WBV-14C.2 “Tiger Team Investigation Plan"

1. The purpose of this investigation is to obtain detailed information for the WBV14C.2 Tiger Team. This information will help the team determine for the Corps of Engineers, its sponsors, and all stakeholders:

- If the WBV14C.2 levee was constructed according to the requirements of the WBV14C.2 plans and specifications,
- If the expected performance of the as-built WBV14C.2 levee will provide the authorized level of flood protection and risk reduction.

2. This investigation plan includes new trench excavations, geotechnical exploration, undisturbed sampling, bulk soil samples, and soils testing to determine geotechnical properties including moisture content, organic content, shear strength, bulk unit weights, classification, and estimation of wood percentage in the new and existing levee fills. The trench excavations and soil borings will allow the Tiger Team to observe the quality of construction of the compacted soils in the completed levee, and in some cases, the quality of fills placed in previous contracts and the existing embankment/foundation interface. This investigation plan will be developed considering the results of recently completed FFEB/Fugro Geophysical surveys, material source charts provided by CEMVN construction, design documentation, historical observations, and non-federal sponsor observations made during the most recent construction. Reference the attached maps of the completed project overview (Figure 1), inspection trench locations (Figures 2 through 8), typical inspection trench sections (Figure 9), Trenching Log (Figure 10 through 12), and Excavation, Inspection, and Testing procedures (Appendices A through D).

3. This inspection plan will be conducted by:

a. Utilizing the results of the completed FFEB/Fugro Geophysical surveys, material source charts provided by CEMVN construction, design documentation, historical observations, and non-federal sponsor observations made during the most recent construction. All of this information will be used to located the investigative trenches and borings in areas suspected to have the greatest wood/debris concentrations.

b. Completing investigative trenching on the existing flood protection project on its centerline, and flood side and protected side berms, observing the quality of construction of the compacted soils in the completed levee, and in some cases, the quality of fills placed in previous contracts and the existing embankment/foundation interface, investigating/quantifying the organic matter, sticks, branches, roots, debris and objectionable material within the levee footprint. The purpose of these trenches will be to assess if the compacted fill meets the requirements of the WBV14C.2 plans and specifications.

c. Obtaining bulk soil samples at discrete elevations immediately adjacent to selected investigation trenches for the purpose of determining more accurate volumes of smaller, non-objectionable woody debris. Based on its observations of the excavated materials, the Tiger Team will decide where the bulk samples will be located. The selected locations will be those that appear to have high concentrations of small woody debris.

d. Completing geotechnical borings obtaining undisturbed samples of existing embankment suitable for observation and testing in the laboratory. The primary intent of the soil borings and undisturbed soil samples and testing is to determine the soil classification, shear strength, unit weights, moisture content, organic content, sand content, and Atterberg limits. A secondary intent of these geotechnical borings is to determine if these samples can provide accurate measurements of small woody debris that exists in the fill. Some of these geotechnical borings shall be located immediately adjacent to the bulk sample locations (described in paragraph 3c above) and undisturbed samples from these borings (at the same elevations as the bulk samples) will be processed to determine the volumes of smaller, non-objectionable woody debris. This data will be compared to the data obtained from the bulk samples. Based on visual inspection, the Tiger Team shall select other undisturbed samples from other borings for similar processing.

4. Trenching shall be conducted at the locations shown on Figures 2 to 8 and detailed in Tables 1a and 1b. All trenching shall be conducted with Tiger Team, MVN, CPRA and SLFPA-W staff members present. Detailed procedures for excavating and inspecting the excavated cuttings are found at the end of this document. Observations and other data collected during the trench excavation shall be recorded on the Field Trench Log shown on Figures 10 through 12 and described in Procedures For Inspection Trench Excavation Cuttings Inspection, and Testing located at the end of this document.

Although the locations shown on Tables 1a and 1b represent the most recent Tiger Team thinking and prevail over locations shown on the map, trench locations and depths may be field adjusted by the COR based on recommendations from Corps, SLFPA-W, and CPRA.

5. The organic matter, sticks, branches, roots, debris, and objectionable material collected from the inspection trench cuttings will be stored in suitable containers and transported to the NOD Soils Lab for detailed testing. Detailed testing procedures for these materials are attached at the end of this document.

6. All trenches shall be completely backfilled within 48 hours of inspection unless directed otherwise by the COR. All backfill shall be in accordance with the existing contract documents, especially “Embankment”, Section 31 24 00.00 12 in the specification.

a. If the excavated material is clean of masses of organic matter, sticks, branches, roots, and other debris, and objectionable material, the open trench shall be backfilled with the excavated material.

b. If the excavated material can be easily cleaned (picked) to a satisfactory condition in the opinion of the Tiger Team, the soils shall be picked and the open trench shall be backfilled with the excavated material.

c. The Contractor shall have additional suitable backfill material on site to backfill any open trenches if the excavated material is contaminated with an unacceptable amount of masses of organic matter, sticks, branches, roots, other debris, and objectionable material.

d. If a hurricane is projected to enter or form in the Gulf of Mexico, the trenching operation shall be revised to limit the number of open trenches to three. Based on NOAA hurricane projections, the Tiger Team may require the contractor officer's representative to direct the Contractor to immediately backfill all open trenches.

e. Prior to backfilling, the vertical side walls of the investigative trenches shall be cut back to flatter slopes. The sidewalls of trenches on the levee section shall be cut back to no steeper than 1.0v/1.5h. The sidewalls of trenches on the marsh side or protected side berms shall be cut back to no steeper than 1.0v/1.0h.

Trench Number		Protected Side Berm		C/L	Flood Side Berm	
	Station	O/S	Depth	Depth	O/S	Depth
Trench Locations Based Upon NFS Areas of Concern						
	48+00	90	3			
	80+00				47	3
	90+00			3.5		
Gnd Truth	122+22	69	3			
Gnd Truth	123+59				69	3.7
Gnd Truth	124+42	39	3			
	140+00				51	3
	145+00	130	3			
	150+00			6		
	160+00				51	3
	170+00			3		
	170+00	137	3			

Table 1a – WBV14C.2 Inspection Trench Locations and Depths
Systematic Investigation Based on NFS Observed Areas of Concern
(Note: These locations include "Ground-Truth trenches" excavated
to investigate anomalies identified by Geophysical surveying.)

7. Undisturbed borings shall be taken through the WBV14C.2 levee fill to elevations and locations to be determined after the field trenching is complete. The CEMVN soils unit or a soils testing laboratory under contract to the New Orleans District will complete classification, moisture content, Atterberg limits, organic matter content, and #200 sieve wash (to obtain sand content), and strength testing. During sample extrusion, a photographic record of the samples will be established and maintained. Unit weight will be determined for selected 1 foot long samples. Selected undisturbed samples will be tested for woody small woody debris (per paragraph 3d above). Select samples may be tested for strength or permeability testing depending on volume of woody debris present.

8. The Southeast Louisiana Flood Protection Authority – West Bank will be allowed to collect additional samples of the excavated cuttings. These samples shall be stored at the SLFPA-W's facilities for preservation. Any testing or use of these materials shall be coordinated through the Tiger Team beforehand. SLFPA-W will provide the resources to collect and transport these samples.

Trench Number		Protected Side Berm		C/L	Flood Side Berm	
	Station	O/S	Depth	Depth	O/S	Depth
Trench Locations Based Upon NFS Areas of Concern, Material Source Charts, and Fugro Geophysical Targets						
1	2+10			6		
2	5+20				100	4
3	4+50	20	3			
4	9+80				65	4-5
5	22+00			4-6		
6	27+25				80	4
7	29+55			5-6		
8	32+30				110	4-5
9	37+10	110	3-5			
10	39+90				110	3-5
11	40+50				40	5
12	57+10			5		
13	60+50				Investigate	
14	61+50				Investigate	
15	66+90			3		
16	70+00			3-5		
17	71+50	55	3			
18	97+00			4-5		
19	104+50	120	4			
20	108+20	60	2.5-5			
21	110+00			4		
22	120+50	65	2.5-5			
23	121+50			4.5		
24	136+00			4-5		
25	141+50	120	Investigate			
26	165+10	45	2.5-5			
27	166+90			3.5-5		
28	172+00	60	2.5-5			
29	174+00			4		
30	179+80			4		
31	180+00	150	4			

Table 1b – WBV14C.2 Inspection Trench Locations and Depths
Based Upon NFS Areas of Concern, Material Source Charts,
and Fugro Geophysical Targets

PROCEDURES FOR INSPECTION TRENCH EXCAVATION,

CUTTINGS INSPECTION AND TESTING.

EXCAVATION PROCEDURES:

1. Locate the inspection trench as per the location (floodside, centerline, or protected side), station and offset shown in Tables 1a and 1b.

2. All trenches shall be 10-foot by 10-foot in plan dimension at the surface. The contractor surveyor will locate the four corners of the trench and its center (on the ground surface), obtaining accurate coordinates and elevations of these five points. The surveyor shall also locate the four corners of the trench and its center every 12-inches of completed excavation.

3. The contractor shall cover a sufficient area of the ground surface surrounding the inspection trench with a construction fabric. A "sufficient area" is that area necessary to contain all of the materials excavated from the trench placed in no more than 6-inch thick layers.

4. The operator shall excavate the inspection trench in 6-inch layers. The operator shall carefully place these cuttings on the construction fabric. The operator shall begin placing the cuttings on the fabric on one end of the fabric and then proceed in an orderly fashion as shown on the Field Trenching Log such that as the excavation depth increases, the cuttings cover more and more of the fabric surrounding the excavation. This will result in the inspection team knowing approximately what depth the observed cuttings originated from.

5. The operator will place and spread the clay cuttings on the fabric in 6-inch layers. The operator will do the necessary work to spread and break-down the cuttings to achieve the 6-inch thick layer. The operator will be careful not to significantly change the location of the cuttings from their originally placement on the fabric. The operator will do the necessary work with the excavator to attempt to break-up or cut-up the cuttings into smaller, more manageable pieces.

6. Once the excavation is complete, the contract surveyor will locate the four corners of the trench and its center (at the bottom of the excavation), obtaining accurate coordinates and elevations of these five points. For excavations deeper than 4-feet, the excavation center point will not be surveyed due to safety concerns for the surveyor. In this case all corner and midpoints of the excavated surface will be surveyed.

7. At any time during the excavation, the Tiger Team may request the COR to temporarily discontinue the contractor's excavation operations in order to access the trench.

CUTTINGS INSPECTION PROCEDURES

1. The team shall carefully and methodically comb through the cuttings, inspecting the cuttings, breaking up the cuttings as necessary by hand or with shovels to collect wood and wood pieces of any size or shape that are visible to the naked eye.

2. If necessary, the team shall ask the contracting officer's representative to instruct the contractor to break down the cuttings into smaller pieces to assist the inspection.

3. All wood collected from this inspection shall be stored in containers of ample volume to store the collected wood. The container shall be marked or labeled with the trench location and depth. An example of the labeling is: NS_CL_90_0-3' depth or EW_FS_123+59_69' offset_0-3' depth. NS = North South, EW = East West, CL = Center Line, FS = Flood Side, PS = Protected Side. The collected wood will be stored for later analyses.

