

ENCLOSURE 1
SCOPE OF SERVICES
ELEVATION SURVEY UPDATE OF COASTWIDE REFERENCE MONITORING
SYSTEM (CRMS) STATIONS AND ASSOCIATED SECONDARY MONUMENTS

1. INTRODUCTION

The Coastal Protection and Restoration Authority of Louisiana (CPRA) requires surveying services in order to update Coastwide Reference Monitoring System (CRMS) station elevations. This comprehensive coastwide survey effort includes updating elevations of all active monitoring stations including stations at 382 CRMS sites and in 11 project areas (Figure A-1; Tables B-1, B-2, B-3 and B-4). The intent is to survey all stations in the same year with field work beginning as soon as duck hunting restrictions allow in the winter to be completed before peak hurricane season in late August 2027.

In order to accomplish the survey, elevations of secondary benchmarks must be updated and a GPS network solution applied to the entire coastal zone. This coastwide survey effort was previously performed in 2014 and 2021. This effort is effectively a repeat of the 2021 coastwide CRMS survey which utilized 173 GPS benchmarks (Figure A-2, Tables B-1, B-2 and B-3) including 54 CRMS Rod Surface Elevation Table (RSET) stations set up as GPS benchmarks for the first time in 2021. High precision surveys of the 53 CRMS RSET benchmarks that remain active stations will be repeated as part of this survey effort and a report on subsidence of Secondary Monuments and RSET rods will be a required deliverable.

The surveying consulting company hereafter referred to as the “Contracting Party”, will perform the specified services according to this Scope of Services.

2. LOCATION

CRMS sites are distributed across coastal Louisiana with sites in every coastal basin and marsh type (Appendix A, Figures A-1 and A-2; Appendix B, Tables B-1, B-2, B-3 and B-4). Access routes and recommended boat type will be provided to the Contracting Party. Routes have been agreed to by landowners and are to be followed precisely unless otherwise directed by the landowner.

3. SCOPE OF WORK

The Contracting Party shall perform all surveying necessary to complete the tasks outlined in the following subsections.

3.1 Permission and access

Permission to access property for surveying activities shall be the responsibility of the Contracting Party. CPRA has previously obtained land rights with each landowner where the CRMS site has been established; however, these agreements specify that notification shall be given to the land owner prior to accessing the property. Rights of entry to privately owned property must be respected by all CPRA contractors. Failure to adhere to the above stated CPRA policy will be considered grounds for termination of the contract. Contact information for each individual CRMS site is provided in Appendix C of this document. These individuals are to be notified each time the Contracting Party visits the property except where advance notice has been given for consecutive day visits. Access restrictions by many landowners begin during hunting seasons; the Contracting Party must negotiate access restrictions with the landowners and accommodate schedules, accordingly. Some landowners require access permits including LDWF Wildlife Management Areas and federal National Wildlife Refuges.

3.2 General

The work to be performed by the Contracting Party consists of furnishing the equipment, supplies, labor, and transportation, including boats and fuel, needed to complete the work outlined in this scope. All materials and services not expressly called for in this scope of work shall be provided by the Contracting Party at no increase in cost to the CPRA.

Data collected at CRMS boardwalks capture soil formation processes including vertical accretion and surface elevation change at millimeter scale. These processes have been measured repeatedly at the same location with the same equipment for almost 20 years. All of the area within and around CRMS boardwalks is occupied by active monitoring stations that must not be disturbed. Surface elevation change is measured relative to an RSET rod driven to refusal located in between the parallel boardwalk sections. Vertical accretion is measured relative to feldspar marker horizons from stations that flank the boardwalk on all sides. It is critical that the marsh surface is not disturbed during this survey.

All work must be performed from the CRMS boardwalks without disturbing the marsh surface around the boardwalk. The Contracting Party will need at least one 10 ft plank to span the distance between the parallel boardwalks (Figures A-8 and A-9). There shall be no walking on the marsh within a 30 foot buffer zone around the boardwalk except at the access point of the boardwalk. Vegetation must be left intact. It can be pushed to the side as needed to access stations but must not be cut or removed.

The access point is marked by a 3" PVC pipe with a yellow cap. The PVC pipe at the opposite end of the boardwalk has an orange cap. The only acceptable way to access a

CRMS site is from the end of the boardwalk marked with a yellow cap. Boats shall park perpendicular to the boardwalk at the access point. Pulling alongside the boardwalk in a parallel fashion is not allowed because accretion stations will be permanently damaged.

The goal is to accomplish all of the field work required for the 2027 CRMS station elevation update before peak hurricane season (before 8/31/2027). It is recommended that a majority of the work occur in the winter and spring in order to avoid summer thunderstorm delays and before vegetation interferes with surveying. In the 2021 surveying effort, surveyors had a difficult time collecting high precision data in swamps. Ultimately, a local GPS network had to be constrained around the Maurepas Swamp. It is recommended that swamp sites be surveyed early in the year.

All field work shall be completed by August 31, 2027. Draft and final versions of reports shall be delivered by March 31, 2028.

