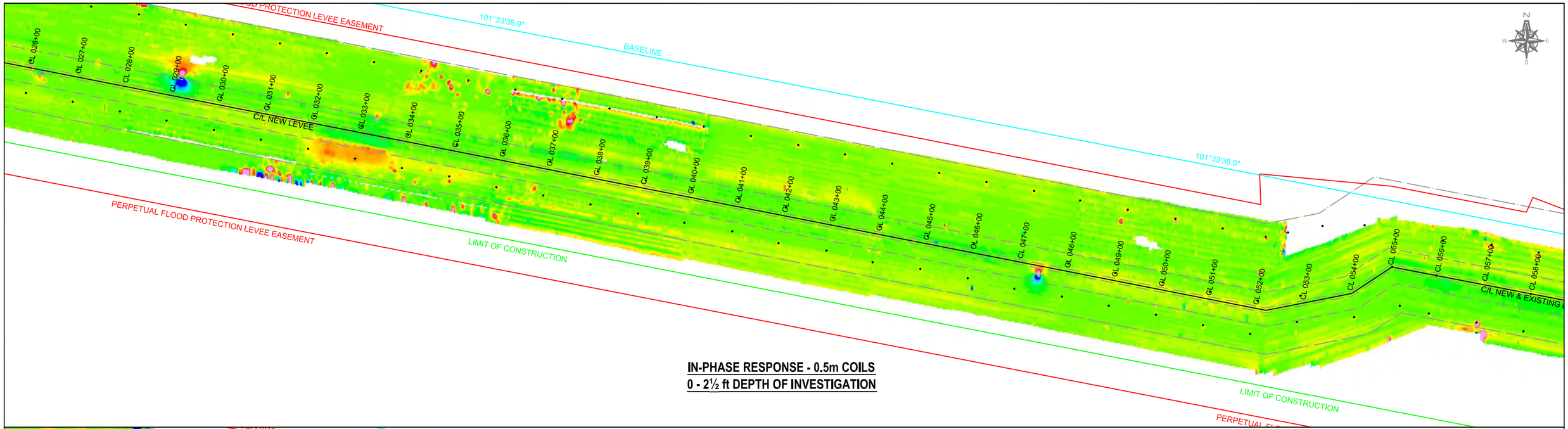
58 73 88 104 127 150 173 196 219 242 265 288 312 335

- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- + CL###+## Centerline stationing (data provided by USACE)

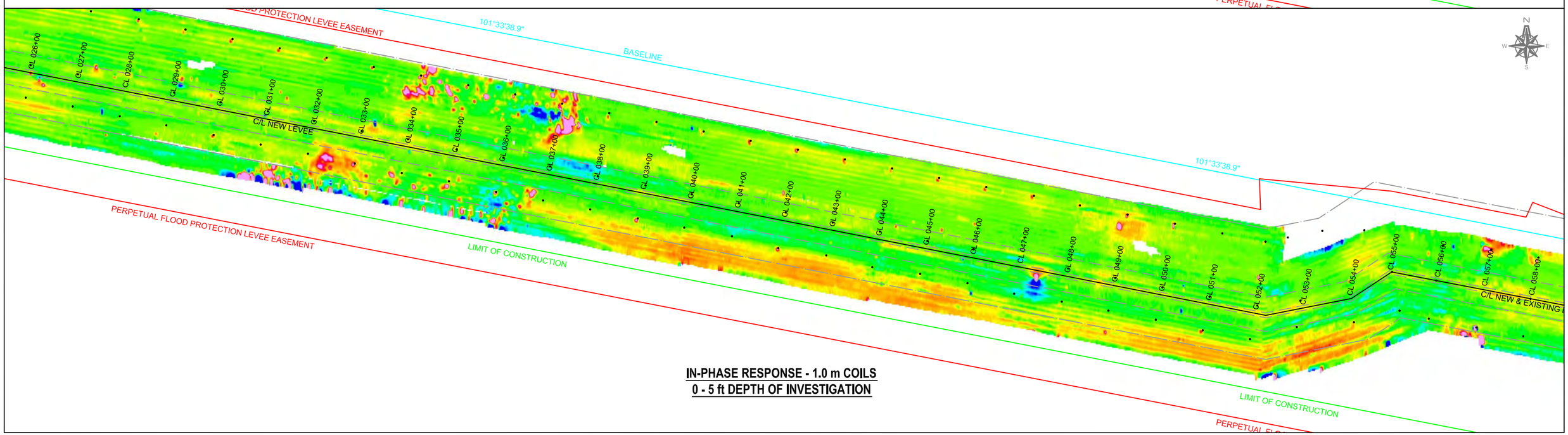
ELECTROMAGNETIC MAPPING SURVEY RESULTS - QUADRATURE RESPONSE
WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT
USACE NEW ORLEANS DISTRICT

PLATE 2A

FFEB Geotechnical Consultants



IN-PHASE RESPONSE - 0.5m COILS
0 - 2½ ft DEPTH OF INVESTIGATION



IN-PHASE RESPONSE - 1.0 m COILS
0 - 5 ft DEPTH OF INVESTIGATION

Scale:

Scale 1" : 200'

0 200 400

Legend:

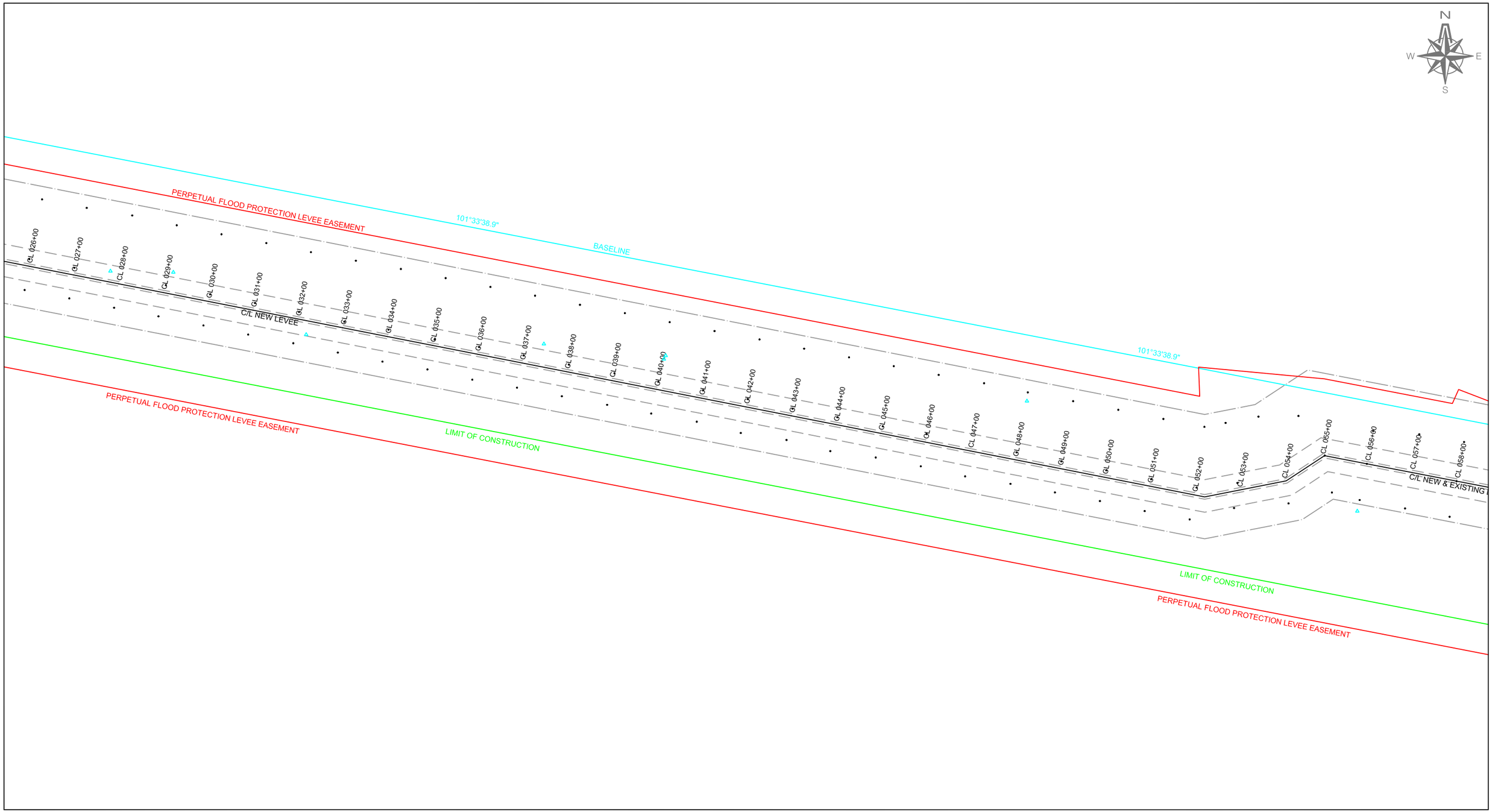
In-Phase Response (ppt)

-1.1 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.1 -0.0 0.1 0.2 0.2 0.3

Centerline of new levee (from UCASE drawings)
Approximate crown and toe of levee (based on typical levee section)
Extent of flood / protected side berms (based on typical levee section)
Approximate location of settlement plate (data provided by Phylway Construction)
+ CL###+## Centerline stationing (data provided by USACE)

ELECTROMAGNETIC MAPPING SURVEY RESULTS - IN-PHASE RESPONSE
WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT
USACE NEW ORLEANS DISTRICT

PLATE 2B



Scale:

Scale 1" : 200'

0 200 400

Legend:

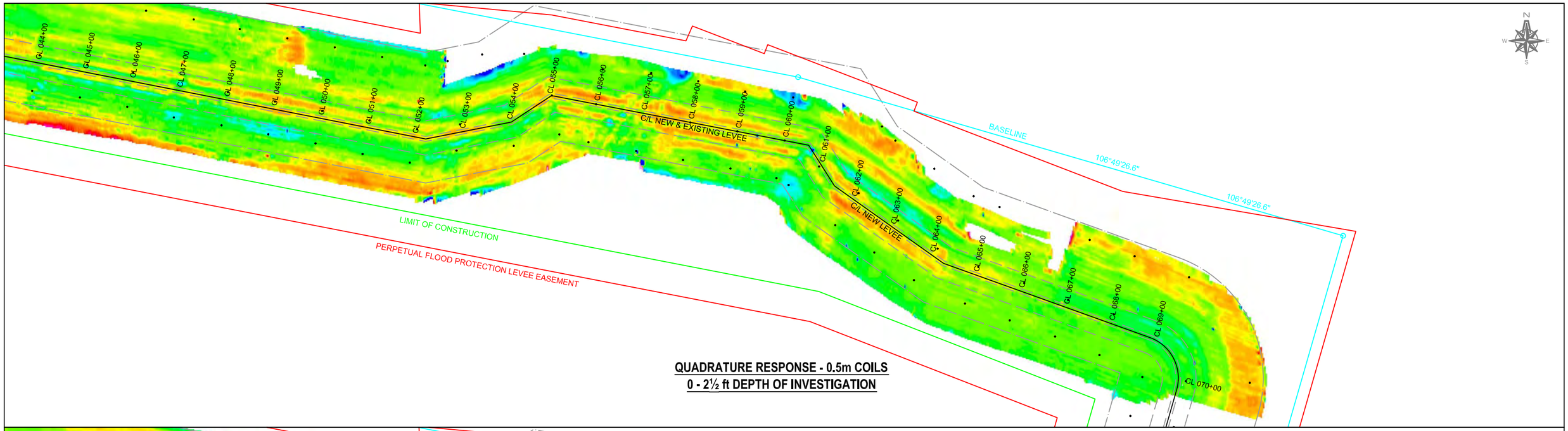
- Anomaly Type 1A - Inferred metallic target - less than about 2.5 ft depth
- Anomaly Type 1B - Inferred metallic target - about 2.5 to 5 ft depth
- Anomaly Type 2A - Inferred conductive target - less than about 2.5 ft depth
- Anomaly Type 2B - Inferred conductive target - about 2.5 to 5 ft depth
- Anomaly Type 3A - Inferred resistive target - less than about 2.5 ft depth
- Anomaly Type 3B - Inferred resistive target - about 2.5 to 5 ft depth
- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- CL###+## Centerline stationing (data provided by USACE)

ELECTROMAGNETIC MAPPING SURVEY RESULTS - INTERPRETED ANOMALY LOCATIONS

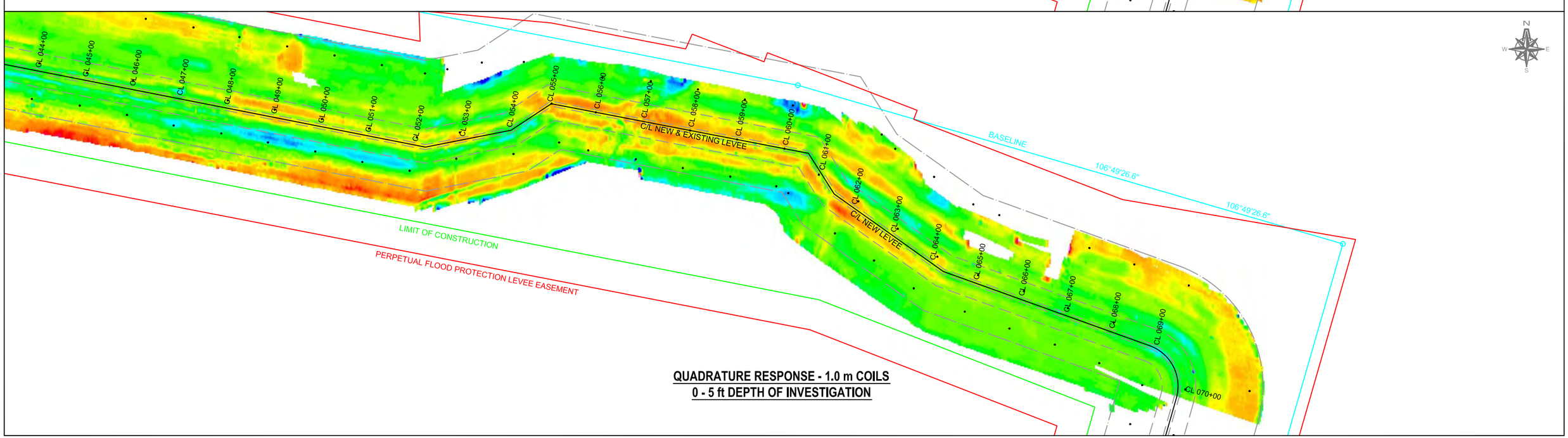
WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT

USACE NEW ORLEANS DISTRICT

PLATE 2C



QUADRATURE RESPONSE - 0.5m COILS
0 - 2½ ft DEPTH OF INVESTIGATION



QUADRATURE RESPONSE - 1.0 m COILS
0 - 5 ft DEPTH OF INVESTIGATION

Scale:

Scale 1" : 200'

0 200 400

Legend:

Average Bulk Conductivity (mS/m)

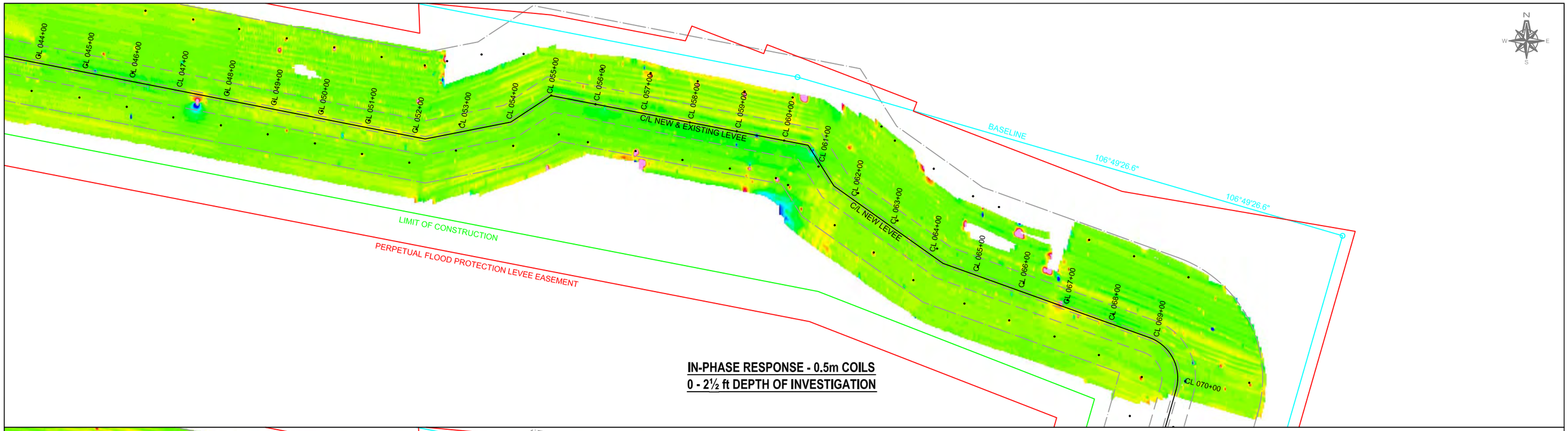
58 73 88 104 127 150 173 196 219 242 265 288 312 335

- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- + CL###+## Centerline stationing (data provided by USACE)

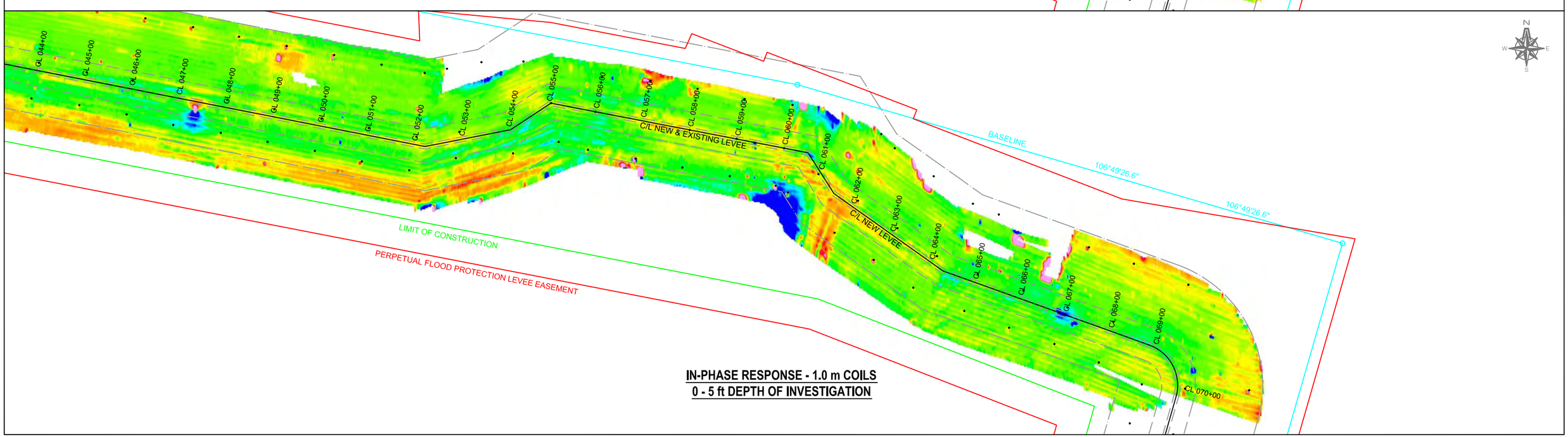
ELECTROMAGNETIC MAPPING SURVEY RESULTS - QUADRATURE RESPONSE
WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT
USACE NEW ORLEANS DISTRICT

PLATE 3A

FFEB Geotechnical Consultants



IN-PHASE RESPONSE - 0.5m COILS
0 - 2½ ft DEPTH OF INVESTIGATION



IN-PHASE RESPONSE - 1.0 m COILS
0 - 5 ft DEPTH OF INVESTIGATION

Scale:

Scale 1" : 200'

0 200 400

Legend:

In-Phase Response (ppt)

-1.1 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.1 -0.0 0.1 0.2 0.2 0.3

- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- + CL###+## Centerline stationing (data provided by USACE)

ELECTROMAGNETIC MAPPING SURVEY RESULTS - IN-PHASE RESPONSE
WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT
USACE NEW ORLEANS DISTRICT

PLATE 3B

Scale:

Scale 1" : 200'

0 200 400

Legend:

- Anomaly Type 1A - Inferred metallic target - less than about 2.5 ft depth
- Anomaly Type 1B - Inferred metallic target - about 2.5 to 5 ft depth
- Anomaly Type 2A - Inferred conductive target - less than about 2.5 ft depth
- Anomaly Type 2B - Inferred conductive target - about 2.5 to 5 ft depth
- Anomaly Type 3A - Inferred resistive target - less than about 2.5 ft depth
- Anomaly Type 3B - Inferred resistive target - about 2.5 to 5 ft depth
- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- CL###+## Centerline stationing (data provided by USACE)

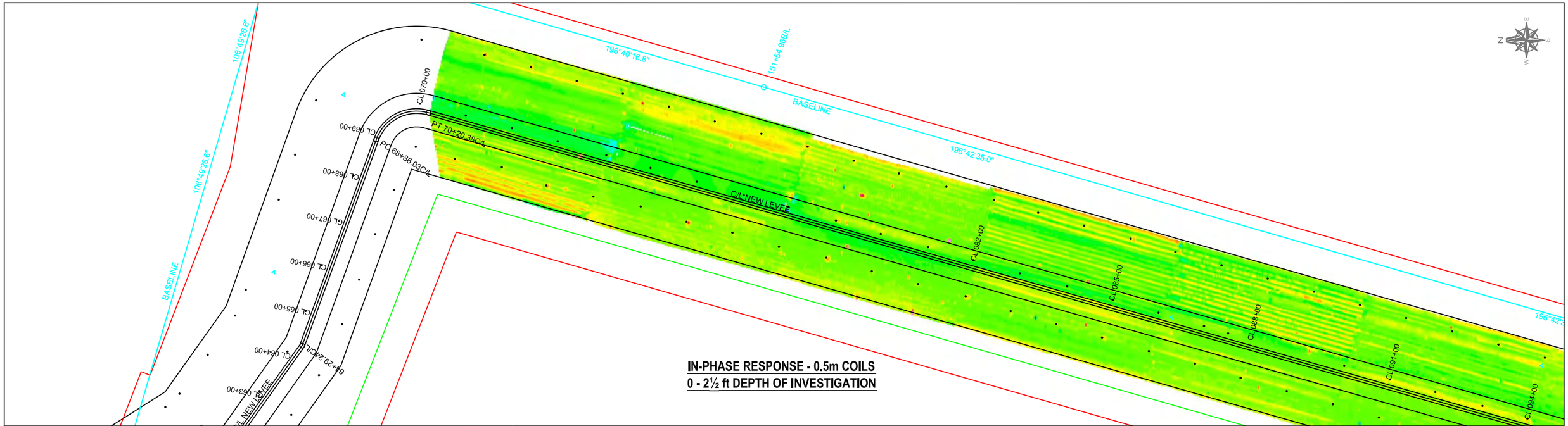
ELECTROMAGNETIC MAPPING SURVEY RESULTS - INTERPRETED ANOMALY LOCATIONS

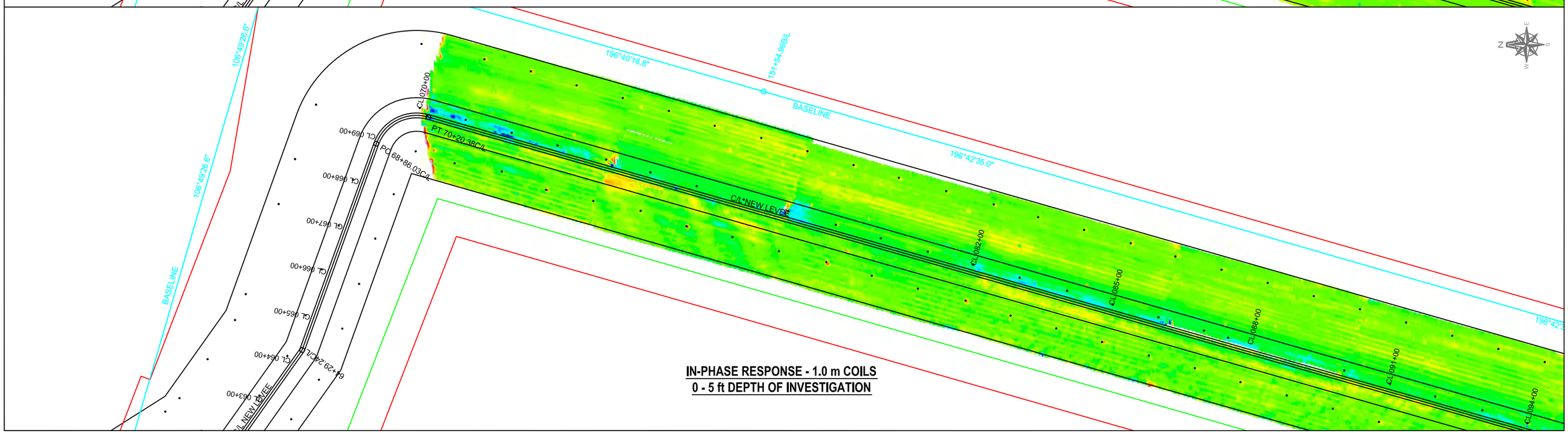
WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT

USACE NEW ORLEANS DISTRICT

PLATE 3C

FFEB Geotechnical Consultants





Scale:

Scale 1" : 200'

0 200 400

Legend:

In-Phase Response (ppt)

-1.1 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.1 -0.0 0.1 0.2 0.2 0.3

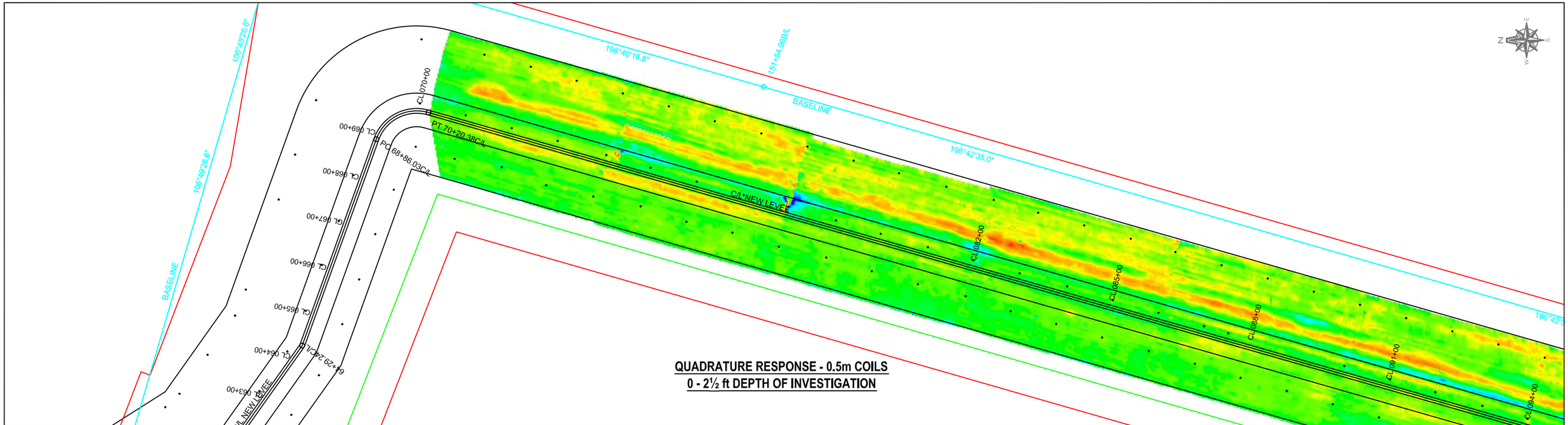
- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- + CL###+## Centerline stationing (data provided by USACE)