4. The team will reach consensus that the necessary efforts have been expended to collect the wood and that all wood that can be collected has been.

5. Finally, the team will gather at the excavation and discuss if any team member observed anything about the cuttings or observed anything about the sidewalls or bottom of the excavation that would cause concern for seepage or stability of the levee or any other observation that might indicate any part of the constructed levee or berms were unsuitable for their intended purpose.

6. All data and observations of the Tiger Team shall be recorded on the Field Trenching Log. An example of the Trenching Log is included as Figures 10 through 12. One person on the Tiger Team shall be designated as the note taker.

WOOD PIECES SMALLER THAN OBJECTIONABLE AND WOOD PIECES NOT VISIBLE TO THE NAKED EYE

1. At trench locations selected by the Tiger Team, the team shall excavate a smaller hole (one or two cubic-feet) immediately next to the previous excavation following ASTM D 4914-08 Density and Unit Weight of Soil and Rock in Place by Sand Replacement Method in a Test Pit. All material collected from this excavation shall be saved.

2. A metal 2 foot square template shall be placed on the prepared surface and fixed into position. The volume of the space between the top of the template and the ground surface is determined from filling the space with calibrated sand on ½ mil plastic using a pouring device. The mass of the sand required to fill the template is determined and the sand is removed. The hole is excavated within the boundaries of the template forming a pit. All soil that is excavated is collected in a container and delivered to the lab for weighing and further testing. The pit and template is fitted again with ½ mil plastic and filled with calibrated sand and the volume of the hole is determined.

3. All cuttings excavated from this hole shall be delivered to the lab. All cuttings from the hole shall be sieved through a No. 4 (4.76 mm) sieve. All wood pieces retained on the No. 4 sieve shall be washed and oven dried for weight and volume determination. A representative portion of soil that passed the No. 4 sieve shall be saved for a subsequent organic content determination. The soil delivered to the lab can be used to determine weight of soil excavated,

moisture content (ASTM D2216), plus No. 4 size wood weight and volume content, and organic content on minus No. 4 fraction (ASTM D2974 Method C).

4. The volume of these wood pieces shall be determined using the in-house procedure described below for the larger wood pieces collected from the trench.

5. The volume of wood pieces collected on the No. 4 sieve shall be divided by the volume of the excavated smaller hole to determine a percentage (by volume) of wood visible to the naked eye.

DETERMINATION OF ORGANIC CONTENT

1. The organic content of the minus No. 4 saved soil shall be determined by ASTM D2974 Method C.

LABORATORY DETERMINATION OF WOOD VOLUME FOR LEVEE FILL

A. The wood pieces collected at the excavations shall be delivered to the testing laboratory. There, any clay pieces adhering to the wood pieces that can be removed by hand without damaging the wood piece shall be removed.

B. The wood pieces shall be separated by size:

Up to 3” long

3” to 6”

6” to 12”

Greater than 12”

C. All wood pieces shall be photographed.

D. All wood pieces shall be weighed in their existing conditions (wet weight as excavated)

E. Sturdy containers shall be used for the wood volume determination process~~es~~. The weight of the empty containers shall be determined. The container shall be filled in two layers with Ottawa sand and then the surface of the sand shall be densified by use of a Kango vibrating hammer fitted with an end plate and vibrated such that the Ottawa sand achieves its maximum density. Additional Ottawa sand shall be added and vibrated for the second layer, with additional sand added as needed to “top off” the container as the sand achieves a greater density. The weight of the container filled with densified Ottawa sand shall be determined multiple times to determine the best value of the weight. The weight of the sand shall be divided by the known volume of the container and reported as the maximum unit weight (density) of the Ottawa sand.

F. The volume of the wood shall be determined by the following in-house developed procedure Wood Volume Determination.

1) **Volume and Mass Determination of Measures (annual):** Determine the Volume of the measures to be used for volume determination by the water filled method as specified in ASTM C29/C29M paragraph 8. Four measures were available and measured for volume with the following results (See Appendix A):

   a. Small Round Measure (0.5 cu.ft.) = 0.5002 cu.ft.
   b. Large Round Measure (1.0 cu.ft.) = 0.9987 cu.ft.
   c. Small Rectangular Measure (1.0 cu.ft.) = 0.9645 cu.ft.
   d. Large Rectangular Measure (2.3 cu.ft.) = 2.2973 cu.ft.

   Note: The rectangular measures were calibrated by water filled method and verified with linear measurements. The mass of each measure was also determined as noted below:

   a. Small Round Measure (0.5 cu.ft.) = 12.4 lbs.
   b. Large Round Measure (1.0 cu.ft.) = 52.0 lbs.
   c. Small Rectangular Measure (1.0 cu.ft.) = 24.3 lbs.
   d. Large Rectangular Measure (2.3 cu.ft.) = 29.8 lbs.

2) **Standard Wood for Verification (annual):** Determine mass and linear measured volume of standard cut pieces of wood used for verifying the determined wood content from the use of densified Ottowa sand within measures of known volume (See Appendix B). Eight pieces wood, five to eight inches long were cut, labeled A thru G, measured and used to verify volume determination by the densified sand method. The total mass and volume of the eight pieces of wood was:

   Wood Pieces A thru G total mass = 599.9 gms = 1.3225 lbs

   Wood Pieces A thru G total volume = 60.943 cu.in. = 0.0353 cu.ft.

   Wood Pieces A thru G unit weight variation from 34.23 pcf to 42.05 pcf

3) **Density Sand:** Obtain good quality Ottowa sand or also known as US Silica Sand (Figure 1). Verify that the quality of the Ottowa sand meets the requirements specified in ASTM D1556 paragraph 6.2. The sand can be re-used, but it should be (a) cleaned to comply with the previously referenced standard by sieving and/or rinsing, and (b) oven drying prior to reuse.

Figure 1 – US Silica Sand or "Ottowa Sand"

4) **<u>Determining Densified Sand within a Measure (daily)</u>:** Determination of densified Ottowa sand within measures using a Kango vibrating hammer Type 638S fitted with a 5.7 inch diameter plate or a 4 inch x 5.5 inch rectangular plate (Figure 2).

Figure 2 – Kango Vibrating Hammer with Round End Plate

Two measures (0.5 cu.ft. small round measure and 1.0 cu.ft. small rectangular measure) were used to determine the densified sand and were based upon use of the Kango vibrating hammer and placement within layers. Clean and dry Ottowa sand is placed loosely within the each layer using a large scoop or the edge of a bucket by flowing and distributing the sand evenly across the surface area. The Kango hammer is then used by placing the bottom plate against the loose sand and vibrating with slight pressure for periods of 1-2 seconds on each coverage area of the

bottom plate. The bottom plate is positioned such that there is overlapping coverage in order to vibrate the total surface area of each layer of sand. The number of vibration placements of the hammer and layers were determined as noted in the following trials. The trials were determined and repeated for the two selected measures with further identification for methods of use on the other measures yet to be determined:

a. Small Round Measure (0.5 cu.ft.) – (1) Position measure over a large catch pan for collecting excess sand. Place loose Ottowa sand in one layer (half height of measure); (2) Using the Kango hammer fitted with the round end plate, vibrate the sand in **four** overlapping positions for **1-2 seconds** each position (Figure 3); (3) Place loose Ottowa sand in a second layer (full height of measure); (4) Vibrate the sand in this final layer in **four** overlapping positions for **1-2 seconds** each position taking care not to allow the vibrating plate to impact the top edge (rim) of the mold. The sand should consolidate below the top rim of the measure; (5) Place additional (excess) sand above the top of the measure. It should appear to overflow. Place the larger round metal plate (approximately 10.5 inch diameter) on the excess sand. Position the vibrating hammer with end plate on the larger metal plate and **vibrate for 3-4 seconds.** (Figure 4) It is desired to have excess sand above the top of the rim after vibration of about 1/8 inch; (6) Using a straight metal bar, strike off the excess sand, leaving the sand flush with the top rim of the measure (Figure 5); (7) Weigh the measure and densified sand and determine the mass per unit volume of the measure; (8) Repeat steps 1 thru 7 for a total of three determinations of densified sand mass per unit volume, and calculate the average mass per unit volume (See Appendix C).

b.

Average mass per unit volume of densified sand = 104.56 pcf

Figure 3 – Vibrating First Layer

Figure 4 – Vibrating Final Layer

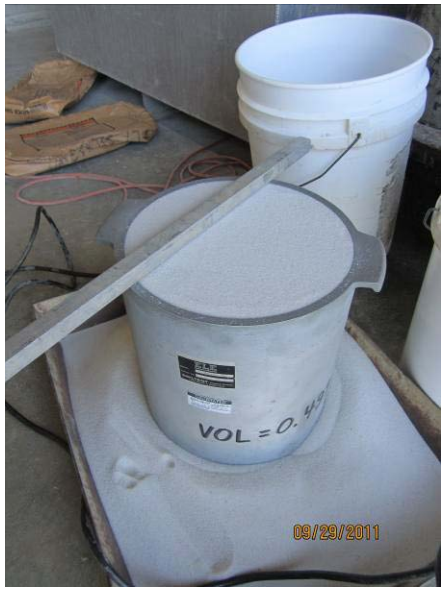


Figure 5 – Strike Off Excess Sand

c. Large Round Measure (1.0 cu.ft.) - (1) Position measure over a large catch pan for collecting excess sand. Place loose Ottowa sand in one layer (half height of measure); (2) Using the Kango hammer fitted with the round end plate, vibrate the sand in **eight** overlapping positions for **1-2 seconds** each position; (3) Place loose Ottowa sand in second layer (full height of measure); (4) Vibrate the sand in this final layer in **eight** overlapping positions for **1-2 seconds** each position taking care not to allow the vibrating plate to impact the top edge (rim) of the mold. The sand should consolidate below the top rim of the measure; (5) Place additional (excess) sand above the top of the measure. It should appear to overflow. Place the larger round metal plate (approximately 10.5 inch diameter) on the excess sand. Position the vibrating hammer with end plate on the larger metal plate and **vibrate for 3-4 seconds.** It is desired to have excess sand above the top of the rim after vibration of about 1/8 inch; (6) Using a straight metal bar, strike off the excess sand, leaving the sand flush with the top rim of the measure; (7) Weigh the measure and densified sand and determine the mass per unit volume of the measure; (8) Repeat steps 1 thru 7 for a total of three determinations of densified sand mass per unit volume, and calculate the average mass per unit volume.