3.2.1 Datums and Accuracy:

Horizontal Datum

- Units: Units of XY data (meters)
- Coordinate System: Universal Transverse Mercator (UTM) Zone 15 N
- Datum: North American Datum 1983 (NAD 83)

Vertical Datum

- Z_Unit: feet
- Datum: NAVD 88 Geodetics GEOID12B
- Geodetic Reference System 1980 (GRS 80)

Vertical Accuracy

- 0.5 to 2 cm for Survey Benchmarks (Secondary Monuments)
- <1 cm for high precision monuments
- 3-5 cm for RTK

3.3 Deep Rod Secondary Monument Network Solution

The Contracting Party shall perform static GPS surveys at all benchmarks required to create a GPS network plan as described in Section C of the CPRA Survey Standards document (CPRA, 2019; T Baker Smith, 2022). In 2021, 173 benchmarks were utilized to constrain a coastwide GPS network (Figure A-1, Table B-1). The same benchmarks can be utilized or alternate benchmarks may be recommended by the Contracting Party if better monuments are available.

In 2021, 54 CRMS sites were incorporated into the Secondary Monument network. Of those, 32 were established as benchmarks at 2 cm resolution and 22 were established as high precision, sub-cm benchmarks. Two of the CRMS RSET benchmarks have been compromised leaving 52 CRMS RSET benchmarks active on the landscape to be re-surveyed to the same precision as was performed in 2021 (Table B-1).

TBM's may be used when benchmarks are not available. Where possible, CRMS RSET rods are to be established as benchmarks in lieu of temporary TBMs.

Benchmark elevations are to be modeled into a numerically constructed GPS network as was performed in 2014 and 2021. See Section F of the CPRA's 2019 Standards of Practice for Contractors document (CPRA 2019). A network adjustment report will be required (T Baker Smith, 2022).

Deliverables for static GPS monument observations are listed in Section H, and the standard forms and example documents are shown in Section J of the referenced survey standards document (CPRA 2019). These deliverables will include GPS monument information datasheets, GPS session schedules and GPS log sheets, field notebook records, photographs, final adjusted GPS data, and digital GPS data in a RINEX format. Note, the monument datasheets slightly differ from the example provided in the 2019 Standards of Practice document in that the UTM NAD 83 coordinates in meters are also required in addition to geodetic and lambert coordinate (LSZ) positions.

Secondary Monument datasheets must be updated with data collected from this survey (Figure D-3). In the 55 cases where the CRMS RSET rod serves as a secondary benchmark, the datasheets shall additionally include a 'top of rod' and 'top of collar' elevation (as described in Section 3.5.2 and Figure D-6) and shall denote the accuracy of the survey after the Date of Survey in the following manner: "Survey Accuracy: 2 Centimeter" or "Survey Accuracy: Sub Centimeter".

3.4 High-Precision Static GPS Observations on RSET Rods

In 2021, a subset of 22 CRMS sites were surveyed to sub cm resolution. This work will be repeated on the same RSET stations as part of this scope of work (Figure A-1 and Table B-1). These static GPS observations will consist of three separate data collection sessions at each RSET Rod. Each GPS session will have a minimum duration of 6-hours separated by periods of approximately two days (48 hours) at each RSET Rod. For example, the Contracting Party shall collect static GPS observations for 6-hours and will return to this RSET rod a minimum of 48 hours later for a 2nd 6-hour session followed by a 3rd 6-hour session at least 48 hours after the 2nd static GPS session has concluded. The purpose of these replicate (3 sessions) and long duration (6-hour) static GPS observations are to attain sub centimeter level elevation accuracies at the selected RSET rods. Separation between observation periods are set so the

observation series are collected under differing atmospheric conditions and different satellite constellations.

NOTE: This procedure slightly deviates from Section F of the 2019 Standards of Practice document and simply requires a 3rd GPS session and a minimum of 6-hour sessions to achieve sub centimeter level elevation accuracies. Therefore, portions of this task can be combined with the task listed in Section 3.3 by recording static GPS observations for at least 6-hours and requiring a 3rd data collection session at the selected RSET rods.

Monument data from the 2021 network solution will be provided to the Contracting Party for comparison to monument elevations established by this survey. A report that describes subsidence of the monuments will be required (Section 5.3).

3.5 Real Time Kinematic (RTK) Surveys

RTK will be utilized to update elevation of all active CRMS hydrology and RSET stations in addition to a handful of remaining project specific stations. Ancillary marsh and water bottom elevations will also be collected at each CRMS hydrology station while on site.

Most CRMS sites have the same set up with one hydrology station and one RSET station to be surveyed. There are special cases where there is no hydrology station or RSET rods have been compromised and removed. A complete list of stations to be surveyed can be found in Tables B-2, B-3 and B-4 and special cases are called out in Tables B-5 and B-6.

If propagation errors occur due to multipath distortion, conventional elevation surveys may be performed as long as TBM(s) have been established using RTK methods. The TBM must be within the 3 mile radius of a LCZ GPS network Deep Rod Monument or another TBM that has been surveyed into this network. Where possible, existing CRMS RSET rods shall be used as TBMs. In addition, a level loop (single-run leveling) must be performed to minimize the effects of elevation misclosure when using optical instruments.

3.5.1 Hydrologic Station (H0#) Data Collection on Support Poles

Marks on the continuous recorder (CR) and staff gauge (SG) support poles are to be surveyed into the LCZ GPS network by the Contracting Party. The Mark (or nail) is to be the primary elevation point for each CRMS hydrology station. Elevations will also be collected from the tops of the wooden 4x4" CR and SG posts as well as water surface and water bottom elevations near the station (Section 3.5.3).