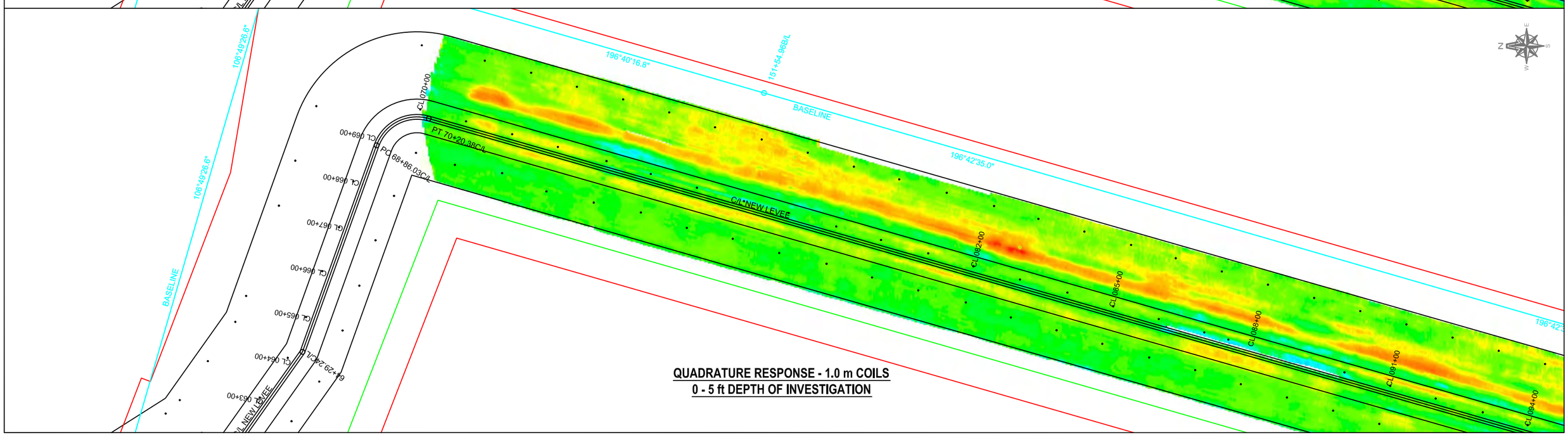
ELECTROMAGNETIC MAPPING SURVEY RESULTS - IN-PHASE RESPONSE

WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT

USACE NEW ORLEANS DISTRICT

PLATE 4B





Scale:

Scale 1" : 200'

0 200 400

Legend:

Average Bulk Conductivity (mS/m)

58 73 88 104 127 150 173 196 219 242 265 288 312 335

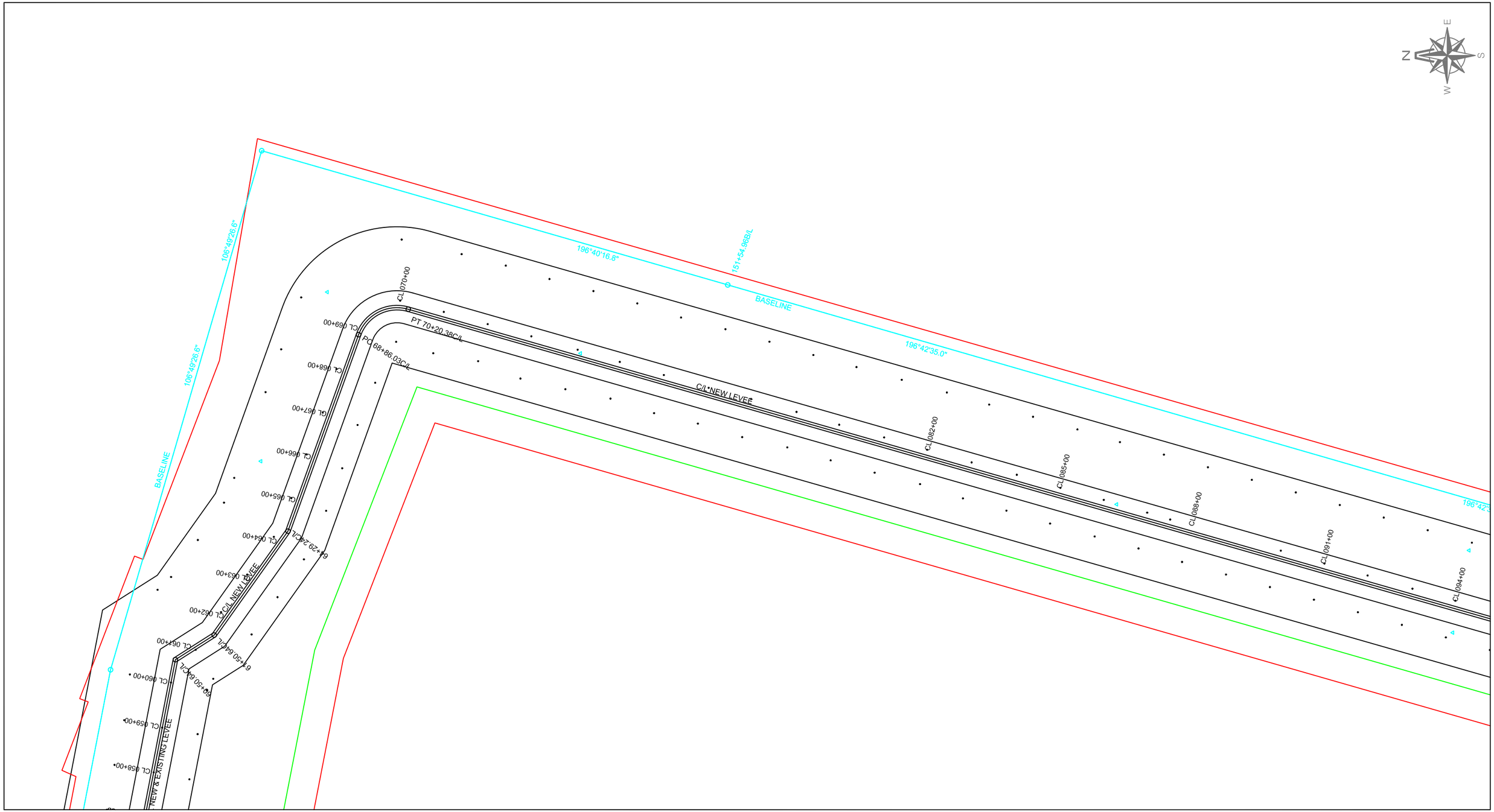
- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- + CL###+## Centerline stationing (data provided by USACE)

ELECTROMAGNETIC MAPPING SURVEY RESULTS - QUADRATURE RESPONSE

WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT

USACE NEW ORLEANS DISTRICT

PLATE 4A



Scale:

Scale 1" : 200'

0 200 400

Legend:

- Anomaly Type 1A - Inferred metallic target - less than about 2.5 ft depth
- Anomaly Type 1B - Inferred metallic target - about 2.5 to 5 ft depth
- Anomaly Type 2A - Inferred conductive target - less than about 2.5 ft depth
- Anomaly Type 2B - Inferred conductive target - about 2.5 to 5 ft depth
- Anomaly Type 3A - Inferred resistive target - less than about 2.5 ft depth
- Anomaly Type 3B - Inferred resistive target - about 2.5 to 5 ft depth

- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- + CL###+## Centerline stationing (data provided by USACE)

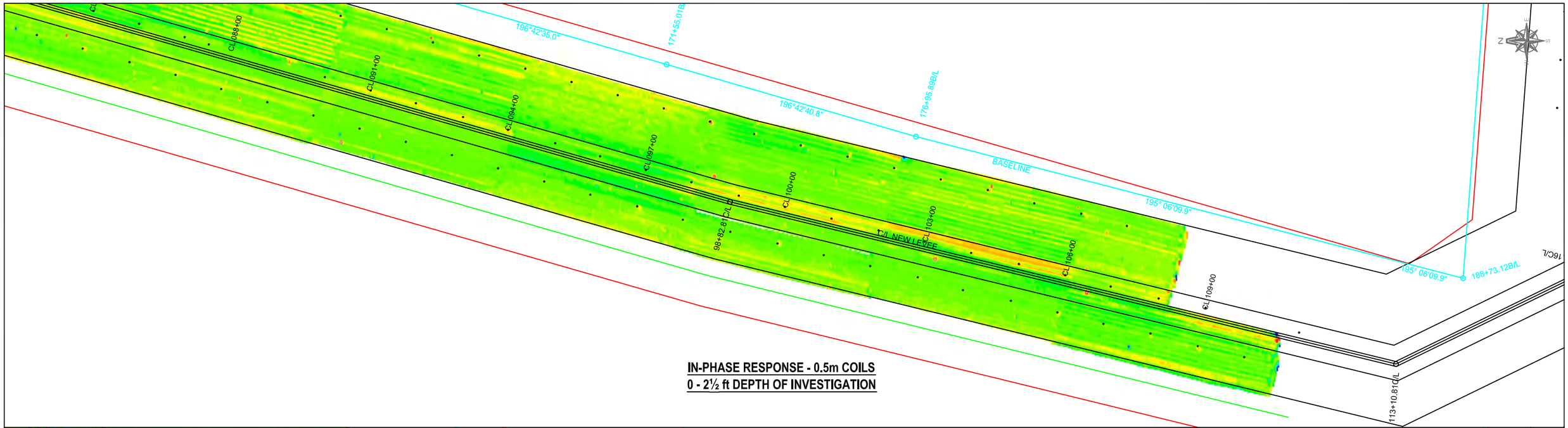
ELECTROMAGNETIC MAPPING SURVEY RESULTS - INTERPRETED ANOMALY LOCATIONS

WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT

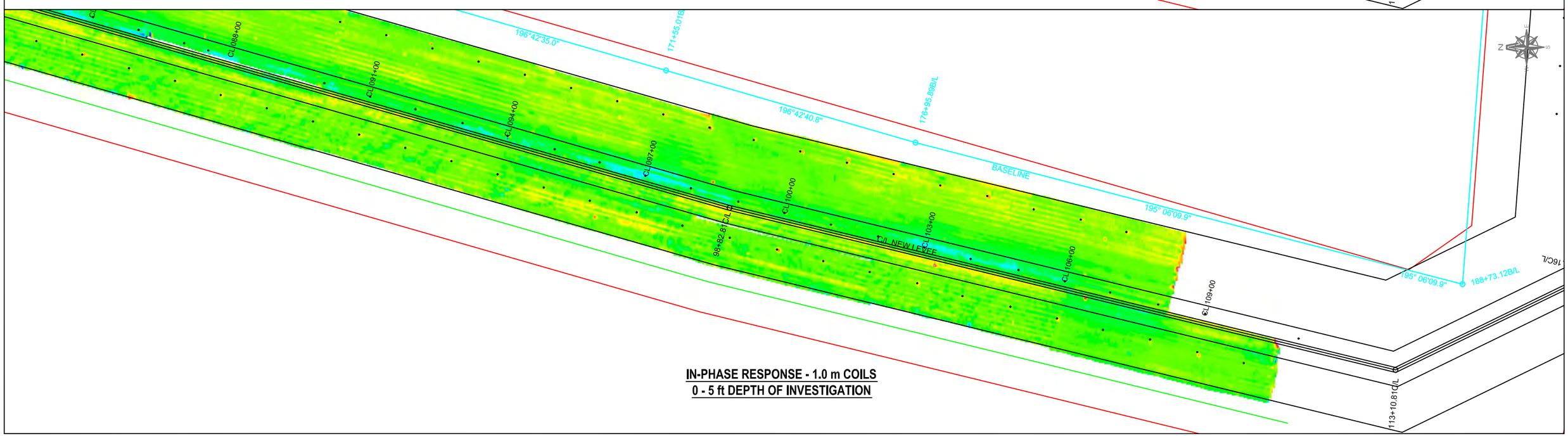
USACE NEW ORLEANS DISTRICT

PLATE 4C

FFEB Geotechnical Consultants



IN-PHASE RESPONSE - 0.5m COILS
0 - 2½ ft DEPTH OF INVESTIGATION



IN-PHASE RESPONSE - 1.0 m COILS
0 - 5 ft DEPTH OF INVESTIGATION

Scale:

Scale 1" : 200'

0 200 400

Legend:

In-Phase Response (ppt)