Average mass per unit volume of densified sand = T.B.D.

d. Small Rectangular Measure (1.0 cu.ft.) (Figure 6) - (1) Position measure over a large catch pan for collecting excess sand. Place loose Ottowa sand in one layer (half height of measure); (2) Using the Kango hammer fitted with the rectangular end plate, vibrate the sand in **thirteen** overlapping positions for **1-2 seconds** each position; (3) Place loose Ottowa sand in second layer (full height of measure); (4) Vibrate the sand in this final layer in **thirteen** overlapping positions for **1-2 seconds** each position taking care not to allow the vibrating plate to impact the top edge (rim) of the mold. The sand should

consolidate below the top rim of the measure; (5) Place additional (excess) sand above the top of the measure. It should appear to overflow. Vibrate the sand in this final layer in **thirteen** overlapping positions for **1-2 seconds** each position taking care not to allow the vibrating plate to impact the top edge (rim) of the mold. The sand should remain above the top rim of the measure. It is desired to have excess sand above the top of the rim after vibration of about 1/8 inch; (6) Using a straight metal bar, strike off the excess sand, leaving the sand flush with the top rim of the measure; (7) Weigh the measure and densified sand and determine the mass per unit volume of the measure; (8) Repeat steps 1 thru 7 for a total of three determinations of densified sand mass per unit volume, and calculate the average mass per unit volume (See appendix C).

Average mass per unit volume of densified sand = 106.62 pcf

e. Large Rectangular Measure (2.3 cu.ft.) - (1) Position measure over a large catch pan for collecting excess sand. Place loose Ottowa sand in one layer (half height of measure); (2) Using the Kango hammer fitted with the rectangular end plate, vibrate the sand in **twenty six** overlapping positions for **1-2 seconds** each position; (3) Place loose Ottowa sand in second layer (full height of measure); (4) Vibrate the sand in this final layer in **twenty six** overlapping positions for **1-2 seconds** each position taking care not to allow the vibrating plate to impact the top edge (rim) of the mold. The sand should consolidate below the top rim of the measure; (5) Place additional (excess) sand above the top of the measure. It should appear to overflow. Vibrate the sand in this final layer in **twenty six** overlapping positions for **1-2 seconds** each position taking care not to allow the vibrating plate to impact the top edge (rim) of the mold. The sand should remain above the top rim of the measure. It is desired to have excess sand above the top of the rim after vibration of about 1/8 inch; (6) Using a straight metal bar, strike off the excess sand, leaving the sand flush with the top rim of the measure; (7) Weigh the measure and densified sand and determine the mass per unit volume of the measure; (8) Repeat steps 1 thru 7 for a total of three determinations of densified sand mass per unit volume, and calculate the average mass per unit volume.

Average mass per unit volume of densified sand = T.B.D.

Note: Average densified sand mass per unit volume shall be determined daily and any adjustments in methods including number and timing of vibrations should be documented. Three repeated determinations of densified sand mass per unit volume shall be within 2.0 pcf of each subsequent determination for each daily average determination. See Appendix C for blank form used for determining densified sand within a measure.

5) **<u>Wood Verification (annual)</u>:** Verification of wood volume determination was conducted on the small round 0.5 cu.ft. measure and the small rectangular 1.0 cu.ft. measure. Wood pieces measured in Step 2) above were used in each measure by **densifying sand and four wood pieces in each layer, for a total of eight wood pieces within each measure**. The same procedures outlined in Step 4) above are used to place and densify the sand and wood within the measures. The wood is placed within each layer with at least ½ inch of loose sand beneath and around the wood pieces (Figure 6). The mass of the densified sand, measure, and wood is used to

determine the density and subsequent volume of the wood. See below the following verifications for the measures identified above:

Figure 6 – Placement of Standard Wood Pieces for Verification

a. Small Round Measure (0.5 cu.ft.) – (1) Determine the volume and weight of the measure as noted in Step 1) above; (2) Determine the average densified sand mass per unit volume as noted in Step 4) a. above; (3) Determine volume and mass of pre-cut pieces of wood as noted in Step 3) above; (4) Densify wood in layers following the similar method noted in Step 4) a. above; Determine the densified sand and wood mass in the unit measure; (5) Calculate the volume of wood as shown below:

   (a) Small Round Measure (0.5 cu.ft.) = 0.5002 cu.ft.
   (b) Small Round Measure (0.5 cu.ft.) = 12.4 lbs.
   (c) Average mass per unit volume of densified sand = 104.56 pcf
   (d) Wood Pieces A thru G total mass = 599.9 gms = 1.3225 lbs
   (e) Wood Pieces A thru G total volume = 60.943 cu.in. = 0.0353 cu.ft.
   (f) Average determined densified sand, wood, & measure mass = 62.4 lbs (average of 2 minimum determinations)
   (g) Densified sand only mass (no wood) = (c) x (a) = 52.3009 lbs
   (h) Densified sand only mass (with wood) = (f) – (b) – (d) = 48.6775 lbs
   (i) Volume of wood (from densified sand test) = [(g) – (h)] / (c) = 0.0347 cu.ft.
   (j) % actual volume wood = 100 x (e) / (a) = 7.06
   (k) % tested volume wood = 100 x (i) / (a) = 6.94

   Note: Verify that the two calculated % volumes are within ± 0.2% of each other.

b. Small Rectangular Measure (1.0 cu.ft.) - (1) Determine the volume and weight of the measure as noted in Step 1) above; (2) Determine the average densified sand mass per unit volume as noted in Step 4) c. above; (3) Determine volume and mass of pre-cut pieces of wood as noted in Step 3) above; (4) Densify wood in layers following the similar method noted in Step 4) c. above; Determine the densified sand and wood mass in the unit measure; (5) Calculate the volume of wood as shown below:

(a) Small Rectangular Measure (1.0 cu.ft.) = 0.9645 cu.ft.
(b) Small Rectangular Measure (1.0 cu.ft.) = 24.3 lbs.
(c) Average mass per unit volume of densified sand = 106.62 pcf
(d) Wood Pieces A thru G total mass = 599.9 gms = 1.3225 lbs
(e) Wood Pieces A thru G total volume = 60.943 cu.in. = 0.0353 cu.ft.
(f) Average determined densified sand, wood, & measure mass = 124.6 lbs (average of 2 minimum determinations)
(g) Densified sand only mass (no wood) = (c) x (a) = 102.8350 lbs
(h) Densified sand only mass (with wood) = (f) – (b) – (d) = 98.9775 lbs
(i) Volume of wood (from densified sand test) = [(g) – (h)] / (c) = 0.0362 cu.ft.
(j) % actual volume wood = 100 x (e) / (a) = 3.66
(k) % tested volume wood = 100 x (i) / (a) = 3.75

Note: Verify that the two calculated % volumes are within ± 0.2% of each other.

6) **Wood Volume Determination:** Determination of wood volume for a test sample as follows. Determine the mass of the sample wood prior to placement into the loose sand layers. Wood pieces from a sample are placed in one of the tested measures above by following procedures as outlined in Step 4). The wood is placed within each layer of loose sand with at least ½ inch of loose sand beneath and around the various wood pieces. The mass of the densified sand, measure, and wood is used to determine the density and subsequent volume of the wood. See below the following verifications for the measures identified above:

a. Small Rectangular Measure (1.0 cu.ft.) - (1) Determine the volume and weight of the measure as noted in Step 1) above; (2) Determine the average densified sand mass per unit volume as noted in Step 4) a. above; (3) Determine mass of sample pieces of wood; (4) Densify wood in layers following the similar method noted in Step 4) a. above; Determine the densified sand and wood mass in the unit measure; (5) Calculate the volume of wood as shown below in **example** for Station 80+00 Flood side:

(a) Small Rectangular Measure (1.0 cu.ft.) = 0.9645 cu.ft.
(b) Small Rectangular Measure (1.0 cu.ft.) = 24.3 lbs.
(c) Average mass per unit volume of densified sand = 106.62 pcf
(d) Mass of Sample Wood Pieces = 2.65 lbs
(e) Determined densified sand, wood, & measure mass = 124.2 lbs
(f) Densified sand only mass (no wood) = (c) x (a) = 102.835 lbs
(g) Densified sand only mass (with wood) = (e) – (b) – (d) = 97.25 lbs
(h) Volume of wood (from densified sand test) = [(f) – (g)] / (c) = 0.0524 cu.ft.
(i) Volume of excavated hole ***(assumed)*** = 10 cu.yds. x 27 = 270 cu.ft.
(j) % tested volume wood = 100 x (h) / (i) = 0.02

Documentation: Forms for documenting these procedures are provided in Appendix D. As a minimum, calibrations of measures should be documented annually on the Unit Weight Measure Volume Determination Record. Daily, the Densified Sand unit weight shall be documented on the Densified Sand Calibration Record. Test records for samples shall be documented on the Wood Volume Determination Record.

Appendix A

Unit Weight Measure Volume Determination Record

Verified By: Mwielputz **Date:** 29 Sept 11

Equipment: 0.5 cu.ft Round Unit Wt. Bucket

Identification No. _____ **Verification Frequency:** 12 Months

Previous Verification Date: _____ **Next Due Date:** _____

Verification Equipment Used: Scale # 121606 Therm # CP35496

Verification Procedure: In House Procedure C2, ASTM C29 and C138

Volume Determination			
(A)	Wt. Measure + Plate + H_2O	46.7	~~gms~~, lbs
(B)	Wt. Measure + Plate	15.6	~~gms~~, lbs
(A-B)	Weight H_2O	31.1	~~gms~~, lbs
	Temperature of H_2O	28.6°C	°C, ~~°F~~
(C)	Density of H_2O (from chart)	62.181	~~g/cc~~, lbs/ft^3
(A-B)/C	Volume of Measure	0.5002	~~cm^3~~, ft^3

Density of H_2O		
Temperature °C (°F)	g/cc	lbs/ft^3
16 (60.8)	0.99897	62.3626
17 (62.6)	0.99880	62.3520
18 (64.4)	0.99862	62.3408
19 (66.2)	0.99843	62.3289
20 (68.0)	0.99823	62.3164
21 (69.8)	0.99802	62.3033
22 (71.6)	0.99779	62.2889
23 (73.4)	0.99756	62.2746
24 (75.2)	0.99733	62.2602
25 (77.0)	0.99707	62.2440
26 (78.8)	0.99681	62.2278
27 (80.6)	0.99654	62.2109
28 (82.4)	0.99626	62.1934

Action: Repeat _____ **Replace** _____ **Place In Service** ✓

Remarks: _____

Form Orig. Date: 08 July 2002 Rev: 0

Unit Weight Measure Volume Determination Record

Verified By: M Wiefgate **Date:** 29 Sept 11

Equipment: 1.0 cuft Round Unit Wt. Bucket

Identification No. _____ **Verification Frequency:** 12 Months

Previous Verification Date: _____ **Next Due Date:** _____

Verification Equipment Used: Scale # 121606 Therm # CP35496

Verification Procedure: In House Procedure C2, ASTM C29 and C138

Volume Determination			
(A)	Wt. Measure + Plate + H_2O	117.2	~~gms~~, lbs
(B)	Wt. Measure + Plate	55.1	~~gms~~, lbs
(A-B)	Weight H_2O	62.1	~~gms~~, lbs
	Temperature of H_2O	28.6°C	°C, ~~°F~~
(C)	Density of H_2O (from chart)	62.101	~~g/cc~~, lbs/ft^3
(A-B)/C	Volume of Measure	0.9987	~~cm^3~~, ft^3