Hydrologic stations (H0#) consist of two 4"x4" timber posts driven to resistance in an open body of water with nails driven into one side of each post (TBM). One of the 4"x4" posts functions as the support pole for a continuous recorder (CR, Figures A-3, A-4, and A-5) while the other 4"x4" posts functions as the support pole for a staff gauge (SG, Figures A-4 and A-6). The nail constitutes the "mark", or TBM, that CPRA utilizes to convert the water-level data to the NAVD 88 datum (ft). The top of the 4"x4" timber posts shall be surveyed and measurements shall be obtained to calculate the NAVD 88 (ft) elevation of the nail. The nail shall also be surveyed as a check as outlined in section P of the 2019 Standards of Practice manual. Data collected shall be sufficient to complete the spreadsheet and data sheets in Appendix D (Figure D-1 and Figures D-4 and D-5). Survey notes and photos shall follow the detail outlined in section P of the 2019 Standards of Practice manual.

NOTE: The "nail" has been established in each post/board; therefore, another one shall not be established without approval from a CPRA employee.

NOTE: While at the site, verify that the elevations from the two adjacent CR and SG stations make sense. Tape down from elevations collected on the CR and SG posts to water level and verify that all measurements taken from each station are reasonable relative to one another. Water level can change quickly in tidal marshes so it is a good idea to get water elevation measurements at about the same time as all other elevations are recorded from each CR and SG post.

Special Cases in Hydrology Setups

USGS ran ten CRMS real-time stations from program inception through July 2026 when they were converted to typical CRMS non-real-time stations. The USGS platforms are larger than typical CRMS hydro stations with four posts and room for solar panels and transmitters (Figure A-7). In most cases, the new, non-real-time equipment was attached to the USGS real-time platform. Site specific details for USGS real-time platforms are provided in Appendix E.

Floating marsh sites are set up differently than attached marsh sites. At each of the 33 floating sites, there is an open water station (-H01) that is to be surveyed as described above. There is also a boardwalk that goes into the marsh where a floating marsh water level recorder (-M100) is located. M100 stations measure inundation of the floating mat and are not surveyed to datum. Staff gauge posts have been added to the floating marsh sites at the boardwalk near the -M100 station and those need to be surveyed for the first time. Survey points to be collected on floating marsh staff gauge posts include the Top of Post, Mark (nail), water bottom elevation, and the elevation of the floating mat at the time of survey. The staff gauge data sheet (Figure D-1) and marsh elevation data sheet (Figure D-2) can be utilized for these floating marsh staff gauge surveys.

Previous analyses revealed that seven CRMS hydro stations were redundant (meaning daily mean water level and salinity were statistically the same). In those cases, one hydro station provides data for two CRMS sites (Appendix B, Tables B-2, B-4 and B-5). Stations that have a surrogate hydrology station are identified in CRMS as –H0X stations. There is no hydrology equipment to be surveyed at –H0X stations.

3.5.2 Rod Surface Elevation Table (RSET) Stations

Survey points on CRMS RSET stations (E0#) include the top of the 9/16” stainless steel rod and the collar mounted to the rod (Figures A-8, A-9, A-10 and A-11). In order to access these stations, boards at least 10’ long should be placed across the two boardwalks to span the distance between without disturbing the marsh surface. Survey notes and photos, similar to section K of the 2019 Standards of Practice manual shall clearly define the top of the rod and measurements shall be obtained from the top of the collar at the number “1” position to the top of the rod. Data collected shall be sufficient to complete the data sheet in Appendix D (Figure D-1 and Figure D-6).

There are 347 RSET rods included in this survey (Appendix B; Tables B-2 and B-3). Due primarily to erosion and land loss, RSET rods from 17 CRMS sites that were previously surveyed do not require surveys in 2027 (Tables B-2, B-3 and B-6). Active hydrology stations remain at eight of the 17 sites that no longer have RSET rods (Table B-4) and those hydrology stations and nearby fringe marsh do need to be surveyed (see Section 3.5.4 below).

As described in Section 3.4 above, 52 RSET rods that were used as benchmarks in the 2021 survey effort remain intact and available for the 2027 survey effort (Table B-1). The remaining 295 active RSET rods are to be surveyed using RTK precision and methodology.

3.5.3 Marsh Surface Elevation at the Boardwalk

At CRMS boardwalks, marsh elevations will be collected from ten locations; two from each corner of the boardwalk that surrounds the RSET station and two from the marsh adjacent to the RSET station (Figure A-8).

In most marsh types, one marsh elevation per location is sufficient (one from each location identified in Figure A-8). However in clumpy, *Spartina patens* (saltmeadow cordgrass) marshes where the vegetation can be much higher within clumps of vegetation than on the mud surface between clumps of vegetation, two observations are required from each location: one to be taken within the clump of *Spartina patens* and one to be taken from the mud adjacent to/between the clumps of grass. In this case, 20 elevation shots are to be taken at CRMS boardwalks. Marsh elevations are to be recorded on the datasheet presented in Figure D-2.

In general marsh surface with respect to elevation surveys is defined as “where the survey rod is resting among living stems or is supported by soil containing living roots.” In order to get a consistent reading it will often be necessary to move stems in some marsh vegetation where stem density is extremely high.