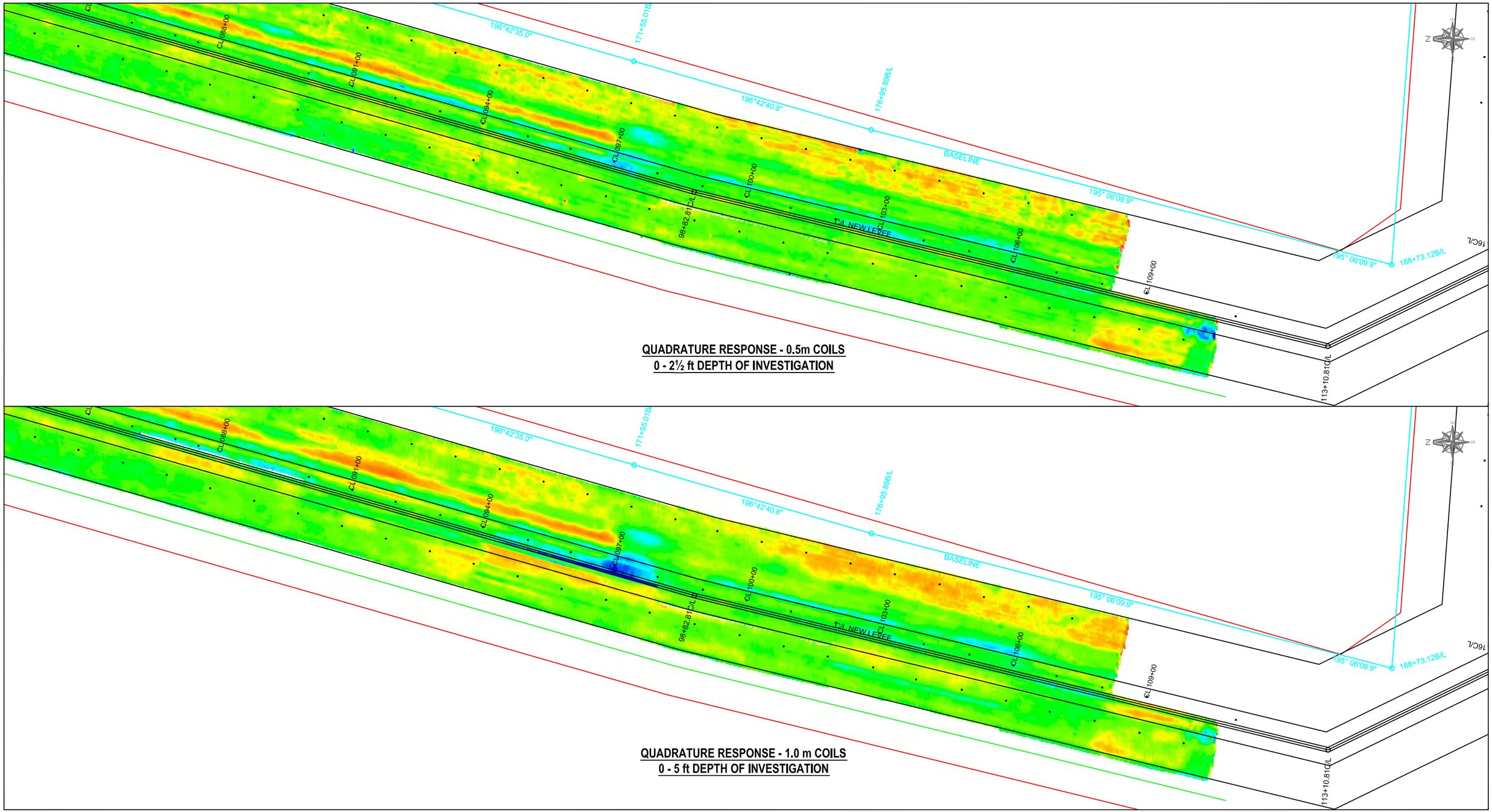
-1.1 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.1 -0.0 0.1 0.2 0.2 0.3

Centerline of new levee (from UCASE drawings)
Approximate crown and toe of levee (based on typical levee section)
Extent of flood / protected side berms (based on typical levee section)
Approximate location of settlement plate (data provided by Phylway Construction)
+ CL###+## Centerline stationing (data provided by USACE)

ELECTROMAGNETIC MAPPING SURVEY RESULTS - IN-PHASE RESPONSE
WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT
USACE NEW ORLEANS DISTRICT

PLATE 5B

FFEB Geotechnical Consultants



Scale:

Scale 1" : 200'

0 200 400

Legend:

Average Bulk Conductivity (mS/m)

58 73 88 104 127 150 173 196 219 242 265 288 312 335

Centerline of new levee (from UCASE drawings)

Approximate crown and toe of levee (based on typical levee section)

Extent of flood / protected side berms (based on typical levee section)

Approximate location of settlement plate (data provided by Phylway Construction)

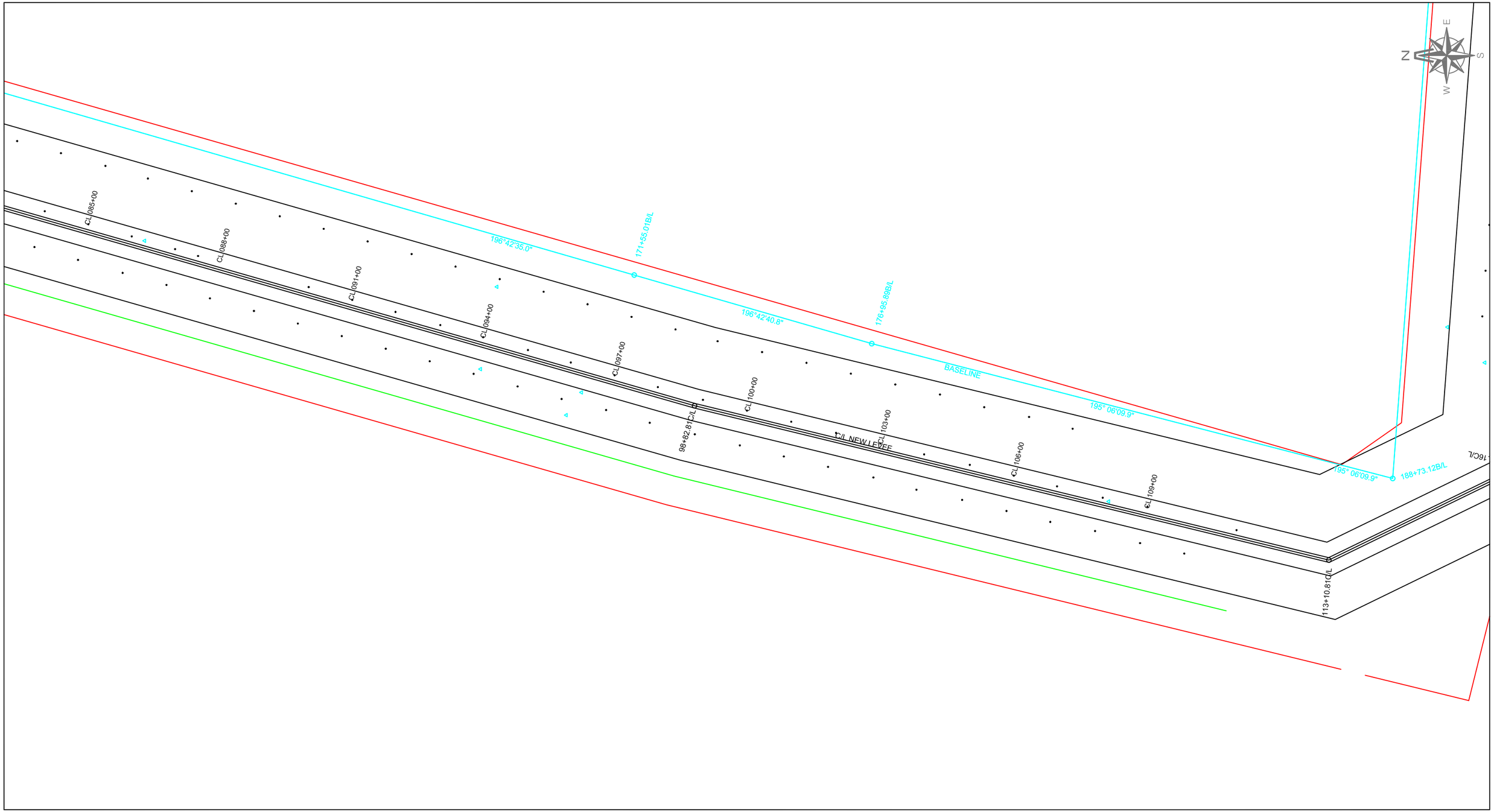
+ CL###+## Centerline stationing (data provided by USACE)

ELECTROMAGNETIC MAPPING SURVEY RESULTS - QUADRATURE RESPONSE

WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT

USACE NEW ORLEANS DISTRICT

PLATE 5A



Scale:

Scale 1" : 200'

0 200 400

Legend:

- Anomaly Type 1A - Inferred metallic target - less than about 2.5 ft depth
- Anomaly Type 1B - Inferred metallic target - about 2.5 to 5 ft depth
- Anomaly Type 2A - Inferred conductive target - less than about 2.5 ft depth
- Anomaly Type 2B - Inferred conductive target - about 2.5 to 5 ft depth
- Anomaly Type 3A - Inferred resistive target - less than about 2.5 ft depth
- Anomaly Type 3B - Inferred resistive target - about 2.5 to 5 ft depth
- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- CL###+## Centerline stationing (data provided by USACE)

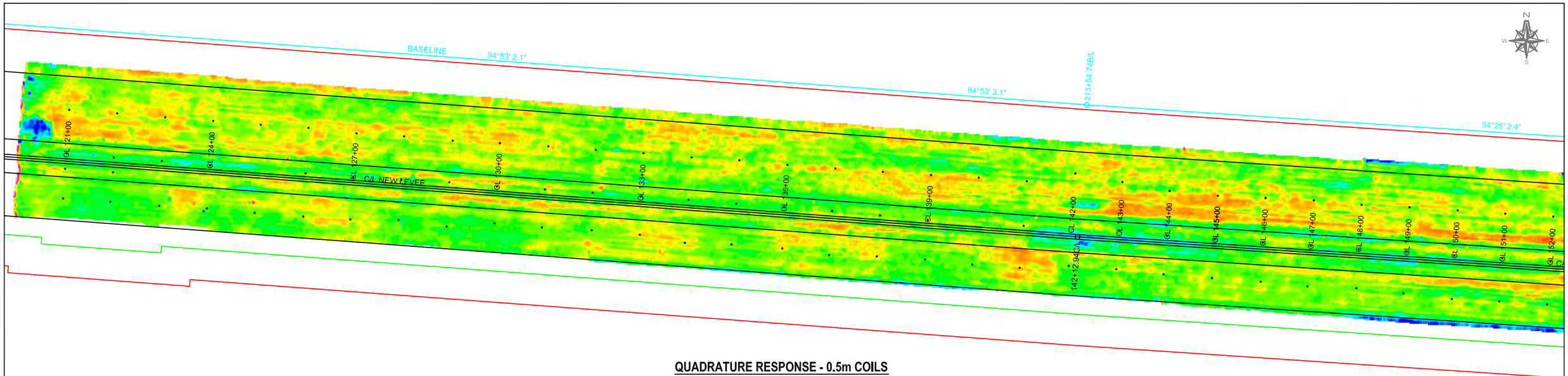
ELECTROMAGNETIC MAPPING SURVEY RESULTS - INTERPRETED ANOMALY LOCATIONS

WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT

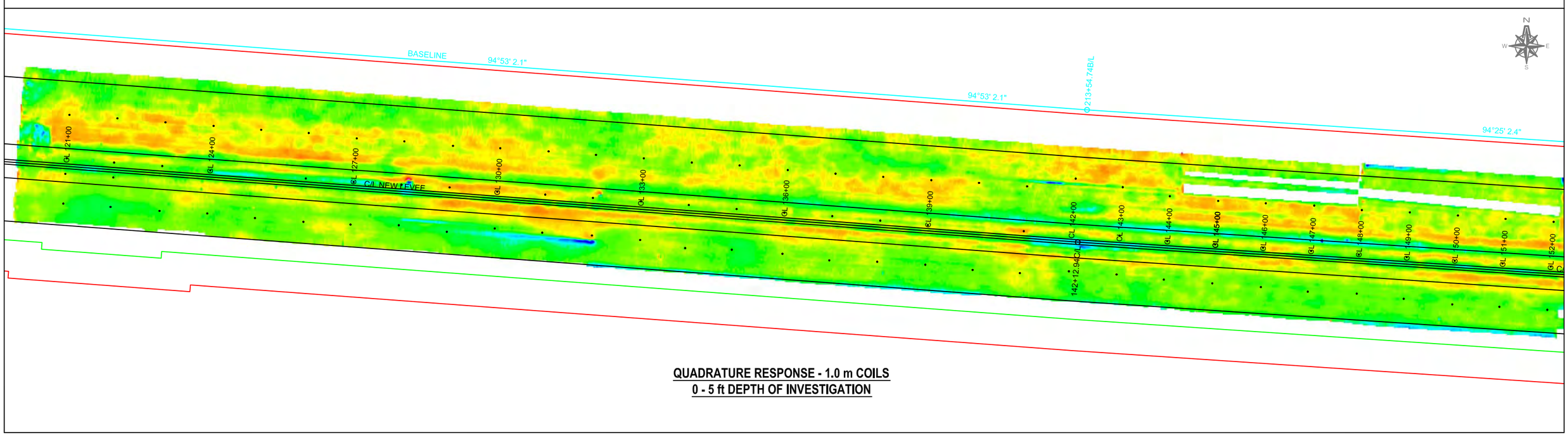
USACE NEW ORLEANS DISTRICT

PLATE 5C

FFEB Geotechnical Consultants



QUADRATURE RESPONSE - 0.5m COILS
0 - 2½ ft DEPTH OF INVESTIGATION



QUADRATURE RESPONSE - 1.0 m COILS
0 - 5 ft DEPTH OF INVESTIGATION

Scale:

Scale 1" : 200'

0 200 400

Legend:

Average Bulk Conductivity (mS/m)

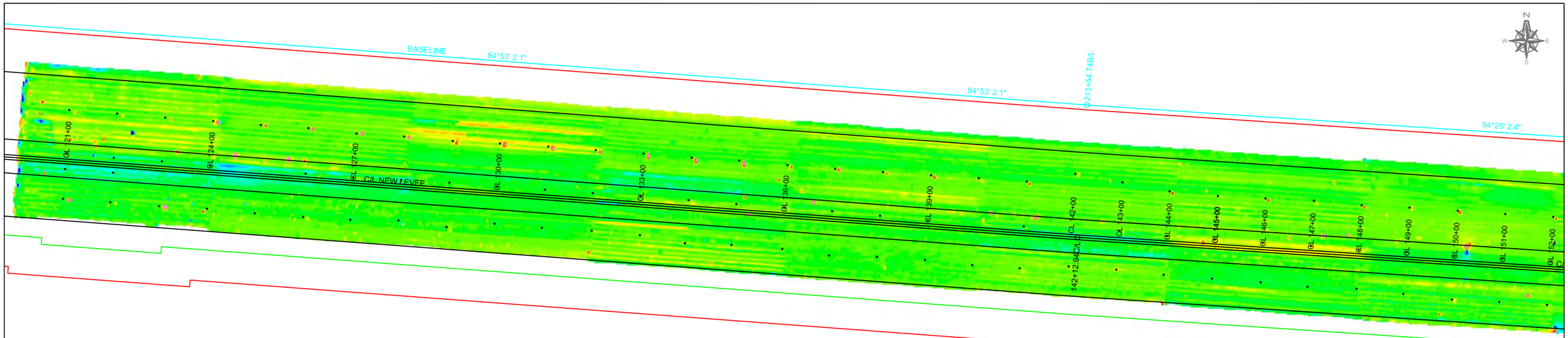
58 73 88 104 127 150 173 196 219 242 265 288 312 335

- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- + CL###+## Centerline stationing (data provided by USACE)

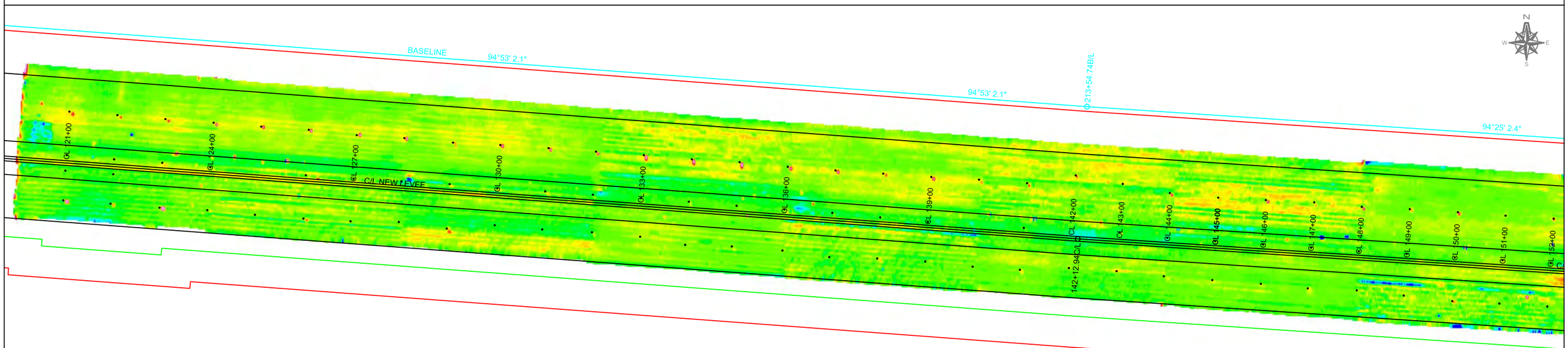
ELECTROMAGNETIC MAPPING SURVEY RESULTS - QUADRATURE RESPONSE
WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT
USACE NEW ORLEANS DISTRICT

PLATE 6A

FFEB Geotechnical Consultants



IN-PHASE RESPONSE - 0.5m COILS
0 - 2½ ft DEPTH OF INVESTIGATION



IN-PHASE RESPONSE - 1.0 m COILS
0 - 5 ft DEPTH OF INVESTIGATION

Scale:

Scale 1" : 200'

0 200 400

Legend:

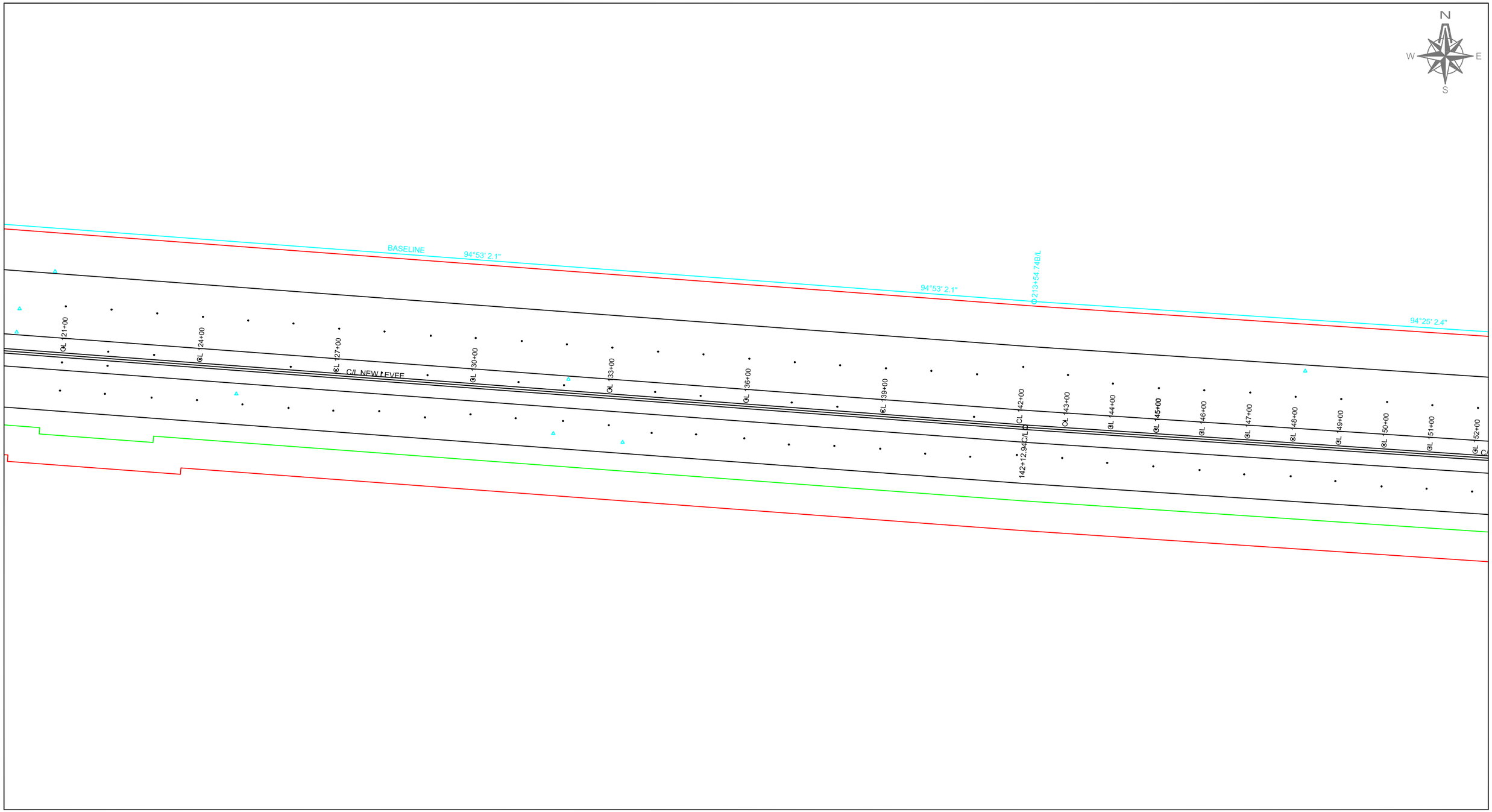
In-Phase Response (ppt)

-1.1 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.1 -0.0 0.1 0.2 0.2 0.3

Centerline of new levee (from UCASE drawings)
Approximate crown and toe of levee (based on typical levee section)
Extent of flood / protected side berms (based on typical levee section)
Approximate location of settlement plate (data provided by Phylway Construction)
+ CL###+## Centerline stationing (data provided by USACE)

ELECTROMAGNETIC MAPPING SURVEY RESULTS - IN-PHASE RESPONSE
WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT
USACE NEW ORLEANS DISTRICT

PLATE 6B



Scale:

Scale 1" : 200'

0 200 400

Legend:

- Anomaly Type 1A - Inferred metallic target - less than about 2.5 ft depth
- Anomaly Type 1B - Inferred metallic target - about 2.5 to 5 ft depth
- Anomaly Type 2A - Inferred conductive target - less than about 2.5 ft depth
- Anomaly Type 2B - Inferred conductive target - about 2.5 to 5 ft depth
- Anomaly Type 3A - Inferred resistive target - less than about 2.5 ft depth
- Anomaly Type 3B - Inferred resistive target - about 2.5 to 5 ft depth
- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- + CL###+## Centerline stationing (data provided by USACE)

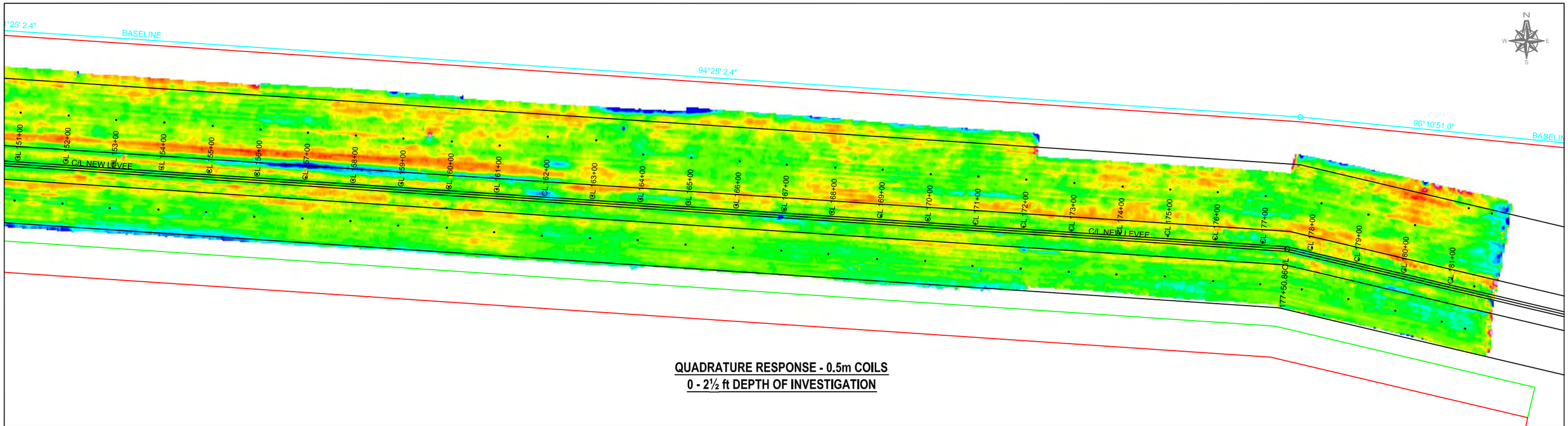
ELECTROMAGNETIC MAPPING SURVEY RESULTS - INTERPRETED ANOMALY LOCATIONS

WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT

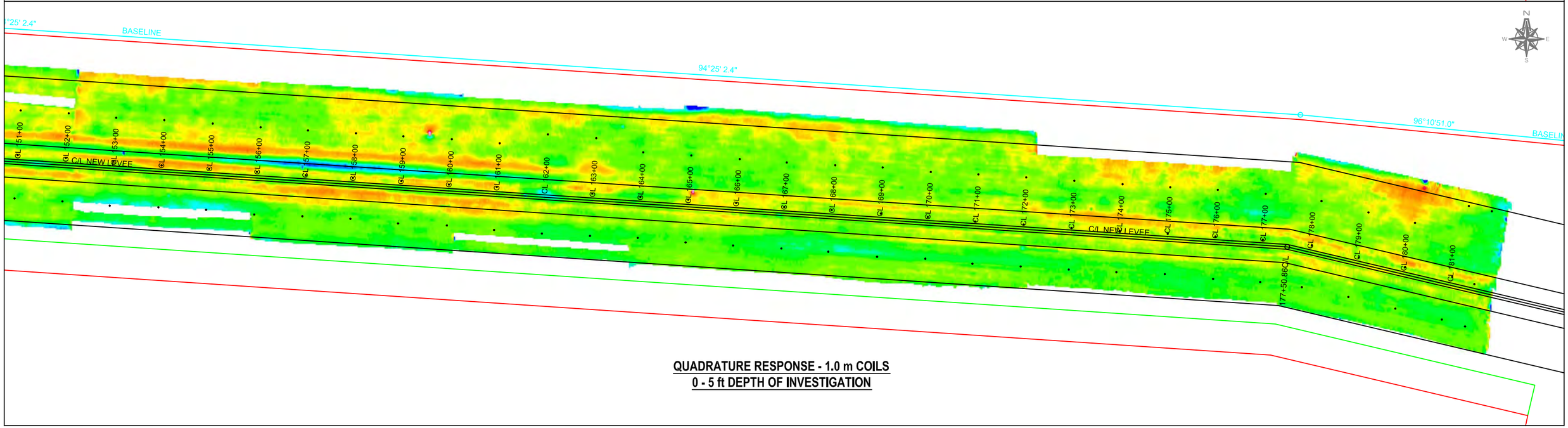
USACE NEW ORLEANS DISTRICT

PLATE 6C

FFEB Geotechnical Consultants



QUADRATURE RESPONSE - 0.5m COILS
0 - 2½ ft DEPTH OF INVESTIGATION



QUADRATURE RESPONSE - 1.0 m COILS
0 - 5 ft DEPTH OF INVESTIGATION

Scale:

Scale 1" : 200'

0 200 400

Legend:

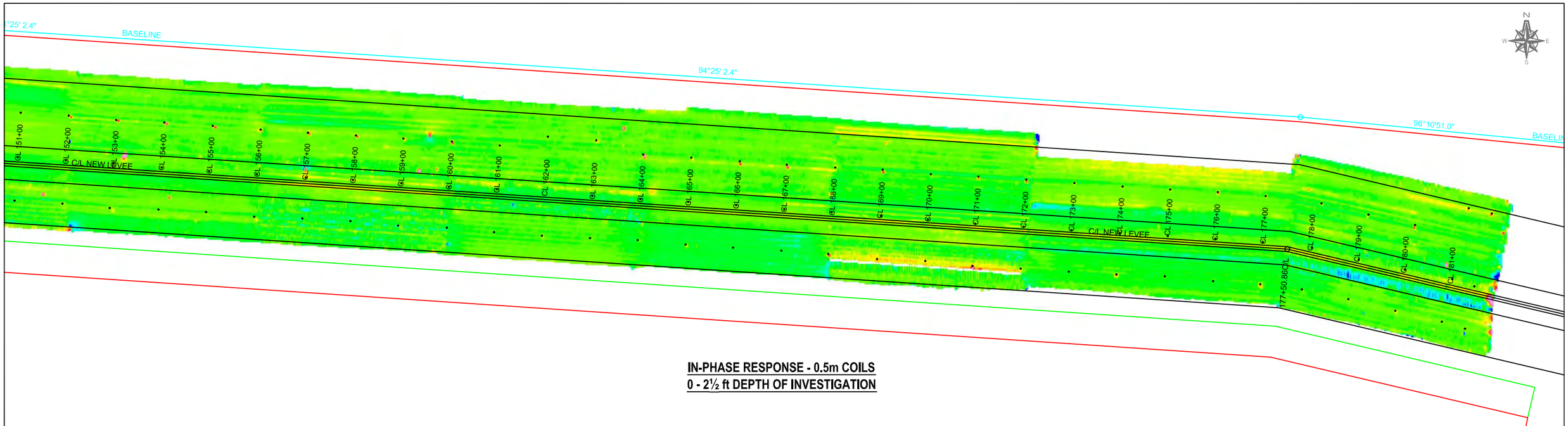
Average Bulk Conductivity (mS/m)

58 73 88 104 127 150 173 196 219 242 265 288 312 335

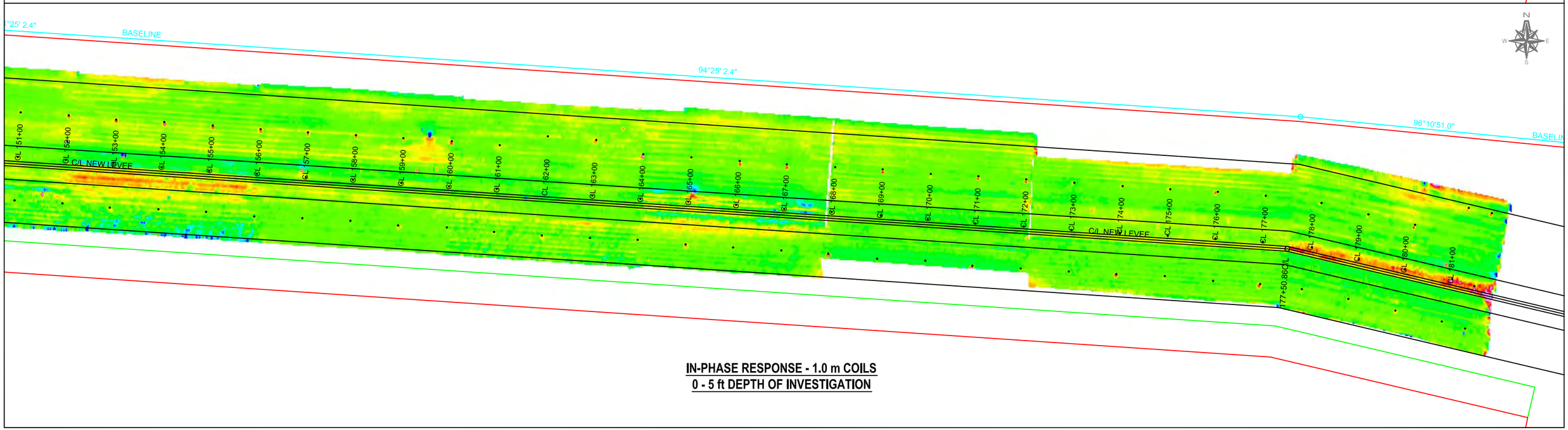
Centerline of new levee (from UCASE drawings)
Approximate crown and toe of levee (based on typical levee section)
Extent of flood / protected side berms (based on typical levee section)
Approximate location of settlement plate (data provided by Phylway Construction)
+ CL###+## Centerline stationing (data provided by USACE)

ELECTROMAGNETIC MAPPING SURVEY RESULTS - QUADRATURE RESPONSE
WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT
USACE NEW ORLEANS DISTRICT

PLATE 7A



IN-PHASE RESPONSE - 0.5m COILS
0 - 2½ ft DEPTH OF INVESTIGATION



IN-PHASE RESPONSE - 1.0 m COILS
0 - 5 ft DEPTH OF INVESTIGATION

Scale:

Scale 1" : 200'

0 200 400

Legend:

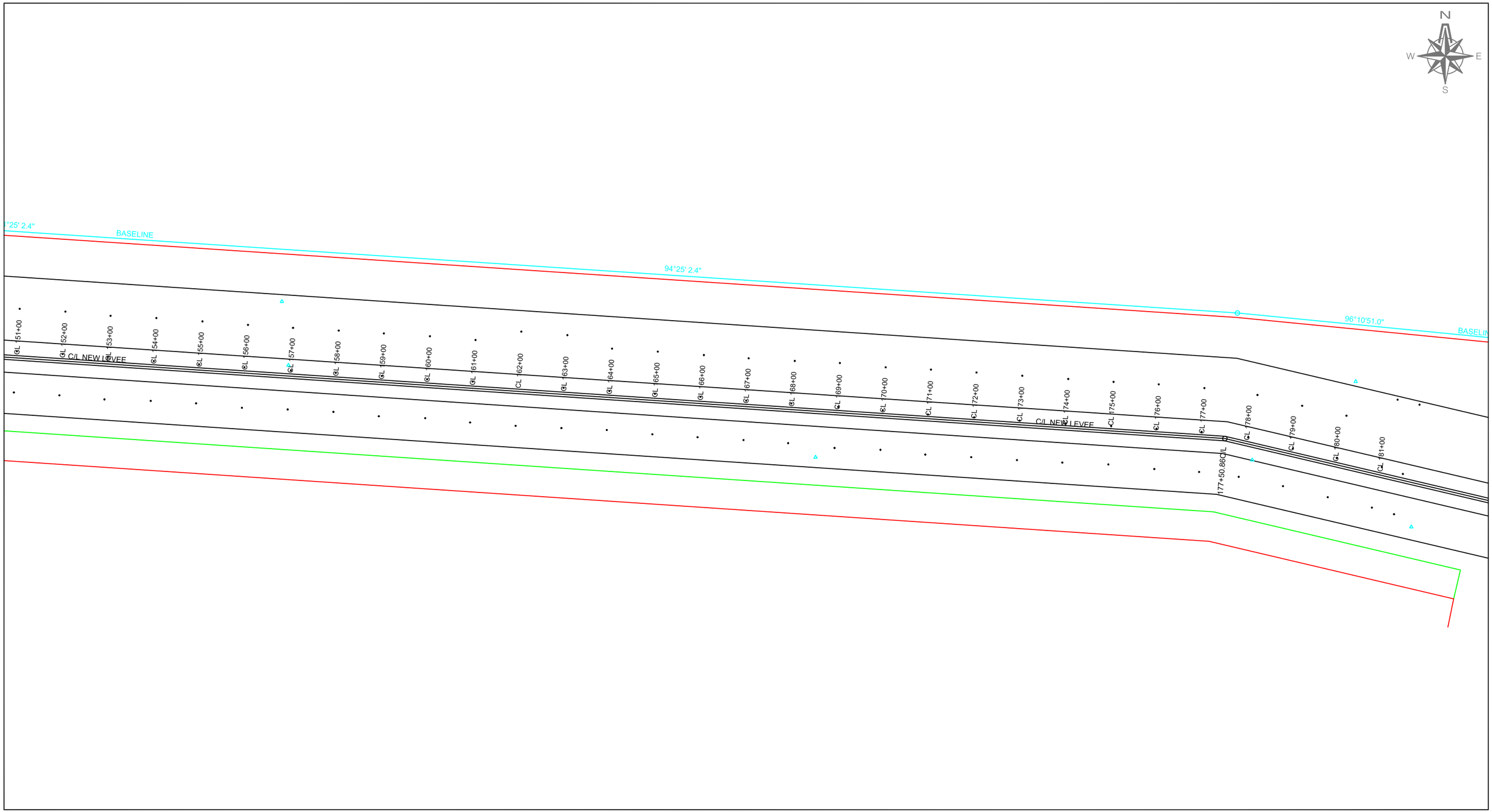
In-Phase Response (ppt)

-1.1 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.3 -0.1 -0.0 0.1 0.2 0.2 0.3

Centerline of new levee (from UCASE drawings)
Approximate crown and toe of levee (based on typical levee section)
Extent of flood / protected side berms (based on typical levee section)
Approximate location of settlement plate (data provided by Phylway Construction)
+ CL###+## Centerline stationing (data provided by USACE)

ELECTROMAGNETIC MAPPING SURVEY RESULTS - IN-PHASE RESPONSE
WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT
USACE NEW ORLEANS DISTRICT

PLATE 7B



Scale:

Scale 1" : 200'

0 200 400

Legend:

- Anomaly Type 1A - Inferred metallic target - less than about 2.5 ft depth
- Anomaly Type 1B - Inferred metallic target - about 2.5 to 5 ft depth
- Anomaly Type 2A - Inferred conductive target - less than about 2.5 ft depth
- Anomaly Type 2B - Inferred conductive target - about 2.5 to 5 ft depth
- Anomaly Type 3A - Inferred resistive target - less than about 2.5 ft depth
- Anomaly Type 3B - Inferred resistive target - about 2.5 to 5 ft depth
- Centerline of new levee (from UCASE drawings)
- Approximate crown and toe of levee (based on typical levee section)
- Extent of flood / protected side berms (based on typical levee section)
- Approximate location of settlement plate (data provided by Phylway Construction)
- CL###+## Centerline stationing (data provided by USACE)

ELECTROMAGNETIC MAPPING SURVEY RESULTS - INTERPRETED ANOMALY LOCATIONS

WBV-14c.2 WESTWEGO TO HARVEY CANAL LEVEE ASSESSMENT

USACE NEW ORLEANS DISTRICT

PLATE 7C

APPENDIX A

FIELD ACTIVITY LOGS

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 12, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	1 SIR20		1 Other 400MHz antenna
X Electromagnetic Mapping	□ EM31	□ EM34	2 EM38	□ EM61	2 Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	2 dGPS	□ rtk GPS		1 Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

08:00 : Arrive at FCL Kenner office, prep survey equipment
09:15 : Depart office for meeting at USACE office
10:00 : Meeting at USACE
11:45 : Return to FCL Kenner office, load up equipment
12:30 : Lunch
13:00 : Travel to site
13:45 : Arrive on site – meet with Glenn Gremillion, Jeremy George. Discuss logistics, review drawings etc.
14:30 : Travel site with Jeremy George
15:45 : Lay out survey grids for EM38 data collection from STA 70+00 to STA 90+00
16:45 : Unload equipment at USACE cabin, leave GPS batteries on charge in cabin
17:00 : Depart site
17:20 : Arrive at hotel

TIME RECORD

Time depart office:	08:00	Time arrive on site:	13:45	Lunch:	0:30
Time return office:	17:20	Time depart site:	17:00	**Total Hours:**	8:50

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 12, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 13, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	1 SIR20		1 Other 400MHz antenna
X Electromagnetic Mapping	□ EM31	□ EM34	2 EM38	□ EM612	Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	2 dGPS	□ rtk GPS		1 Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Leave hotel, travel to site

06:30 : Collect equipment from USACE cabin, set up for EM34 data collection

07:15 : Collect EM38 data from STA 70+00 to 82+00 (entire width of construction)

12:30 : Breakdown EM38 equipment

13:00 : Rest period in USACE cabin

13:20 : Set up for GPR data collection

14:30 : Collect GPR data from STA 70+00 to 90+00 (protected side toe to 40ft east)

16:20 : Breakdown GPR equipment

16:40 : Leave site

16:50 : Arrive at hotel

TIME RECORD

Time depart office:	06:20	Time arrive on site:	06:30	Lunch:	NA
Time return office:	16:50	Time depart site:	16:40	**Total Hours:**	10:30

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 13, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 14, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	**1** SIR20		**1** Other 400MHz antenna
X Electromagnetic Mapping	□ EM31	□ EM34	**2** EM38	□ EM61	**2** Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	**2** dGPS	□ rtk GPS		**1** Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Leave hotel, travel to site

06:30 : Collect equipment from USACE cabin, set up for EM38 data collection

06:50 : Collect EM38 data from STA 82+00 to 90+00 (entire width of construction)

11:40 : Breakdown EM38 equipment

12:00 : Rest period in USACE cabin

12:20 : Set up for GPR data collection

12:40 : Collect GPR data from STA 70+00 to 90+00 (protected side, centerline to limit of construction)

16:35 : Breakdown GPR equipment

16:50 : Leave site

17:00 : Arrive at hotel

Data Collected to date

EM34 : STA 70+00 to 90+00, entire width of construction

GPR : STA70+00 to 90+00, centerline of new levee to limit of construction on protected side)

TIME RECORD

Time depart office:	06:20	Time arrive on site:	06:30	Lunch:	NA
Time return office:	17:00	Time depart site:	16:50	**Total Hours:**	10:40

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 14, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 14, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	**1** SIR20		**1** Other 400MHz antenna
X Electromagnetic Mapping	□ EM31	□ EM34	**2** EM38	□ EM61	**2** Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	**2** dGPS	□ rtk GPS		**1** Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Leave hotel, travel to site

06:30 : Collect equipment from USACE cabin, set up for EM38 data collection

06:50 : Collect EM34 data from STA 90+00 to 98+00 (entire width of construction)

11:00 : A. Guerrero – Breakdown EM38 equipment, set up for GPR collection

11:00 : D. Valintine – Collect EM38 data from STA 98+00 to 102+00

12:00 : A. Guerrero – Collect GPR data from STA70+00 to 90+00 (floodside)