Density of H_2O		
Temperature °C (°F)	g/cc	lbs/ft^3
16 (60.8)	0.99897	62.3626
17 (62.6)	0.99880	62.3520
18 (64.4)	0.99862	62.3408
19 (66.2)	0.99843	62.3289
20 (68.0)	0.99823	62.3164
21 (69.8)	0.99802	62.3033
22 (71.6)	0.99779	62.2889
23 (73.4)	0.99756	62.2746
24 (75.2)	0.99733	62.2602
25 (77.0)	0.99707	62.2440
26 (78.8)	0.99681	62.2278
27 (80.6)	0.99654	62.2109
28 (82.4)	0.99626	62.1934

Action: Repeat _____ **Replace** _____ **Place In Service** ✓

Remarks: _____

Form Orig. Date: 08 July 2002 Rev: 0

Unit Weight Measure Volume Determination Record

Verified By: MWiefnitz **Date:** 29 Sept 11

Equipment: Small Rectangle Unit Weight Measure

Identification No. _____ **Verification Frequency:** 12 Months

Previous Verification Date: _____ **Next Due Date:** _____

Verification Equipment Used: Scale # 121606 Therm # CP15496

Verification Procedure: In House Procedure C2, ASTM C29 and C138

Volume Determination			
(A)	Wt. Measure + Plate + H_2O	89.8	~~gms~~, lbs
(B)	Wt. Measure + Plate	29.8	~~gms~~, lbs
(A-B)	Weight H_2O	60.0	~~gms~~, lbs
	Temperature of H_2O	27.0°C	°C, ~~°F~~
(C)	Density of H_2O (from chart)	62.210	~~g/cc~~, lbs/ft^3
$\frac{(A-B)}{C}$	Volume of Measure	0.9645	~~cm^3~~, ft^3

Linear measurement
11.8 x 17.72 x 8"
209.096 in^2 x 8 =
1672.768 in^3
0.968 ft^3

Density of H_2O		
Temperature °C (°F)	g/cc	lbs/ft^3
16 (60.8)	0.99897	62.3626
17 (62.6)	0.99880	62.3520
18 (64.4)	0.99862	62.3408
19 (66.2)	0.99843	62.3289
20 (68.0)	0.99823	62.3164
21 (69.8)	0.99802	62.3033
22 (71.6)	0.99779	62.2889
23 (73.4)	0.99756	62.2746
24 (75.2)	0.99733	62.2602
25 (77.0)	0.99707	62.2440
26 (78.8)	0.99681	62.2278
27 (80.6)	0.99654	62.2109
28 (82.4)	0.99626	62.1934

Action: Repeat _____ **Replace** _____ **Place In Service** ✓

Remarks: _____

Form Orig. Date: 08 July 2002 Rev: 0

Unit Weight Measure Volume Determination Record

Verified By: M Wiefatz **Date:** 29 Sept 11

Equipment: Large Rectangular Unit Weight Measure

Identification No. _____ **Verification Frequency:** 12 Months

Previous Verification Date: _____ **Next Due Date:** _____

Verification Equipment Used: Scale # 121606 Therm # CP35496

Verification Procedure: In House Procedure C2, ASTM C29 and C138

Volume Determination			
(A)	Wt. Measure + Plate + H_2O	178.1	~~gms~~, lbs
(B)	Wt. Measure + Plate	35.3	~~gms~~, lbs
(A-B)	Weight H_2O	142.8	~~gms~~, lbs
	Temperature of H_2O	29°C	°C, ~~°F~~
(C)	Density of H_2O (from chart)	62.159	~~g/cc~~, lbs/ft^3
(A-B)/C	Volume of Measure	2.2973	~~cm^3~~, ft^3

Linear Measurements
13.23 × 30 × 10
397 in^2 × 10 = 3970 in^3
2.2975 cu ft.

Density of H_2O		
Temperature °C (°F)	g/cc	lbs/ft^3
16 (60.8)	0.99897	62.3626
17 (62.6)	0.99880	62.3520
18 (64.4)	0.99862	62.3408
19 (66.2)	0.99843	62.3289
20 (68.0)	0.99823	62.3164
21 (69.8)	0.99802	62.3033
22 (71.6)	0.99779	62.2889
23 (73.4)	0.99756	62.2746
24 (75.2)	0.99733	62.2602
25 (77.0)	0.99707	62.2440
26 (78.8)	0.99681	62.2278
27 (80.6)	0.99654	62.2109
28 (82.4)	0.99626	62.1934

Action: Repeat _____ **Replace** _____ **Place In Service** ✓

Remarks: _____

Form Orig. Date: 08 July 2002 Rev: 0

Appendix B

29 Sept 2011

wt. grams	L	T	W
92.5 gms (A)	8.15	0.77	1.50
0.2039 lbs	8.25	0.77	1.49
9.3511 in.^{3}	8.22	0.75	1.48
0.0054 ft^3	8.18	0.77	1.48
37.7597 pcf	8.20	0.765	1.4875
84.6 gms (B)	8.16	0.78	1.50
0.1865 lbs	8.24	0.75	1.52
9.4148 in^3	8.25	0.76	1.50
0.0054 ft^3	8.22	0.75	1.51
34.2304 pcf	8.2175	0.76	1.5075
109.5 gms (C)	8.17	0.73	1.58
0.2414 lbs.	8.20	0.75	1.55
9.9195 in.^{3}	8.27	0.83	1.53
0.0057 ft^3	8.18	0.82	1.52
42.0523 pcf	8.205	0.7825	1.545
89.8 gms (D)	8.15	0.76	1.49
0.1980 lbs.	8.11	0.75	1.50
9.4409 in.^{3}	8.20	0.79	1.50
0.0055 ft^3	8.13	0.79	1.51
36.2406 pcf	8.1475	0.7725	1.50
54.5 gms (E)	5.10	0.75	1.51
0.1201 lbs	5.04	0.75	1.51
5.7256 in.^{3}	5.05	0.75	1.49
0.0033 ft^3	5.10	0.75	1.50
36.247 pcf	5.0725	0.75	1.505

wt. grams	L	T	W
56.4 gms (F)	5.16	0.76	1.50
0.1243 lbs	5.12	0.77	1.50
5.8726 in.^{3}	5.17	0.75	1.49
0.0034 ft^3	5.19	0.76	1.50
36.575 pcf	5.16	0.76	1.4975
54.4 gms (G)	5.10	0.76	1.50
0.1199 lbs	5.10	0.74	1.48
5.7663 in^3	5.12	0.78	1.48
0.0033 ft^3	5.15	0.75	1.49
35.9307 pcf	5.1175	0.7575	1.4875
58.2 gms (H.)	5.12	0.65	1.57
0.1283 lbs	5.10	0.71	1.52
5.4722 in^3	5.10	0.72	1.50
0.0032 ft^3	5.14	0.74	1.48
40.516 pcf	5.115	0.705	1.5175

total wt. 1 = 62.3 lbs
2 = 62.4 lbs
3 = 62.5 lbs
} − 12.4 mold

Average Densified Sand plus 8 Wood pieces = 50.0 lbs

8 Wood pieces wt = 599.90 gms, 1.3225 lbs

Total Volume Wood = 60.943 in^3
= 0.0353 ft^3

Wt Densified Sand only =
50.0 − 1.3225 = 48.6775 lbs

Volume densified sand = 0.4644 ft^3

0.4990 − 0.4644 ≐ 0.0346 ft^3
Wood Volume

Appendix C

Densified Sand Using Kango Hammer & Unit Measure

Verified By: M Wielputz **Date:** 29 Sept 2011

Equipment: Small Round Unit Measure 0.5 cu.ft.

Identification No. _____ **Verification Frequency:** Daily (in use)

Previous Verification Date: _____ **Next Due Date:** _____

Verification Equipment Used: Kango Hammer Type 638S with 5.7 inch diameter end plate, Scale # 12160 ,

Verification Procedure: In-house Procedure

Density Sand Supply		Ottowa Sand from Durham Geo			
Measurement of Densified Sand in a Calibrated Unit Measure		Units	Trial #1	Trail #2	Trial #3
Weight of container filled with densified sand	A	(lbs)	65.0	64.7	64.4
Weight of container empty	B	(lbs)	12.4	12.4	12.4
Weight of densified sand used to fill container	C = (A – B)	(lbs)	52.6	52.3	52.0
Volume of Container	D	(cf)	0.5002	0.5002	0.5002
Densified Unit Weight of Sand	C (lbs) / D	(pcf)	105.16	104.56	103.96
Average Weight (Mass) of Densified Sand		(lbs)	52.3		
Average Densified Unit Weight of Sand		(pcf)	104.56		

Action: **Repair** _____ **Replace** _____ **In Service** ✓

Remarks: _____

Form Orig. Date: 29 Sept 2011 Rev: 0

Densified Sand Using Kango Hammer & Unit Measure

Verified By: M Wielpute **Date:** 29 Sept 2011

Equipment: Small Rectangular Unit Measure 1.0 cu.ft.

Identification No. _____ **Verification Frequency:** Daily (in use)

Previous Verification Date: _____ **Next Due Date:** _____

Verification Equipment Used: Kango Hammer Type 638S with 4 inch x 5.5 inch rectangular end plate, Scale # 121606 .

Verification Procedure: In-house Procedure

Density Sand Supply		Ottowa Sand from Durham Geo			
Measurement of Densified Sand in a Calibrated Unit Measure		Units	Trial #1	Trail #2	Trial #3
Weight of container filled with densified sand	A	(lbs)	126.8	127.1	127.5
Weight of container empty	B	(lbs)	24.3	24.3	24.3
Weight of densified sand used to fill container	C = (A – B)	(lbs)	102.5	102.8	103.2
Volume of Container	D	(cf)	0.9645	0.9645	0.9645
Densified Unit Weight of Sand	C (lbs) / D	(pcf)	106.27	106.58	107.00
Average Weight (Mass) of Densified Sand		(lbs)	102.83		
Average Densified Unit Weight of Sand		(pcf)	106.62		

Action: **Repair** _____ **Replace** _____ **In Service** ✓

Remarks: _____

Form Orig. Date: 29 Sept 2011 Rev: 0

Appendix D

Unit Weight Measure Volume Determination Record

Verified By: _____ **Date:** _____

Equipment: _____

Identification No. _____ **Verification Frequency:** 12 Months

Previous Verification Date: _____ **Next Due Date:** _____

Verification Equipment Used: _____

Verification Procedure: In House Procedure C2, ASTM C29 and C138

Volume Determination			
(A)	Wt. Measure + Plate + H_2O		gms, lbs
(B)	Wt. Measure + Plate		gms, lbs
(A-B)	Weight H_2O		gms, lbs
	Temperature of H_2O		°C, °F
(C)	Density of H_2O (from chart)		g/cc, lbs/ft^3
$\frac{(A-B)}{C}$	Volume of Measure		cm^3, ft^3