3.5.4 Marsh Surface Elevation in Fringe Marsh

At some CRMS sites where significant erosion has occurred, the RSET rod has been removed and only hydrology monitoring continues. The Contracting Party will survey marsh elevation in the fringe marsh near these eight sites (Tables B-2 and B-6 and Figures B-1a to B-1g). Marsh elevation will be collected from within living vegetation at ten locations in homogenous marshes and 20 locations in clumpy *Spartina patens* marsh as described above. There are not specific station locations to be surveyed but rather the intent is to capture elevation of nearby remaining vegetation to be used in inundation depth calculations.

At CRMS0302, the RSET rod has destabilized and has been removed but vegetation stations remain intact (Table B-6). Here, the Contracting Party will survey the hydrology station and will also install a TBM that CRMS data collection contractors can use to run a loop with a laser level.

3.5.5 Water Bottom Elevation

Ancillary water bottom elevation data are to be collected opportunistically at each CRMS hydrology station and along select waterways in between CRMS stations (Appendix F). The purpose is to maximize the impact of the CRMS dataset by providing CPRA’s Coastal Master Plan modelers information necessary to contextualize CRMS hydrology data.

The locations to be surveyed include water bottom elevation at the base of each active CRMS hydrology station along with the transition from water bottom to vegetated surface where possible. The X, Y, Z deliverable format is included in Appendix D (Figure D-7).

NOTE: Surveying CRMS stations is the primary objective of this scope and the water bottom surveying is ancillary. The Contracting Party should utilize whichever boat type is required for the primary objective. Where large boats are needed, it may not be possible to also survey transition to vegetation.

Sonde to Shore

Survey water bottom elevation at the base of each hydro station. In small channels (< 20 feet wide), also survey a cross section of the waterway from vegetated marsh surface, across the waterway to the vegetated surface on the opposite bank collecting water bottom elevations every five feet. In larger bodies of water, survey water bottom from the CRMS station to the nearest edge and up onto the vegetated surface as equipment allows.

Up and Down Stream

When stations are located in bayous, canals and other channels, survey water bottom elevation in the center of the waterway up and down stream for 100 feet in each direction from the hydrology station taking an elevation every ten feet. In large water bodies, orient the 200 foot transect along the typical flow path (i.e. from inshore towards offshore) and take elevations every ten feet.

While Traveling between CRMS Sites

The CMP team has identified locations where channel bathymetry data is lacking and any and all water bottom elevations would be useful for improving CMP assumptions (Appendix F). If time in the field allows while surveying CRMS stations, also survey water bottom elevations at the center of the channel every 100 ft in locations identified in Appendix F.

3.6 Methodology Meeting

A meeting will be conducted between CPRA and the Contracting Party to discuss methodologies and details of the survey prior to starting field work.

4. LASARD

CPRA maintains the Louisiana Sand Resources Database (LASARD) Program to help facilitate the identification and management of nearshore, offshore and riverine sediment resources. The LASARD database is also used to manage, archive, and maintain geological, geophysical, topographic, bathymetric, geotechnical and other related data pertaining to the exploration of sand/sediment in various environments (Kahlil et al., 2022).

The Contracting Party shall follow the LASARD Standard Operating Procedures for Geo-Scientific Data Management with respect to data collection and reporting guidelines for the survey investigation and all other data collection efforts. This Standard Operating Procedure, corresponding attribute specifications, and GIS templates can be obtained from the CPRA website with the link provided in Section 6. For all questions pertaining to the LASARD program, please contact Syed Khalil at 225-342-1641 or syed.khalil@la.gov.

5. DELIVERABLES

5.1 Bi-Weekly Report

Reports will be required on a bi-weekly basis and shall include: (1) sites and benchmarks visited, (2) status of work completed at each site, and (3) any problems or encounters with landowners or lessees. The bi-weekly reports shall be sent to the CPRA Task Manager (Leigh Anne Sharp, LeighAnne.Sharp@la.gov).

5.2 Survey Reports

A survey report shall be generated for each CRMS site to be delivered in PDF format. The report will include but is not limited to a title page with PLS stamp and signature, a methodology report, and the deliverables listed in Section 3 of this Scope of Work. These deliverables will include:

- a) Data Sheets – GPS Monument, Continuous Recorder (H0#), Staff Gauge (H0#), and RSET (E0#)
- b) GPS Session Schedules and GPS Log Sheet
- c) Tables and Excel Spreadsheets – Continuous Recorder Gauge, Staff Gauge (include gauge correction factors), and RSET (E0#)
- d) Field Notes That Include Drawings
- e) All GPS Data Will Be Provided in a Digital Format Including Final Adjusted GPS Data
- f) Digital Static Survey GPS data in a RINEX format
- g) All photographs taken at the site in a zip file

NOTE: Photos in the survey report shall be photos of the actual CRMS stations at the time they were surveyed and not stand in, generic photos.

NOTE: Before deliverables are finalized, draft versions are to be sent for review and comment.

The draft and final versions of reports shall be delivered to Leigh Anne Sharp Coastal Resource Scientist Manager of CPRA in the Lafayette Regional Office who will serve as Task Manager for this contract. The address is as follows:

Coastal Protection and Restoration Authority
PO box 62027
Lafayette LA 70596-2027

Physical Address:
635 Cajundome Blvd.

Invoices are to be delivered to Leigh Anne Sharp for review and processing.