12:40 : D. Valintine – Breakdown EM38 equipment, assist with GPR data collection

16:15 : Breakdown GPR equipment

16:55 : Leave site

17:05 : Arrive at hotel

Data Collected to date

EM38 : STA 70+00 to 98+00, entire width of construction. STA 98+00 to 102+00, flood side only

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD

Time depart office:	06:20	Time arrive on site:	06:30	Lunch:	NA
Time return office:	17:00	Time depart site:	16:50	**Total Hours:**	10:45

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 15, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 16, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	**1** SIR20		**1** Other 400MHz antenna
X Electromagnetic Mapping	□ EM31	□ EM34	**2** EM38	□ EM61	**2** Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	**2** dGPS	□ rtk GPS		**1** Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Leave hotel, travel to site

06:30 : Collect equipment from USACE cabin, set up for EM38 data collection

06:50 : D. Valintine – Collect EM38 data from STA 102+00 to 106+00 (flood side)

06:50 : A. Guerrero – Collect EM38 data from STA 98+00 to 108+00 (protected side) and STA 106+00 to 111+00 (flood side)

09:00 : D. Valintine – Collect GPS data as contractor stakes out ground truth locations, process data on site for quality control purposes

10:00 : D. Valintine – Observe trenching at ground truth locations

13:30 : Reconnaissance of STA 121+00 to STA 156+00

14:00 : Lunch break

14:30 : Set out survey markers from STA 60+00 to 70+00

16:15 : Demobilize GPR equipment from USACE cabin

16:40 : Leave site

16:50 : Arrive at hotel

Data Collected to date

EM38 : STA 70+00 to 108+00, entire width of construction. STA 108+00 to 111+00, flood side only

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD

Time depart office:	06:20	Time arrive on site:	06:30	Lunch:	NA
Time return office:	16:50	Time depart site:	16:40	**Total Hours:**	10:30

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 16, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 17, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	□ SIR20		□ Other ……..
X Electromagnetic Mapping	□ EM31	□ EM34	**2** EM38	□ EM61	**2** Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	**2** dGPS	□ rtk GPS		**1** Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Leave hotel, travel to site

06:30 : Collect equipment from USACE cabin, set up for EM38 data collection

06:50 : Collect EM38 data from STA 60+50 to 70+20 (flood and protected side)

11:30 : Lunch break

12:00 : Collect EM38 data from STA 52+20 to 60+50 (flood and protected side)

15:50 : Set out survey markers from STA 120+00 to 140+00

16:35 : Return equipment to USACE cabin

16:55 : Leave site

17:05 : Arrive at hotel

Data Collected to date

EM38 : STA 52+20 to 108+00, entire width of construction. STA 108+00 to 111+00, flood side only

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD

Time depart office:	06:20	Time arrive on site:	06:30	Lunch:	NA
Time return office:	18:05	Time depart site:	16:55	**Total Hours:**	10:45

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 17, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 18, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	□ SIR20		□ Other ……..
X Electromagnetic Mapping	□ EM31	□ EM34	**2** EM38	□ EM61	**2** Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	**2** dGPS	□ rtk GPS		**1** Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Leave hotel, travel to site

06:30 : Collect equipment from USACE cabin, set up for EM38 data collection

06:50 : Collect EM38 data from STA 120+00 to 132+00 (flood and protected side)

12:40 : Lunch break

13:00 : Collect EM38 data from STA 132+00 to 136+00 (flood and protected side)

15:00 : Set out survey markers from STA 136+00 to 152+00

15:45 : Return equipment to USACE cabin

15:55 : Leave site

16:05 : Arrive at hotel

Data Collected to date

EM38 : STA 52+20 to 108+00 (flood and protected side) STA 108+00 to 111+00 (flood side only) STA 120+00 to 136+00 (flood,

EM38 : STA 120+00 to 136+00 (flood and protected side)

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD

Time depart office:	06:20	Time arrive on site:	06:30	Lunch:	NA
Time return office:	16:05	Time depart site:	15:55	**Total Hours:**	9:45

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 18, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 19, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	□ SIR20		□ Other ……..
X Electromagnetic Mapping	□ EM31	□ EM34	**2** EM38	□ EM61	**2** Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	**2** dGPS	□ rtk GPS		**1** Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Leave hotel, travel to site

06:30 : Standby (weather delay) – wait at USACE cabin

07:00 : Progress update with Jeremy George, abandon site work for today

07:25 : Leave site – return to hotel

07:35 : Arrive at hotel – Standby (weather delay)

Data Collected to date

EM38 : STA 52+20 to 108+00 (flood and protected side) STA 108+00 to 111+00 (flood side only) STA 120+00 to 136+00 (flood,

EM38 : STA 120+00 to 136+00 (flood and protected side)

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD

Time depart office:	06:20	Time arrive on site:	06:30	Lunch:	NA
Time return office:	07:35	Time depart site:	07:25	**Total Hours:**	8:00 (Standby)

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 19, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 20, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	□ SIR20		□ Other ……..
X Electromagnetic Mapping	□ EM31	□ EM34	**2** EM38	□ EM61	**2** Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	**2** dGPS	□ rtk GPS		**1** Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

07:00 : Email received from Jeremy George informing that the site is still too wet for work

08:20 : Travel to site to meet surveyors

08:30 : Meet with Jeremy George & surveyors at USACE cabin. Decide to attempt site work at 13:00 (after ground dries in sun)

10:25 : Leave site – return to hotel

10:35 : Arrive at hotel – Standby (weather delay)

12:40 : Travel to site

12:50 : Walk site from STA 70+00 to 45+00 – ground conditions too soft and surface water present – unsuitable for data collection

13:20 : Drive to Westminster Pump Station

13:30 : Walk site from STA 120+00 to 125+00 – ground conditions too soft and surface water present – unsuitable for data collection

13:40 : Leave site – return to hotel

13:50 : Arrive at hotel – Standby (weather delay)

Data Collected to date

EM38 : STA 52+20 to 108+00 (flood and protected side) STA 108+00 to 111+00 (flood side only) STA 120+00 to 136+00 (flood,

EM38 : STA 120+00 to 136+00 (flood and protected side)

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD

Time depart office:	-	Time arrive on site:	-	Lunch:	NA
Time return office:	-	Time depart site:	-	**Total Hours:**	8:00 (Standby)

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 20, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 21, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	□ SIR20		□ Other ……..
X Electromagnetic Mapping	□ EM31	□ EM34	**2** EM38	□ EM61	**2** Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	**2** dGPS	□ rtk GPS		**1** Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Leave site – return to hotel

06:30 : Collect equipment from USACE cabin, set up for EM38 data collection

07:15 : Collect EM38 data from STA 136+00 to 144+00

11:45 : Lunch break

12:15 : Collect EM38 data from STA 148+00 to 152+00

14:20 : Abandon site work due to heavy rain

14:35 : Breakdown EM38 equipment at USACE cabin

14:40 : Leave site – return to hotel

14:50 : Arrive at hotel

Data Collected to date

EM38 : STA 52+20 to 108+00 (flood and protected side) STA 108+00 to 111+00 (flood side only) STA 120+00 to 136+00 (flood,

EM38 : STA 120+00 to 152+00 (flood and protected side)

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD

Time depart office:	-	Time arrive on site:	-	Lunch:	NA
Time return office:	-	Time depart site:	-	**Total Hours:**	8:30

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 21, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 22, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	□ SIR20		□ Other ……..
X Electromagnetic Mapping	□ EM31	□ EM34	2 EM38	□ EM61	2 Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	2 dGPS	□ rtk GPS		1 Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

07:00 : Travel to site

07:10 : Arrive at site

07:15 : Walk site from STA 70+00 to 60+00 – ground conditions too soft and surface water present – unsuitable for data collection

07:50 : Leave site

08:00 : Arrive at hotel

12:00 : Travel to site

12:10 : Arrive at site, drive to Westminster Pump Station

12:20 : Walk site from STA 120+00 to 125+00 – ground conditions too soft and surface water present – unsuitable for data collection

13:50 : Leave site

14:00 : Arrive at hotel

Data Collected to date

EM38 : STA 52+20 to 108+00 (flood and protected side) STA 108+00 to 111+00 (flood side only) STA 120+00 to 136+00 (flood,

EM38 : STA 120+00 to 152+00 (flood and protected side)

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD0

Time depart office:	-	Time arrive on site:	-	Lunch:	NA
Time return office:	-	Time depart site:	-	**Total Hours:**	8:00 (stand by)

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 22, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 23, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	□ SIR20		□ Other ……..
X Electromagnetic Mapping	□ EM31	□ EM34	2 EM38	□ EM61	2 Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	2 dGPS	□ rtk GPS		1 Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

07:00 : Travel to site

07:10 : Arrive at site

07:15 : Walk site from STA 70+00 to 60+00 – ground conditions too soft and surface water present – unsuitable for data collection

07:50 : Leave site

08:00 : Arrive at hotel

12:00 : Travel to site

12:10 : Arrive at site

12:20 : Walk site from STA 70+00 to 65+00 – ground conditions too soft and surface water present – unsuitable for data collection

12:40 : Set out survey markers from STA 148+00 to 182+00

14:50 : Leave site

15:00 : Arrive at hotel

Data Collected to date

EM38 : STA 52+20 to 108+00 (flood and protected side) STA 108+00 to 111+00 (flood side only) STA 120+00 to 136+00 (flood,

EM38 : STA 120+00 to 152+00 (flood and protected side)

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD0

Time depart office:	-	Time arrive on site:	-	Lunch:	NA
Time return office:	-	Time depart site:	-	**Total Hours:**	8:00 (stand by)

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 23, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 24, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero, J Brimson
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	□ SIR20		□ Other ……..
X Electromagnetic Mapping	□ EM31	□ EM34	2 EM38	□ EM61	2 Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	2 dGPS	□ rtk GPS		1 Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Travel to site

06:30 : Arrive at site – collect equipment from USACE cable and set up for EM38 data collection

06:50 : Collect EM38 data from STA 148+00 to 168+00 (flood side only)

11:45 : Return to USACE cabin to collect charged batteries

12:15 : Collect EM38 data from STA 168+00 to 182+00 (flood side only)

15:55 : Return equipment to USACE cabin

16:10 : Leave site

16:20 : Arrive at hotel

Data Collected to date

EM38 : STA 52+20 to 108+00 (flood and protected side) STA 108+00 to 111+00 (flood side only)

EM38 : STA 120+00 to 148+00 (flood and protected side) STA 148+00 to 182+00 (flood side only)

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD0

Time depart office:	-	Time arrive on site:	-	Lunch:	NA
Time return office:	-	Time depart site:	-	**Total Hours:**	10:00

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 24, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 25, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero, J. Brimson
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	□ SIR20		□ Other ……..
X Electromagnetic Mapping	□ EM31	□ EM34	**2** EM38	□ EM61	**2** Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	**2** dGPS	□ rtk GPS		**1** Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Travel to site

06:30 : Arrive at site – collect equipment from USACE cable and set up for EM38 data collection

06:50 : Collect EM38 data from STA 148+00 to STA 156+00, and STA 168+00 to STA 182+00 (protected side only)

12:15 : Return to USACE cabin to collect charged batteries

12:45 : Collect EM38 data from STA 044+00 to 052+00 (flood side only)

15:15 : Return equipment to USACE cabin

15:25 : Leave site

15:35 : Arrive at hotel

Data Collected to date

EM38 : STA 44+00 to 52+20 (flood side only) STA 52+20 to 108+00 (flood and protected side) STA 108+00 to 111+00 (flood side only) STA 120+00 to 148+00 (flood & protected side) STA 156+00 to 168+00 (flood side) STA 168+00 to 182+00 (flood & protected side)

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD0

Time depart office:	-	Time arrive on site:	-	Lunch:	NA
Time return office:	-	Time depart site:	-	**Total Hours:**	9:15

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 25, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 25, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero, J. Brimson
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

X Ground Penetrating Radar	□ SIR2	□ SIR3000	□ SIR20		□ Other ……..
X Electromagnetic Mapping	□ EM31	□ EM34	2 EM38	□ EM61	2 Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	2 dGPS	□ rtk GPS		1 Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Travel to site

06:30 : Arrive at site – collect equipment from USACE cable and set up for EM38 data collection

06:50 : Collect EM38 data from STA 44+00 to STA 12+00

07:00 : D. Valintine – Leave site to attend Tiger Teams meeting at USACE district office

11:00 : D. Valintine – Arrive back on site, assist with EM38 data collection

15:55 : Return equipment to USACE cabin – Inform Lance regarding progress and contractor activities v's areas left to survey

16:10 : Leave site

16:20 : Arrive at hotel

Data Collected to date

EM38 : STA 12+00 to 52+20 (flood side only) STA 52+20 to 108+00 (flood and protected side) STA 108+00 to 111+00 (flood side only) STA 120+00 to 148+00 (flood & protected side) STA 156+00 to 168+00 (flood side) STA 168+00 to 182+00 (flood & protected side)

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD0

Time depart office:	-	Time arrive on site:	-	Lunch:	NA
Time return office:	-	Time depart site:	-	**Total Hours:**	10:00

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 26, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 27, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero, J. Brimson
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

□ Ground Penetrating Radar	□ SIR2	□ SIR3000	□ SIR20		□ Other ……..
X Electromagnetic Mapping	□ EM31	□ EM34	**2** EM38	□ EM61	**2** Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	**2** dGPS	□ rtk GPS		**1** Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Travel to site

06:30 : Arrive at site – collect equipment from USACE cable and set up for EM38 data collection

06:50 : Collect repeat EM38 data from STA 72+00 to STA 94+00 for quality control

07:30 : Collect EM38 data from STA 52+00 to STA 28+00

11:15 : J. Brimson – Leave site for the day

11:45 : Collect repeat EM38 data from STA 24+00 to STA 36+00 for quality control

12:45 : Collect repeat EM38 data from STA 144+00 to STA 177+00 for quality control