Density of H_2O		
Temperature °C (°F)	g/cc	lbs/ft^3
16 (60.8)	0.99897	62.3626
17 (62.6)	0.99880	62.3520
18 (64.4)	0.99862	62.3408
19 (66.2)	0.99843	62.3289
20 (68.0)	0.99823	62.3164
21 (69.8)	0.99802	62.3033
22 (71.6)	0.99779	62.2889
23 (73.4)	0.99756	62.2746
24 (75.2)	0.99733	62.2602
25 (77.0)	0.99707	62.2440
26 (78.8)	0.99681	62.2278
27 (80.6)	0.99654	62.2109
28 (82.4)	0.99626	62.1934

Action: Repeat _____ Replace _____ Place In Service _____

Remarks: _____

Densified Sand Using Kango Hammer & Unit Measure

Verified By: _____ **Date:** _____

Equipment: Unit Measure

Identification No. _____ **Verification Frequency:** Daily (in use)

Previous Verification Date: _____ **Next Due Date:** _____

Verification Equipment Used: Kango Hammer Type 638S with _____ end plate, Scale # _____, _____

Verification Procedure: In-house Procedure

Density Sand Supply		Ottowa Sand from Durham Geo			
Measurement of Densified Sand in a Calibrated Unit Measure		Units	Trial #1	Trail #2	Trial #3
Weight of container filled with densified sand	A	(lbs)			
Weight of container empty	B	(lbs)			
Weight of densified sand used to fill container	C = (A – B)	(lbs)			
Volume of Container	D	(cf)			
Densified Unit Weight of Sand	C (lbs) / D	(pcf)			
Average Weight (Mass) of Densified Sand		(lbs)			
Average Densified Unit Weight of Sand		(pcf)			

Action: **Repair** _____ **Replace** _____ **In Service** _____

Remarks: _____

Form Orig. Date: 29 Sept 2011 Rev: 0

Wood Volume Determination

Tested By: _____ **Date:** _____

Equipment Used: _____

_____

Volume Measure (a) (cu.ft.): _____ **Mass of Measure (b) (lbs):** _____

Verification Procedure: **In House Wood Volume Determination Procedure**

(a)	Volume of Measure	cu.ft.	Determined annually ASTM C29 paragraph 8		
(b)	Mass of Measure	lbs.	Determined annually ASTM C29 paragraph 8		
(c)	Average Densified Sand in Measure	pcf	Minimum 2 determinations from Step 4) of Procedure		
(d)	Mass of Sample Wood	lbs.	As-received moist wood weight		
(e)	Densified Sand, Wood, and Measure	lbs.	Step 5) of Procedure		
(f)	Densified Sand Mass Only (no wood)	lbs.	(c) X (a)		
(g)	Densified Sand Mass Only (with wood)	lbs.	(e) – (b) – (d)		
(h)	Volume of Wood	cu.ft.	[(f) – (g)] / (c)		
(i)	Volume Excavated Hole	cu.yds.	(i) X 27	cu.ft.	
(j)	Volume of Wood	%	100 x (h) / (i)		

(a) Selected Measure Volume => cubic feet (cu.ft.)
(b) Selected Measure Mass (weight) => pounds (lbs.)
(c) Average mass per unit volume of densified sand only => pound/cubic feet (pcf)
(d) Mass of Sample Wood Pieces => lbs
(e) Determined densified sand, wood, & measure mass => lbs
(f) Densified sand only mass (no wood) = (c) x (a) => lbs
(g) Densified sand only mass (with wood) = (e) – (b) – (d) => lbs
(h) Volume of wood (from densified sand test) = [(f) – (g)] / (c) => cu.ft.
(i) Volume of excavated hole ***(determined)*** => cu.yds. x 27 => cu.ft.
(j) % tested volume wood = 100 x (h) / (i) => %