5.2.1 Data Summary - Changes to CRMS Sites

For each batch of survey reports submitted to CPRA, the Contracting Party shall also provide a spreadsheet that includes:

- a) The name of each CRMS station include in the batch
- b) Original station elevation provided by CPRA
- c) Updated station elevation provided by the Contracting Party
- d) Difference between original elevation and updated station elevation
- e) Any notes on station elevation differences that the Contracting Party can provide
- f) Benchmark utilized in 2021
- g) Benchmark elevation from 2021
- h) Benchmark utilized in 2027
- i) Benchmark elevation in 2027
- j) Change in benchmark elevation
- k) Any notes on benchmark elevation differences that the Contracting Party can provide.

One spreadsheet with all of the station elevation details shall be submitted with each batch of reports.

5.2.2 Survey Precision Report

For each batch of survey reports submitted to CPRA, the Contracting Party shall also provide a spreadsheet that includes:

- a) Point Name
- b) X
- c) Y
- d) Z
- e) Antenna height
- f) Hz Prec (DMRS)
- g) Vt Prec (1 sigma)
- h) PDOP
- i) GDOP
- j) HDOP
- k) VDOP
- l) Base Data Age

- m) Positions Used
- n) Satellites Used

One spreadsheet with all of the station elevation details shall be submitted with each batch of reports.

5.3 Benchmark Summary Report - Update subsidence estimates with benchmark data from this survey effort

The Contracting Party shall prepare a report for CPRA that includes changes in benchmark elevations including any subsidence information that can be extracted from the 2027 CRMS survey effort. This analysis shall reference previous CPRA funded subsidence studies and provide an update on observed subsidence rates (Applied Coastal, 2021, Applied Coastal 2023, Byrnes et al., 2019, Byrnes et al., 2022, and CPRA, 2025). Benchmark information from 2021 will be provided to the Contracting Party by CPRA.

Note: This survey is the first opportunity to estimate subsidence at a subset of 52 CRMS RSET stations. The deliverable will be a document that summarizes changes (.pdf) with associated spreadsheets used in subsidence calculations (.csv or .xlsx).