16:00 : Return to USACE cabin

16:10 : Leave site

16:20 : Arrive at hotel

Data Collected to date

EM38 : STA 12+00 to 28+00 (flood side only) STA 28+00 to 108+00 (flood and protected side) STA 108+00 to 111+00 (flood side only) STA 120+00 to 148+00 (flood & protected side) STA 156+00 to 168+00 (flood side) STA 168+00 to 182+00 (flood & protected side)

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD0

Time depart office:	-	Time arrive on site:	-	Lunch:	NA
Time return office:	-	Time depart site:	-	**Total Hours:**	10:00

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 27, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 28, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero, J. Brimson
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

□ Ground Penetrating Radar	□ SIR2	□ SIR3000	□ SIR20		□ Other ……..
X Electromagnetic Mapping	□ EM31	□ EM34	**2** EM38	□ EM61	**2** Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	**2** dGPS	□ rtk GPS		**1** Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Travel to site

06:30 : Arrive at site – collect equipment from USACE cabin and set up for EM38 data collection

06:50 : Collect EM38 data from STA 28+00 to STA 12+00 (protected side)

08:15 : J. Brimson – Arrive on site

10:45 : J. Brimson – Leave site for the day

12:15 : Collect EM38 data from STA 12+00 to STA 1+00 (flood and protected sides)

16:00 : Return to USACE cabin

16:10 : Leave site

16:20 : Arrive at hotel

Data Collected to date

EM38 : STA 1+00 to 108+00 (flood and protected side) STA 108+00 to 111+00 (flood side only)

STA 120+00 to 148+00 (flood & protected side) STA 156+00 to 168+00 (flood side) STA 168+00 to 182+00 (flood & protected side)

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD0

Time depart office:	-	Time arrive on site:	-	Lunch:	NA
Time return office:	-	Time depart site:	-	**Total Hours:**	10:00

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 28, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

FUGRO CONSULTANTS **Quality Management Form 306**

Field Activity Log – Geophysical Projects

Job Number:	04.00170079	**Date:**	September 29, 2011
Job Name:	WBV-14c.2 – Westwego to Harvey Canal	**Personnel:**	D. Valintine, A. Guerrero, J. Brimson
Owner:	-	**Client:**	USACE

EQUIPMENT & MATERIALS ON SITE

□ Ground Penetrating Radar	□ SIR2	□ SIR3000	□ SIR20		□ Other ……..
X Electromagnetic Mapping	□ EM31	□ EM34	**2** EM38	□ EM61	**2** Other Allegro Field PC
□ Magnetics	□ Handheld	□ Single	□ Gradient	□ Downhole	□ Other ……..
□ Resistivity	□ Field	□ ERT			□ Other ……..
□ Surface Seismic	□ Strataview	□ Geode	□ Geode	□ MASW	□ Other ……..
□ Borehole Methods	□ Down/h	□ Cross/h	□ Logging		□ Other ……..
□ Subsurface Utility Eng.	□ RD400	□ Mac51	□ Fisher	□ Sonde	□ Other ……..
X Survey Equipment	□ Level	**2** dGPS	□ rtk GPS		**1** Other Hydropro software
X Other 4x4 (rental)					
□ Other ……..					
□ Other ……..					

SUMMARY OF FIELD ACTIVITIES AND OBSERVATIONS

06:20 : Travel to site

06:30 : Arrive at site – stand by due to wet ground conditions

07:30 : Walk site from STA 55+00 to 60+00 – Ground conditions too wet for data collection

08:30 : Leave site

08:40 : Arrive at hotel

12:30 : Leave hotel

12:40 : Arrive at site – collect equipment from USACE cabin and set up for EM38 data collection

13:00 : Collect EM38 data from STA 156+00 to 168+00 (protected side)

16:30 : Collect additional EM38 data from STA 48+00 to 32+00 for quality control

18:05 : Return to USACE cabin, demobilize all equipment from site

18:20 : Leave site

18:30 : Arrive at hotel

All data collection activities completed

EM38 : STA 1+00 to 108+00 (flood and protected side) STA 108+00 to 111+00 (flood side only)

STA 120+00 to 182+00 (flood & protected side)

GPR : STA70+00 to 90+00, entire width of construction

TIME RECORD0

Time depart office:	-	Time arrive on site:	-	Lunch:	NA
Time return office:	-	Time depart site:	-	**Total Hours:**	08:20

APPROVAL

Project Geophysicist: (SIGNATURE)	(PRINT) David Valintine	Date: Sept 29, 2011
Site Representative: (SIGNATURE)	(PRINT)	Date:

APPENDIX B

FIELD REPORT FROM TEST PITS

Department of the Army

New Orleans District Corps of Engineers Field Report

CEMVN-ED-F

Dated Sep 17, 2011

CEMVN-ED-F Sep 17, 2011

Field Trip: On 16 Sep 11, Engineering Div. personnel visited the construction site of WBV-14c2, West Bank and Vicinity, New Orleans, Louisiana, Hurricane Protection Project, Westwego to Harvey Canal, New Westwego Pumping Station to Orleans Village Levee.

Purpose: Geophysical testing at the site has started and preliminary results for about half of the North-South levee portion have been completed and "Ground Truthing" was performed to validate preliminary findings. The "Ground Truthing" (field observations) allows for field/equipment comparison and provides information for fine-tuning and calibration of the equipment readings and results.

The following Engineering Div. personnel were on-site: Richard Pinner, Mark Woodward, Kim Tullier, Randy Perrin. Also present were representatives from Construction Div., OCPR, SLFPA-W, and the Contractor.

The A-E Contractor (FFEB) has supplied preliminary results plot of the Electromagnetic (EM) mapping for approximately 2200 feet of levee length by 300 feet of width (from berm toe to berm toe). The EM results were plotted and 115 possible anomalies locations delineated. The chosen locations were based on the 12 highest EM readings for anomalies. Of the 12 locations, 7 were chosen for excavation (Sites 22, 27/28, 21, 46, 55/56, 58, 70). Double number site designations were given to sites with 2 anomalies in close proximity.
Note: On 27 Sep 11, three additional EM sites were investigated and added to this report.

Dig Sites: Sites are designated by anomaly numbers from A-E provided plot. See photos below. They are located between stations 74+00 to 84+00 (C/L levee). For the approximate 15 CY of excavated soils per site, the findings are as follows:

1) Site 22 - Protected Side Berm 29° 52' 53.6" -90° 08' 08.4"
   Sta. 82+98 – Protected Side, 80 ft from C/L levee
   Found: Two pieces of wood (4-5' depth), one a fist-sized piece of wood.

2) Site 27/28 - Protected Side Berm 29° 52' 54.2" -90° 08' 08.4"
   Sta. 82+05 – Protected Side, 53 ft from C/L levee
   Found: Three pieces of wood. One found 2-3' of depth, other two at 4-5' depth.

3) Site 21 - Floodside Berm 29° 52' 53.2" -90° 08' 10.1"
   Sta. 83+54 – Floodside, 64 ft from C/L levee
   Found: Two pieces of wood. One found 2-3' of depth, the other at 4-5' depth.

4) Site 46 - Protected Side Berm 29° 52' 57.4" -90° 08' 07.4"
   Sta. 79+02 – Protected Side, 67 ft from C/L levee
   Found: Two pieces of wood (4'-5' deep). Debris (2'x 2' x 1") broken piece of side wall of concrete drain pipe (3' deep).

5) Site 55/56 - Protected Side Berm 29° 52’ 58.3” -90° 08’ 06.8”
Sta. 77+83 – Protected Side, 63 ft from C/L levee
Found: A piece of wood (2’x2’x5” at 3’ depth). Two pieces of debris (a 1” dia. steel pipe about 16” long at 4’ depth) and a 2.5’ long piece of rubber hose.

6) Site 58 - Protected Side Levee Slope 29° 52’ 58.4” -90° 08’ 07.3”
Sta. 77+83 – Protected Side, 15 ft from C/L levee
Found: One small piece of fist-sized wood (3’ deep).

7) Site 70 - Protected Side Levee Slope 29° 53’ 02.0” -90° 08’ 06.2”
Sta. 74+18 – Protected Side, 11 ft from C/L levee
Found: One piece of wood less than 1 foot in length (4’-5’ deep).

8) Added Site - Sta. 122+22 (69 ft Protected Side of Levee C/L)
Found: One piece metal angle line (~16” x 1½” x 1½”) and several pieces of wood over 12-inches.

9) Added Site - Sta. 123+52 (69 ft Floodside of Levee C/L)
Found: One piece of steel cable (~24” x 1½”) and a small piece of wood

10) Added Site - Sta. 124+42 (39 ft Protected Side of Levee C/L)
Found: One piece of CMP drainage pipe (5’ x 12’) and a plastic hose about 5’ x 1” dia.

Site 22

Site 27/28

Site 21

Site 46

Site 55/56

Site 58

Site 70

Typical Dig Site (#21)

Sta. 122+22 (69 ft Protected Side of Levee C/L)

LAT: 29° 52’ 21.1” LON -90° 08’ 11.2”

Sta. 124+42 (39 ft Protected Side of Levee C/L)

LAT: 29° 52’ 20.7” LON -90° 08’ 08.6”

Sta. 123+52 (69 ft Floodside of Levee C/L)

LAT: 29° 52’ 19.52” LON -90° 08’ 09.8”

APPENDIX C

RESUME – MR. D. VALINTINE

RESUME

DAVID VALINTINE PG

TITLE
Geophysical Services Manager

PERSONAL INFORMATION

Date of birth:	July 14, 1978
Nationality:	British
Marital status:	Married

EDUCATION
BSc (Hons) Geophysics with Mathematics, University of Liverpool (09/96 – 07/99)
MSc Applied Environmental Geology, University of Wales, Cardiff (09/99 – 09/00)

EMPLOYMENT HISTORY

Dec '00 – Mar '04	Geophysical Engineer STATS Ltd., 18 Frogmore Rd, Hemel Hempstead, UK
Mar'04 – Nov'07	Senior Geophysicist Fugro Engineering Services Ltd., Hithercroft Road, Wallingford, UK
Nov'07 - Present	Senior Geophysics Manager Fugro Consultants, Inc., 6100 Hillcroft, Houston, Texas

EXPERIENCE

Mr. Valintine transferred to Fugro Consultants after spending over three years with their sister company in the UK, Fugro Engineering Services. Acting as the Geophysical Services Manager, Mr. Valintine is responsible for the Engineering Geophysics service line of Fugro Consultants, including the supervision of Project Geophysicists and Technicians, research and development projects, client liaisons, marketing and growth of the service line for North America. Mr. Valintine is also a key member of the worldwide Fugro Engineering Geophysics Group within the Fugro Group of companies. On a day-to-day basis, his duties include the design of geophysical surveys, collection, processing, interpretation and reporting of engineering geophysical data for civil, geotechnical, environmental and structural investigations.

Through academic qualifications and dissertations, Mr. Valintine has developed a working knowledge and experience in finite difference modeling techniques applied to geological and geophysical applications with a focus on modeling of subduction zone temperatures. Mr. Valintine's MSc thesis was on the application of electrical resistivity topography to landfill sites from design to post-closure, including the applications of 3D mapping of landfill liner / bedrock topography.

Mr. Valintine has conducted many commercial investigations and has taken lead roles in over 500 projects in the United States, the Caribbean, Europe, and the Middle East. Mr. Valintine has strong experience in the application of the Ground Penetrating Radar technique for a wide variety of applications; Electromagnetic methods, including theory, data acquisition, processing and interpretation; Electrical Resistivity techniques, with focus on the use of multi-electrode arrays for both 2 and 3d surveys; Shallow Seismic techniques, from project planning, data collection, processing and modeling; and Geophysical Logging techniques.

Some of Mr. Valintine's key projects, which he acted as lead Geophysicist, are as follows:

- Dallas – Fort Worth, TX – 150 miles of Electrical Resistivity Imaging surveys along the alignment of a new 10-ft diameter water supply pipeline for the Tarrant Regional Water District and the City of Dallas. Aims of the investigation were to map subsurface stratigraphy, potential fatal flaws and provide preliminary data for cathodic protection.
- May Pen, Jamaica, WI – Over 70 km of resistivity imaging, and collection of over 5,000 microgravity stations to map the depth to bedrock and the presence of karst features across the footprint of two proposed tailings ponds (approx 350ha).
- Various sites, US and abroad – Reviewed numerous geophysical investigations conducted at existing and proposed nuclear power plant locations for quality assurance purposes.
- Olympic Park, London and Rotterdam, Netherlands – Supervision of 1,800 Magnetometer cone pressure meter tests for the detection of World War II unexploded bombs.
- Champlin Refinery, Enid, OK – Electromagnetic Mapping to assess the presence of subsurface contamination at a former oil refinery during the implementation of a Preliminary Field-scale Remedial Technology test.
- Dubai, United Arab Emirates – Collection of downhole and crosshole seismic data, and numerous wireline techniques to assist tunneling and construction of new subway system.
- Abu Dhabi International Airport, UAE – Collection of over 20 km of resistivity imaging and multi-channel surface wave seismic data within the airport property for the detection of karst features.
- Hertfordshire, UK – Electromagnetic Mapping and Magnetic Gradiometry over 4 hectare brownfield site to determine location of buried foundations and debris.
- George Bush Intercontinental Airport, Houston, TX – Ground Penetrating Radar investigation for the detection of underground utilities ahead of the Terminal B Expansion.
- Cambridge, UK – Electromagnetic Mapping to determine the presence of karst features across a proposed 6 hectare commercial development site.
- Loch Ness, Scotland – Electrical Resistivity Imaging and Seismic Refraction methods were employed to seek to determine depth to and quality of bedrock to aid the design of a new hydro-electric dam project.
- Ras Laffan, Qatar – Microgravity survey of 2,500 stations to look for karstic bedrock features at the site of a new oil refinery.

PROFESSIONAL AFFILIATIONS

Mr. Valintine is a Professional Geoscientist registered in the State of Texas, a member of the Society of Exploration Geophysicists (Near Surface Geophysics Section), the Environmental and Engineering Geophysics Society and the European Association of Geoscientists and Engineers (Near Surface Geoscience Division).