Remarks: _____

Form Orig. Date: 5 Oct 2011 Rev: 0

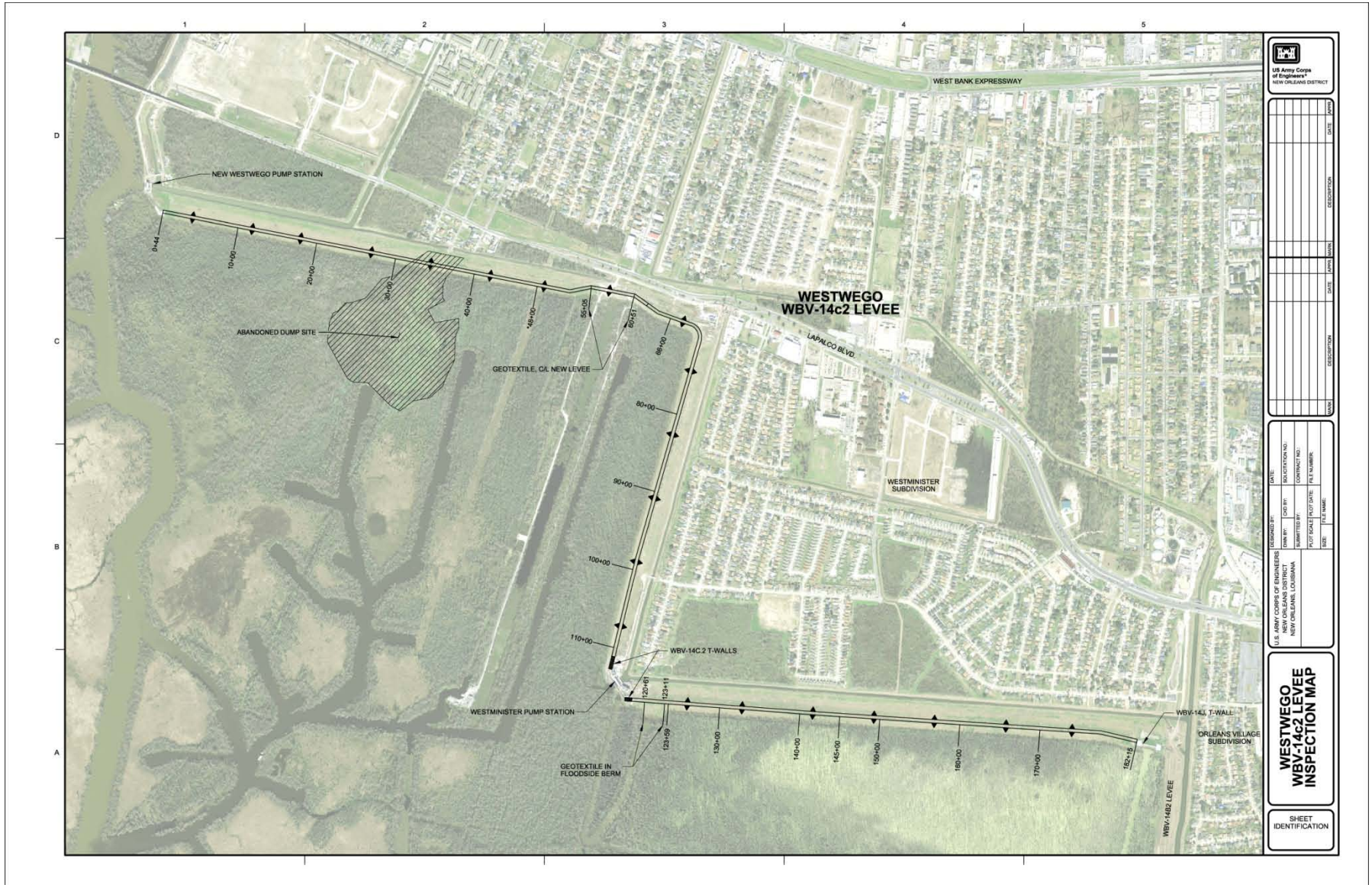


Figure 1 – Completed Project Overview

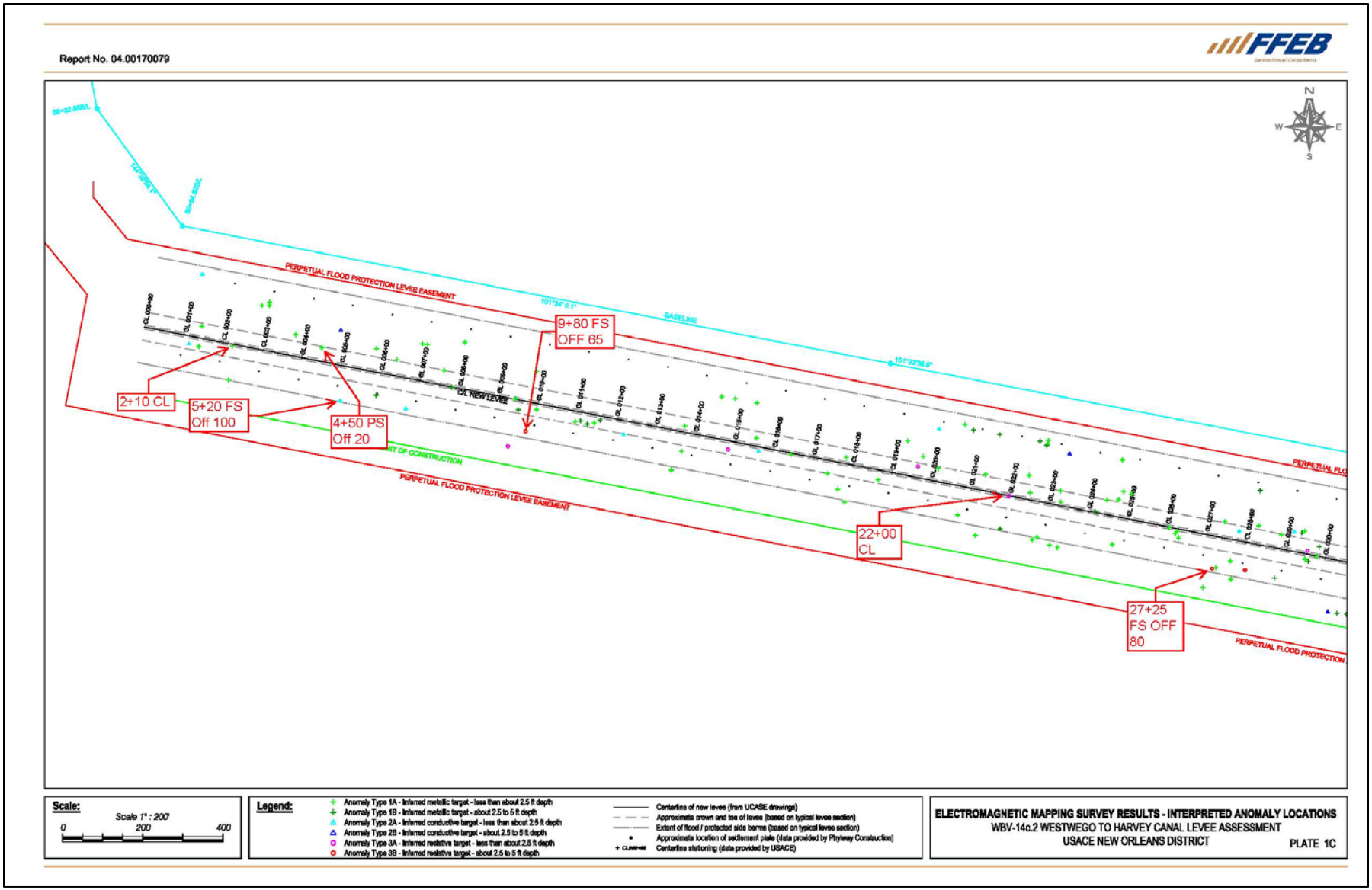


Figure 2 – Trench Locations

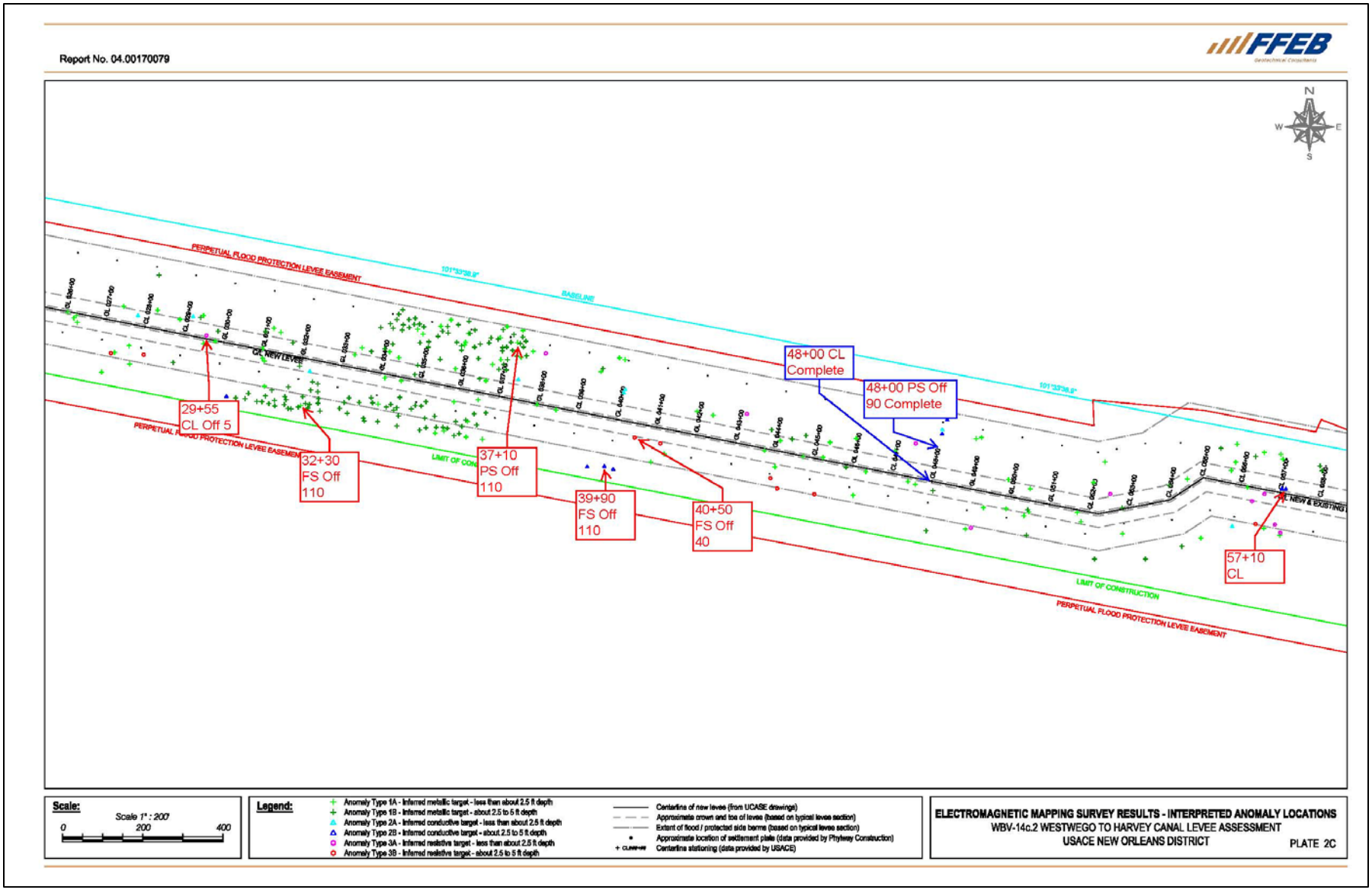


Figure 3 – Trench Locations

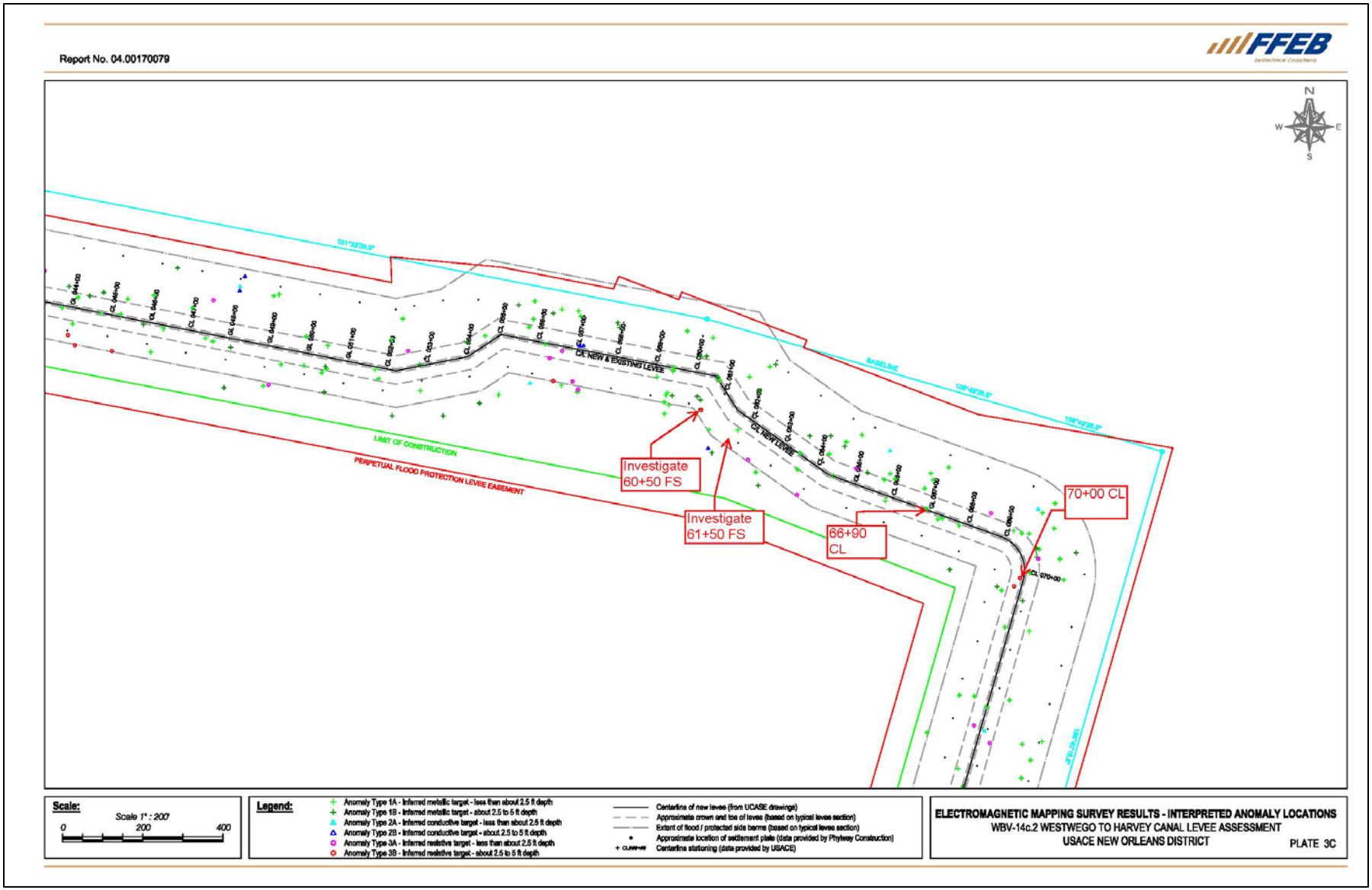


Figure 4 – Trench Locations

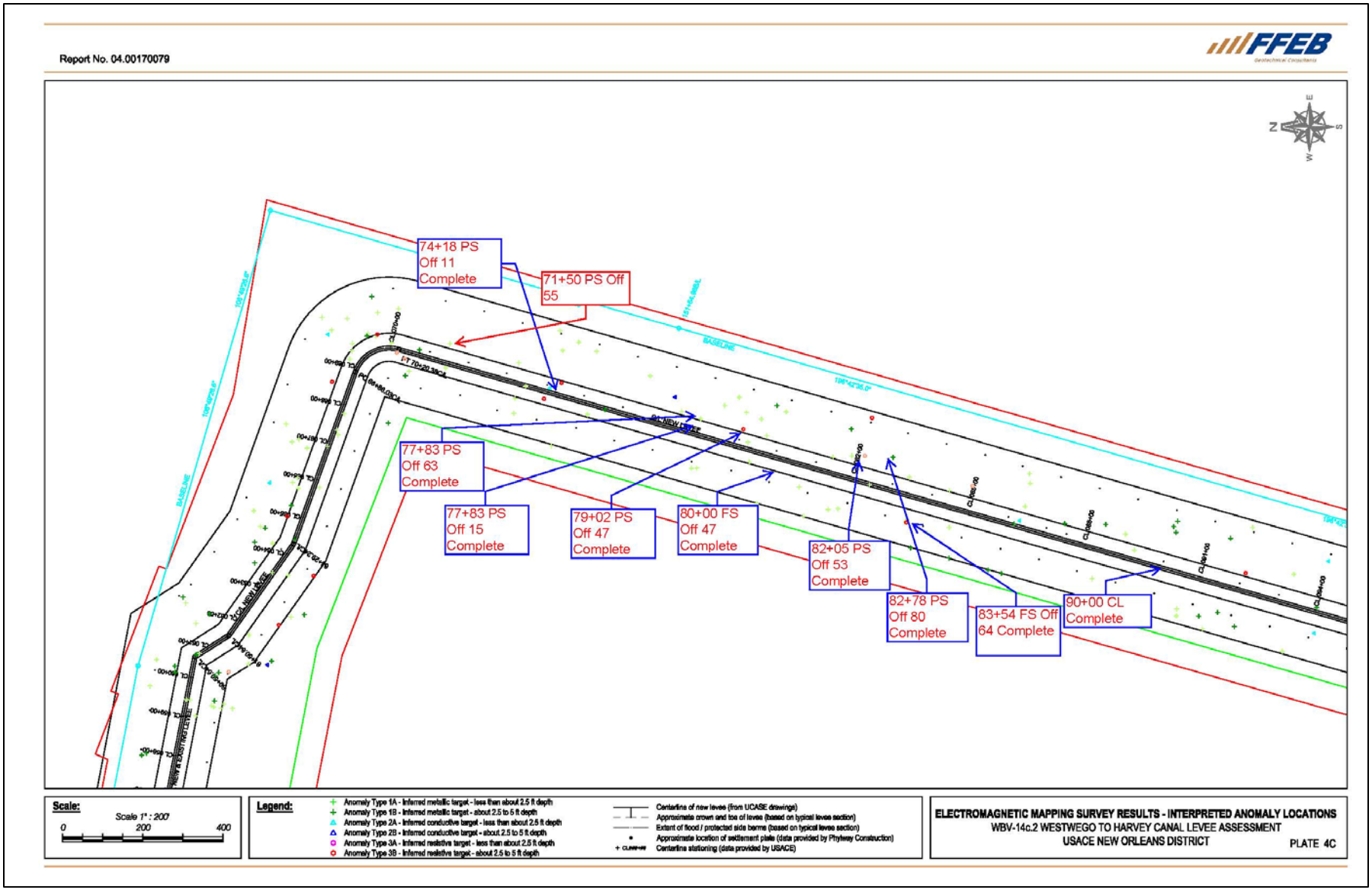


Figure 5 – Trench Locations

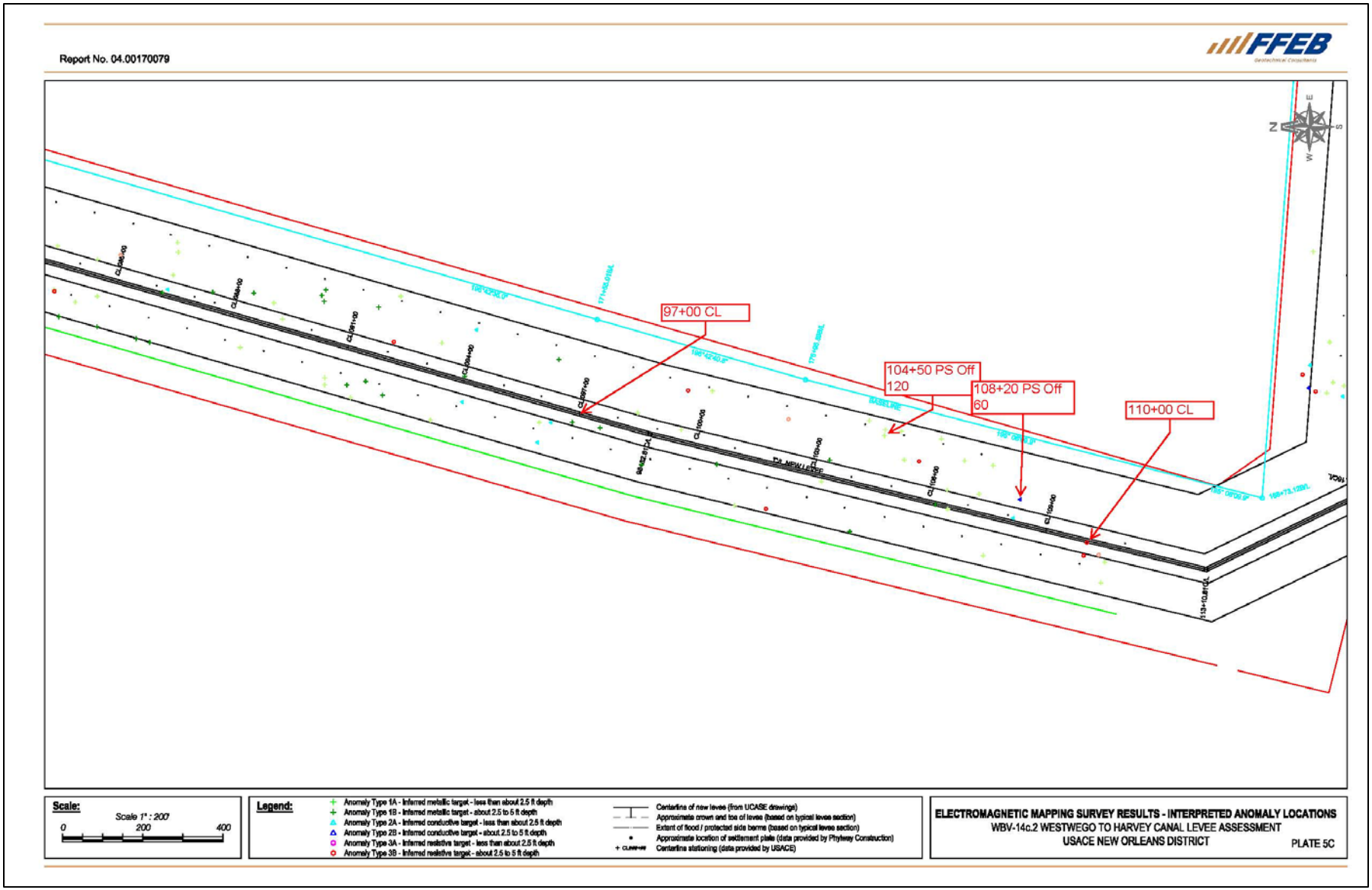


Figure 6 – Trench Locations

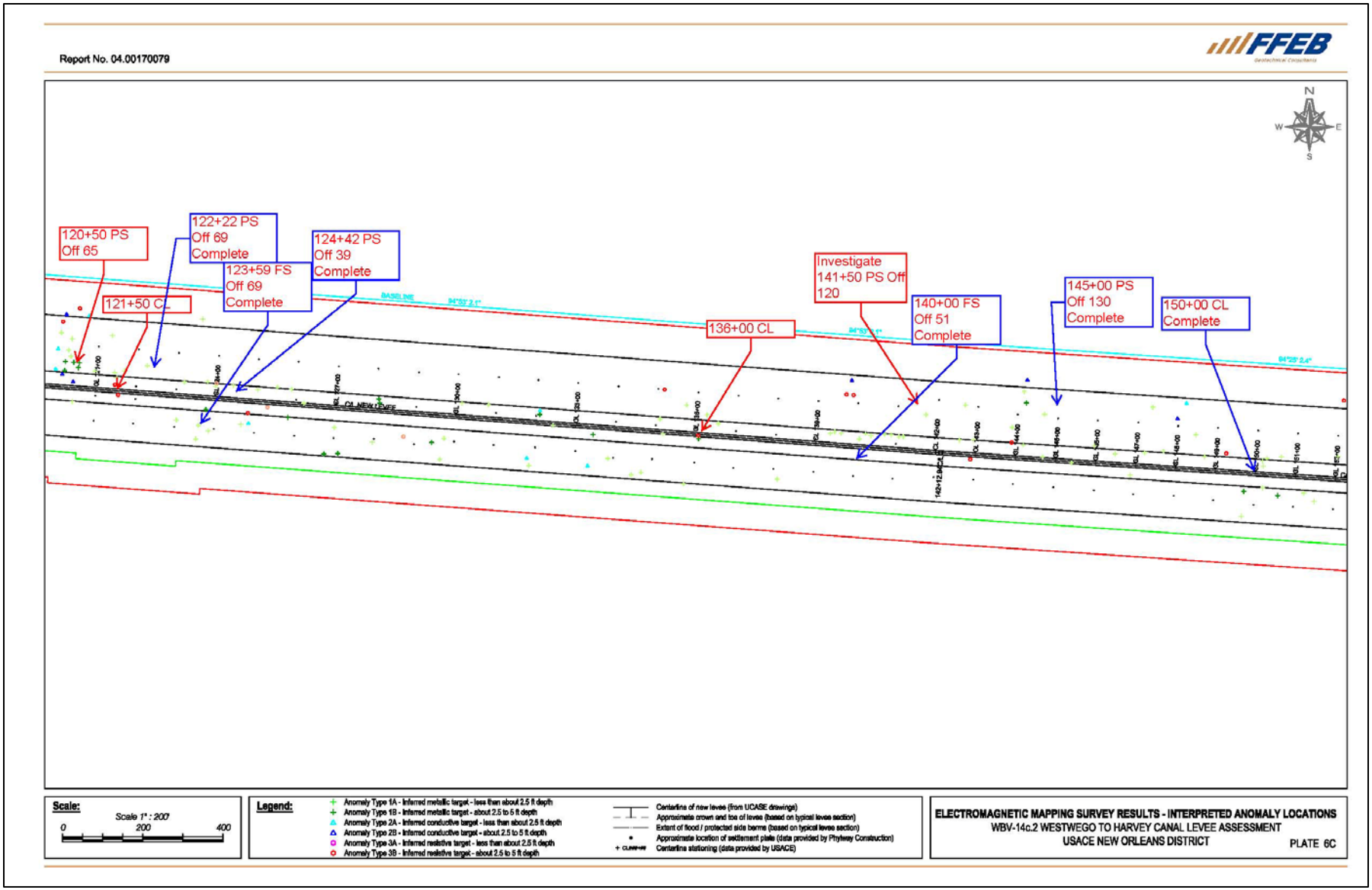


Figure 7 – Trench Locations

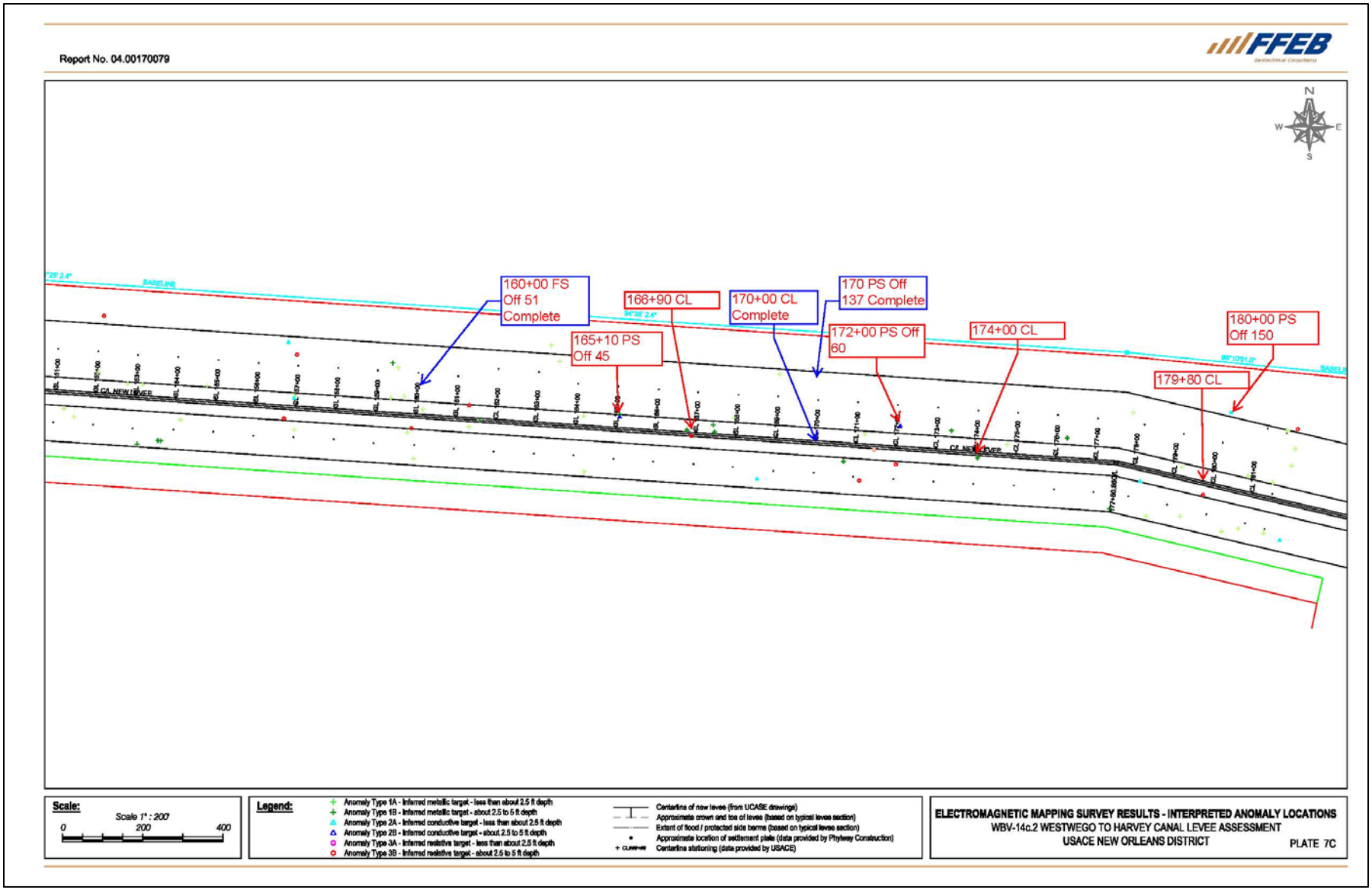


Figure 8 – Trench Locations

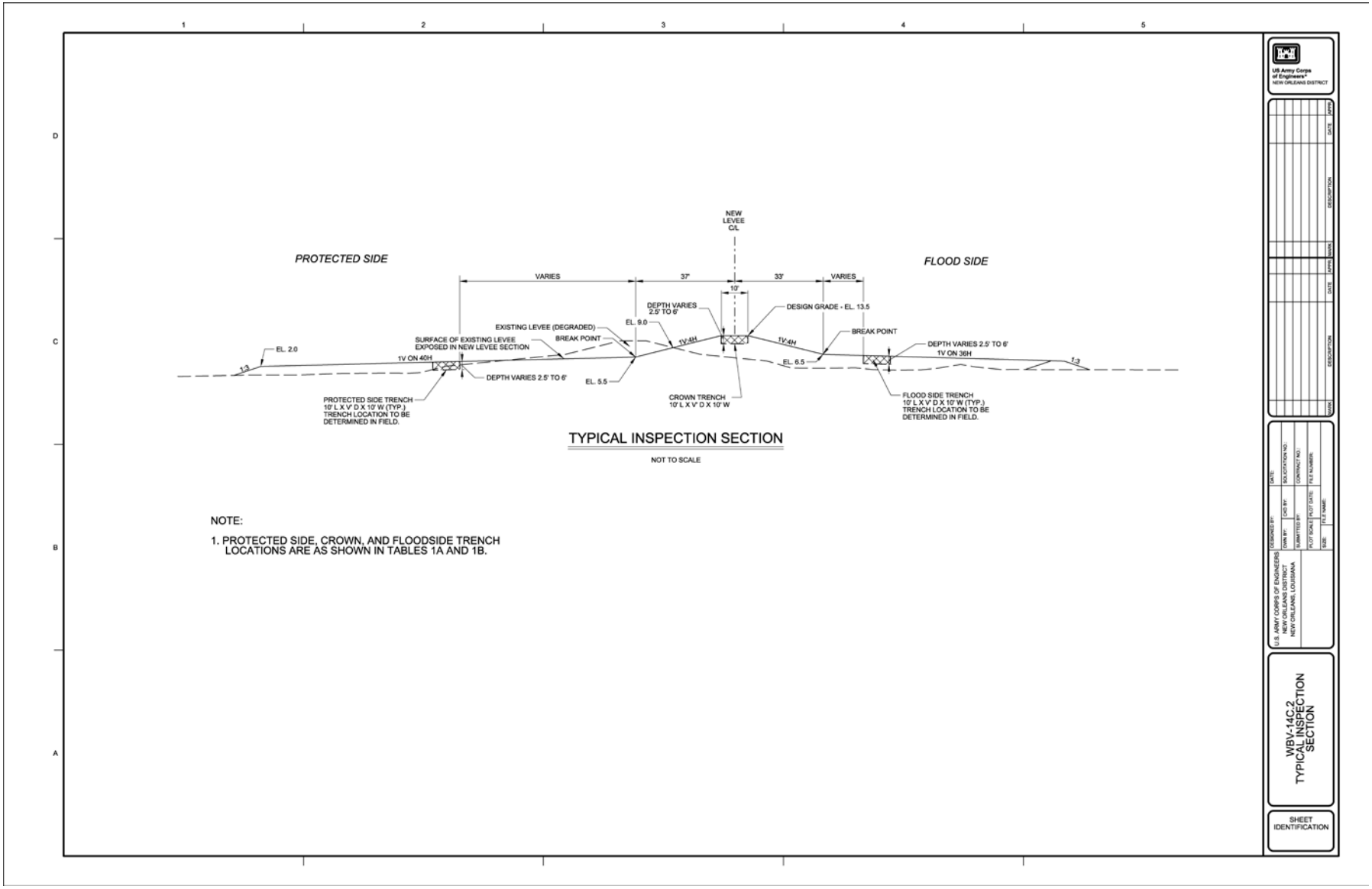
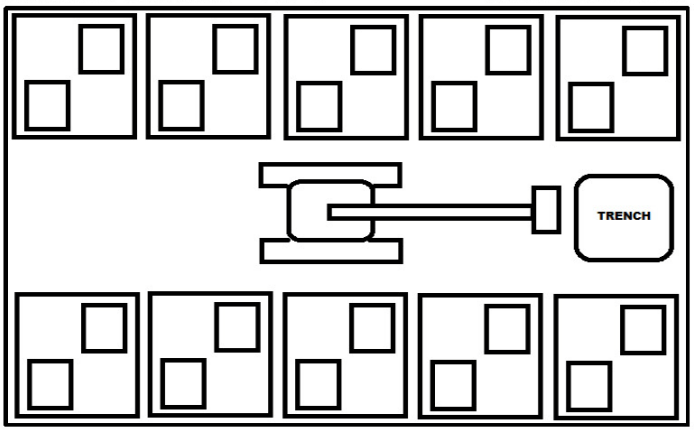


Figure 9 – Typical Inspection Trench Sections

WBV 14C.2
TRENCHING FIELD LOG

CL STA - _____
START TIME - _____
END TIME - _____
WEATHER - _____
DATE - _____
EM GROUND TRUTHING? - Y or N

TRENCH LOCATION - PS - CL - FS
TRENCH OFFSET FROM CL - _____
TOP OF TRENCH EL - _____
ORIGINAL GROUND ELEV - _____
TRENCH DEPTH - _____
TRENCH DIMENSIONS - _____



BORROW SOURCE SUMMARY

Willow Bend	River Birch	EL
Existing Levee	WBV 14B2	
Willow Bend	River Birch	EL
Existing Levee	WBV 14B2	
Willow Bend	River Birch	EL
Existing Levee	WBV 14B2	
Willow Bend	River Birch	EL
Existing Levee	WBV 14B2	