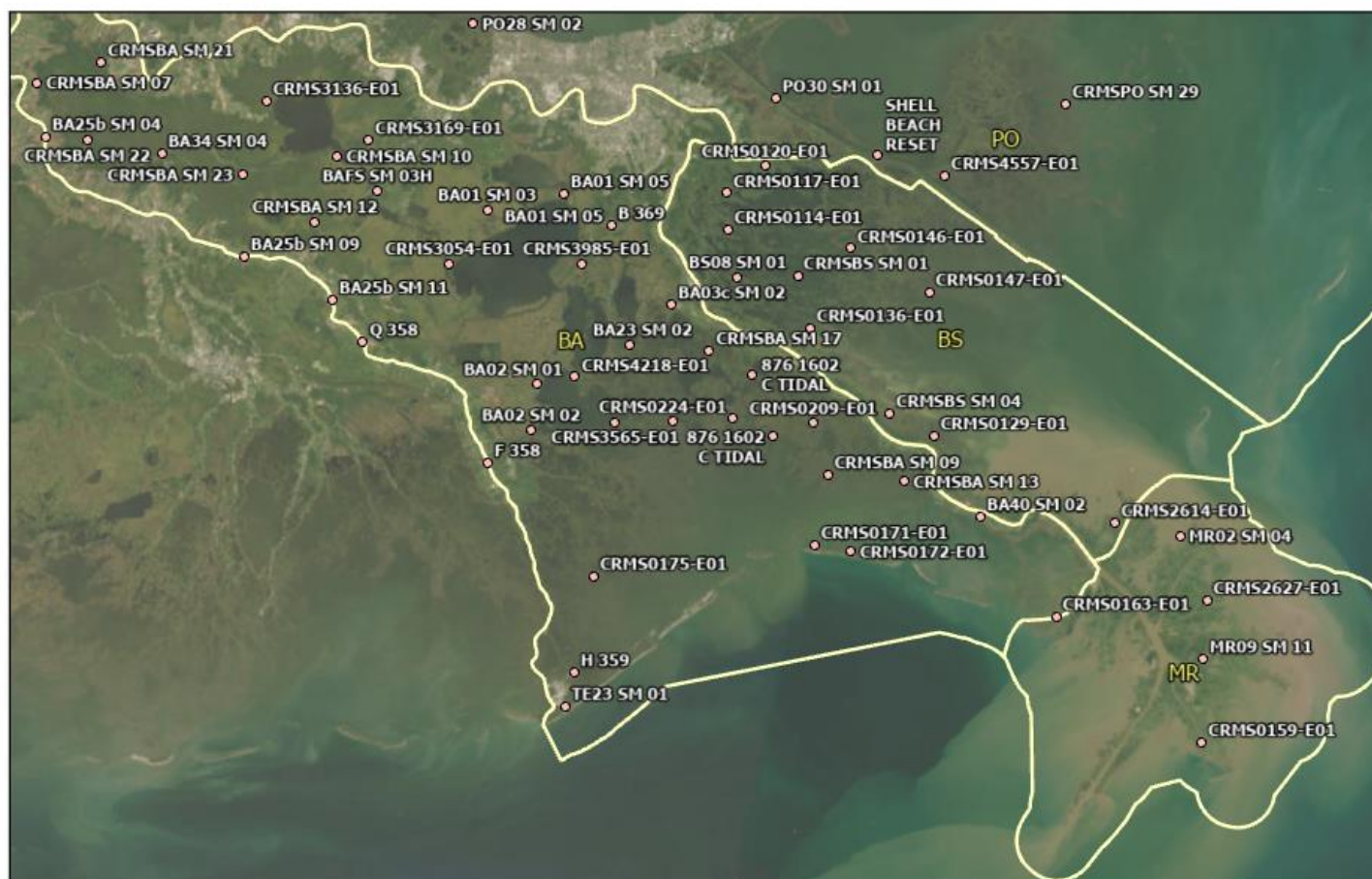
6. REFERENCES

- Applied Coastal Research and Engineering (Applied Coastal), 2021. Recent Subsidence Trends for Southeastern Louisiana Derived from Static GPS Measurements at Primary and Secondary Benchmarks. Final Report prepared for Louisiana Coastal Protection and Restoration Authority, Baton Rouge, LA. 56 p. plus appendices.
- Applied Coastal Research and Engineering (Applied Coastal), 2023. Stability of Reference Monuments for Documenting Elevation Changes in Consolidating Holocene Sediment in South Louisiana Coastal Environments. Final Report prepared for Coastal Protection and Restoration Authority of Louisiana, Baton Rouge, LA, 17 p. plus appendices.
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- Byrnes, M. R., Britsch, L. D., Berlinghoff, J. L., Johnson, R., & Khalil, S., 2019. Recent subsidence rates for Barataria Basin, Louisiana. *Geo-Marine Letters* 39, 265-278.
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- Byrnes, Mark & Hollis, Robert & Britsch, Louis & Berlinghoff, Jennifer & Johnson, Ricardo. (2022). Recent Subsidence Trends for Coastal Louisiana: Phase 4 – Southwestern Louisiana Chenier Plain, Teche/Vermilion Basin, Atchafalaya Basin, Western Pontchartrain Basin, and the Mississippi River Delta Basin and A Synthesis of Results for South Louisiana Coastal Environments.
- Coastal Protection and Restoration Authority (CPRA). 2019. A contractor's guide to the standards of practice: for CPRA contractors performing GPS surveys and determining GPS derived orthometric heights within the Louisiana Coastal Zone. Coastal Protection and Restoration Authority, Operations Division, Baton Rouge, LA. 41 pp.
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- Khalil, S. M., Haywood, E., Wager, R., and Forrest, B., 2022. Standard Operating Procedures for Geo-scientific Data Management, Louisiana Sand Resources Database (LASARD) - Version 5., Coastal Protection and Restoration Authority of Louisiana (CPRA), 28pp.
<https://cims.coastal.la.gov/RecordDetail.aspx?Root=0&sid=12362#>
- T Baker Smith, 2022. 2021 Elevation Survey Update of Coastwide Reference Monitoring System (CRMS) and Associated Secondary Monuments for the Thibodaux Regional Office. 50 pages
- Todd M. Folse, Thomas E. McGinnis, Leigh A. Sharp, Jonathan L. West, Melissa K. Hymel, John P. Troutman, Dona Weifenbach, William M. Boshart, Laurie B. Rodrigue, Danielle C. Richardi, W. Bernard Wood, C. Mike Miller, Elizabeth M. Robinson, Angelina M. Freeman, Camille L. Stagg, Brady R. Couvillion, and Holly

J. Beck. 2023. A Standard Operating Procedures Manual for the Coastwide Reference Monitoring System-Wetlands and the System-Wide Assessment and Monitoring Program: Methods for Site Establishment, Data Collection, and Quality Assurance/Quality Control. Louisiana Coastal Protection and Restoration Authority. Baton Rouge, LA. 255 pp.

<https://cims.coastal.louisiana.gov/RecordDetail.aspx?Root=0&sid=25156#>

APPENDIX A - Site Location and Instrumentation



Monument Network Deltaic Plain (South)