NOTE: INDICATE BUCKET No. IN EACH LOCATION OF MATERIAL PLACEMENT. MAXIMUM OF TWO BUCKET DROPS PER 15 ' X 15 ' OF GEOTEXTILE FABRIC. OPERATOR TO DISTRIBUTE MATERIAL EVENLY TO ALLOW FOR FULL INSPECTION. ABOVE LAYOUT OF FABRIC REPRESENTS 6-INCH EXCAVATION CUTTINGS PLACEMENT.

TRENCHING OBSERVATIONS

BUCKET #	ELEVATION	VISUAL (Y/N)*	HEARD (Y/N)*	DEBRIS Y/N	Soil Type*
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

* See key sheet.

BULK SAMPLES TAKEN:
1 _____
2 _____
3 _____
3 _____
4 _____

TRENCH WALL OBSERVATIONS

SEEPAGE CONCERNS	Y or N
SAND STRATAS	Y or N
STABILITY CONCERN	Y or N
GOOD COMPACTION	Y or N

NOTES:

ATTACHMENT "A"

Figure 10 – Trenching Log (page 1)

CONTAINER TRACKING SHEET

DEBRIS STORAGE CONTAINER:
L x B x H:
Possession of:
Debris Level in a Container:
☐ FULL ☐ 1/2 ☐ 1/4 ☐ 3/4
Debris Size Picked:
☐ > 12" ☐ 3" to 6"
☐ 6" to 12" ☐ 0" to 3"

NOTES:

DEBRIS STORAGE CONTAINER:
L x B x H:
Possession of:
Debris Level in a Container:
☐ FULL ☐ 1/2 ☐ 1/4 ☐ 3/4
Debris Size Picked:
☐ > 12" ☐ 3" to 6"
☐ 6" to 12" ☐ 0" to 3"

NOTES:

DEBRIS STORAGE CONTAINER:
L x B x H:
Possession of:
Debris Level in a Container:
☐ FULL ☐ 1/2 ☐ 1/4 ☐ 3/4
Debris Size Picked:
☐ > 12" ☐ 3" to 6"
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Debris Level in a Container:
☐ FULL ☐ 1/2 ☐ 1/4 ☐ 3/4
Debris Size Picked:
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NOTES:

ATTACHMENT "A"

Figure 11 – Trenching Log (page 2)

KEY SHEET

Logging Procedure:

1. Prior to trenching collect all information related to location of the trench (Station, Offset, etc.)