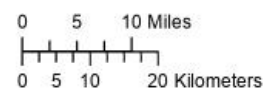
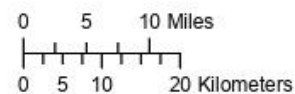
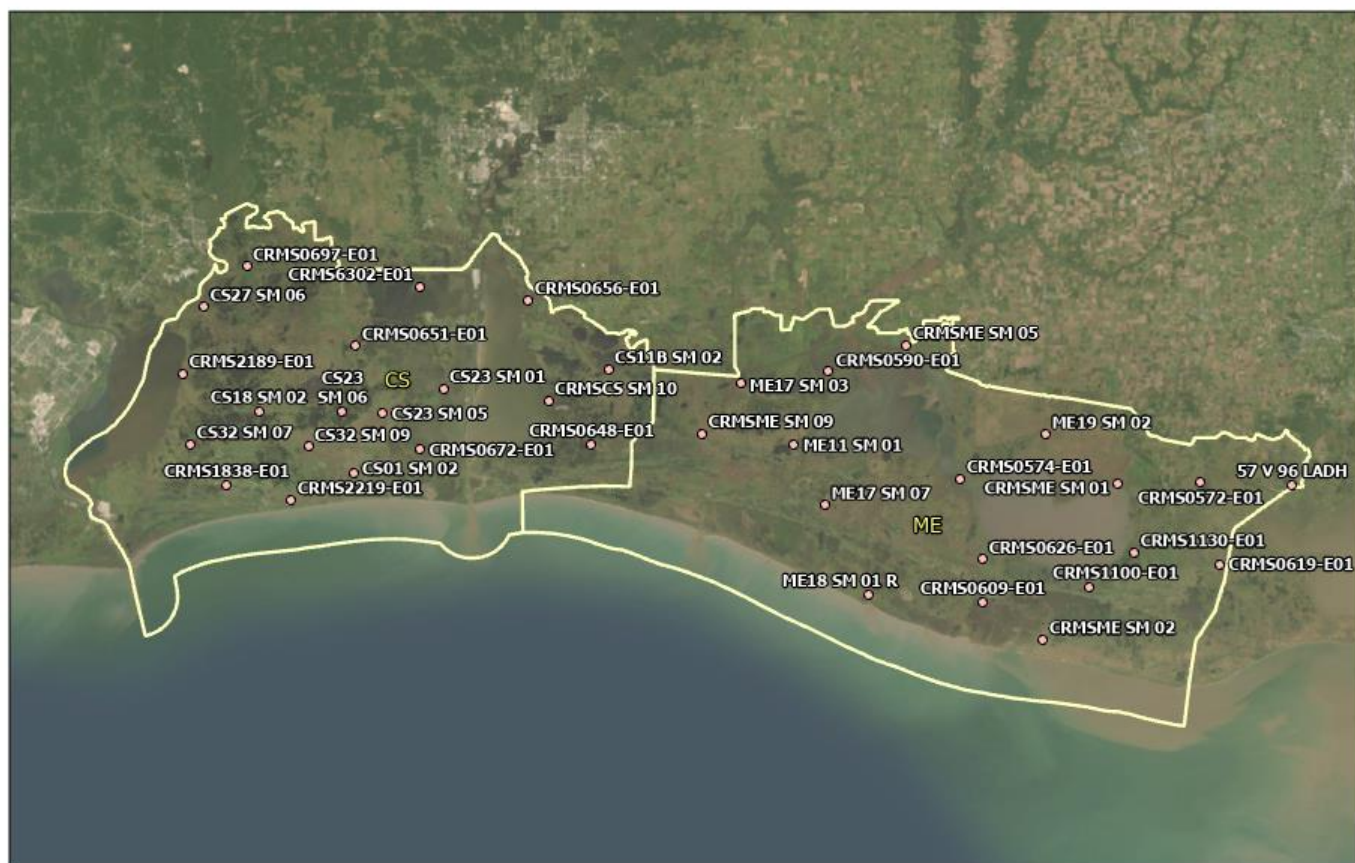


Figure A-1b. Location of secondary monuments sites in lower Barataria basin, the Mississippi River delta, and lower Breton Sound





Monument Network Chenier Plain



Figure A-1d. Location of the secondary monuments sites in Calcasieu/Sabine and Mermentau basins