2. Fll out other general information like data, time, weather, etc.
3. Fill out information related to existing and original ground elevations.
4. Verify/Indicate if the trench is for EM Ground Truthing
5. The layout of fabric represents 6-inch excavation cuttings placement
6. Indicate bucket number in each location of material placement over the fabric. Maximum of two bucket drops per 15' x 15 ' of geotextile fabric. Operator to distribute material evenly to allow for full inspection.
7. Record all trenching observations in the table provided. Include the elevations on top of each cut. Include the visual and noise observations for debris tracking.
8. From the lift schedule and visual observations made during trenching, fill out the summary table for borrow source.
9. Fill out the dimentions of the debris storage container on container tracking sheet. Track the amount of debris in each container.
10. Track the size of the debris being collected from each 6-inch cutting.
11. Track any representative bulk samples taken.
12. After picking of the debris record issues relating to stability, seepage, sand strata and compaction.

SOIL TYPES	
CH	Fat CLAY
CL	Lean CLAY
CHOA	Organic CLAY
PT	PEAT
SP	SAND
SM	Silty SAND
SC	Clayey SAND
SC-SM	Silty Clayey SAND

VISUAL: Saw Wood or Metal when bucket dumped.

HEARD: Heard bucket contact noise with Wood or Metal or Debris

Figure 12 – Trenching Log (page 3)