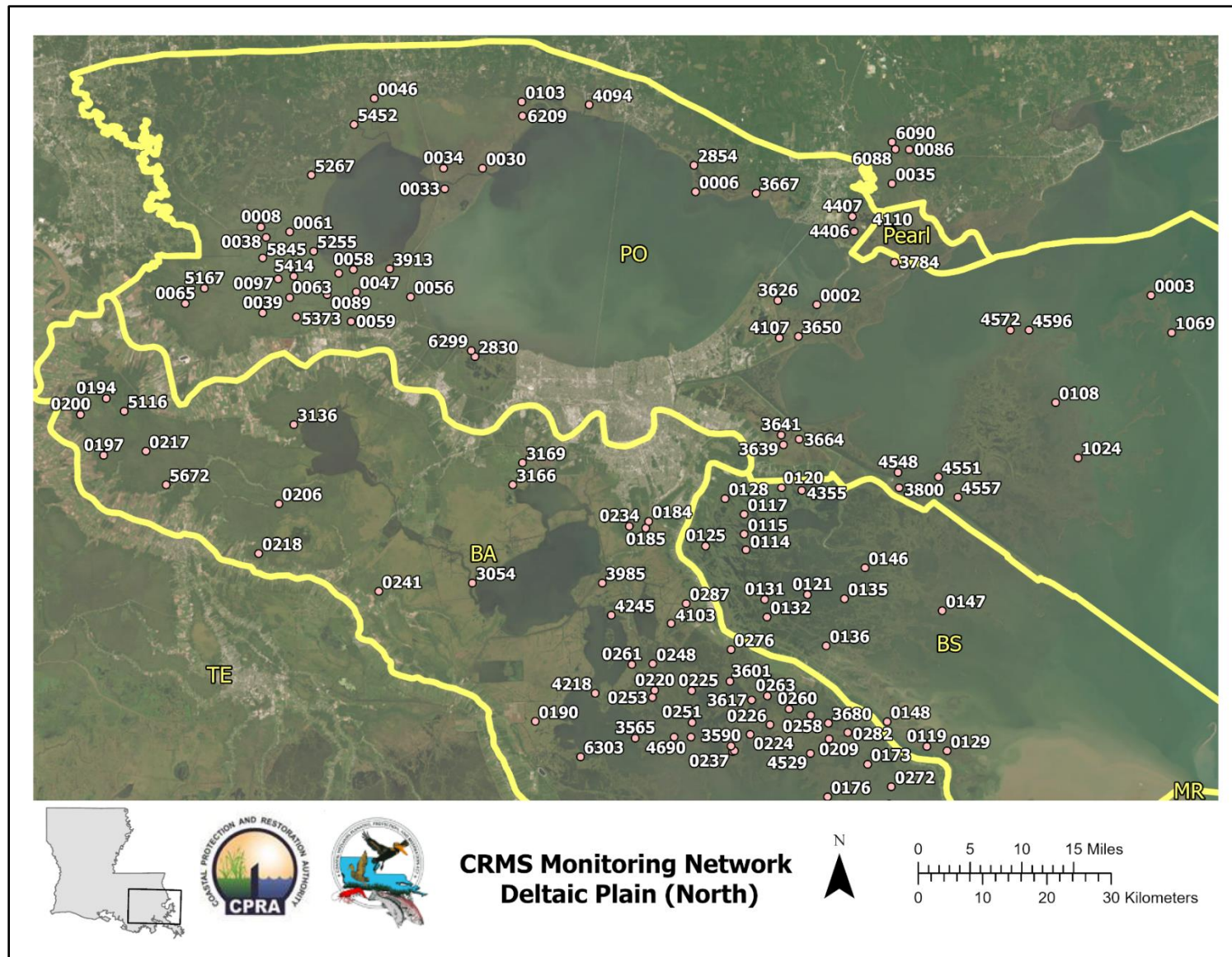


Figure A-2a. Location of the CRMS sites in the Barataria, Breton Sound, and Pontchartrain basins

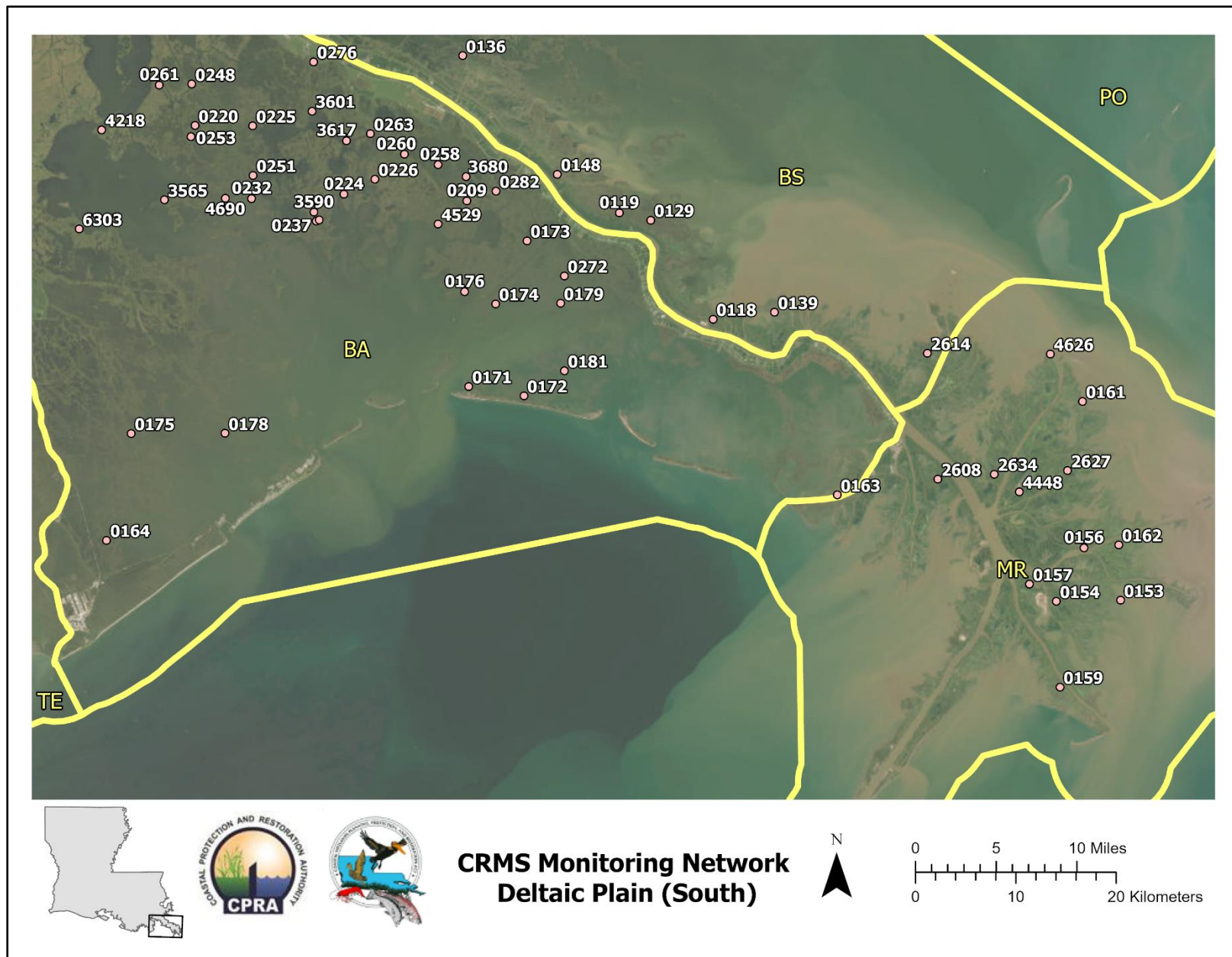


Figure A-2b. Location of the CRMS sites in lower Barataria basin, the Mississippi River delta, and lower Breton Sound

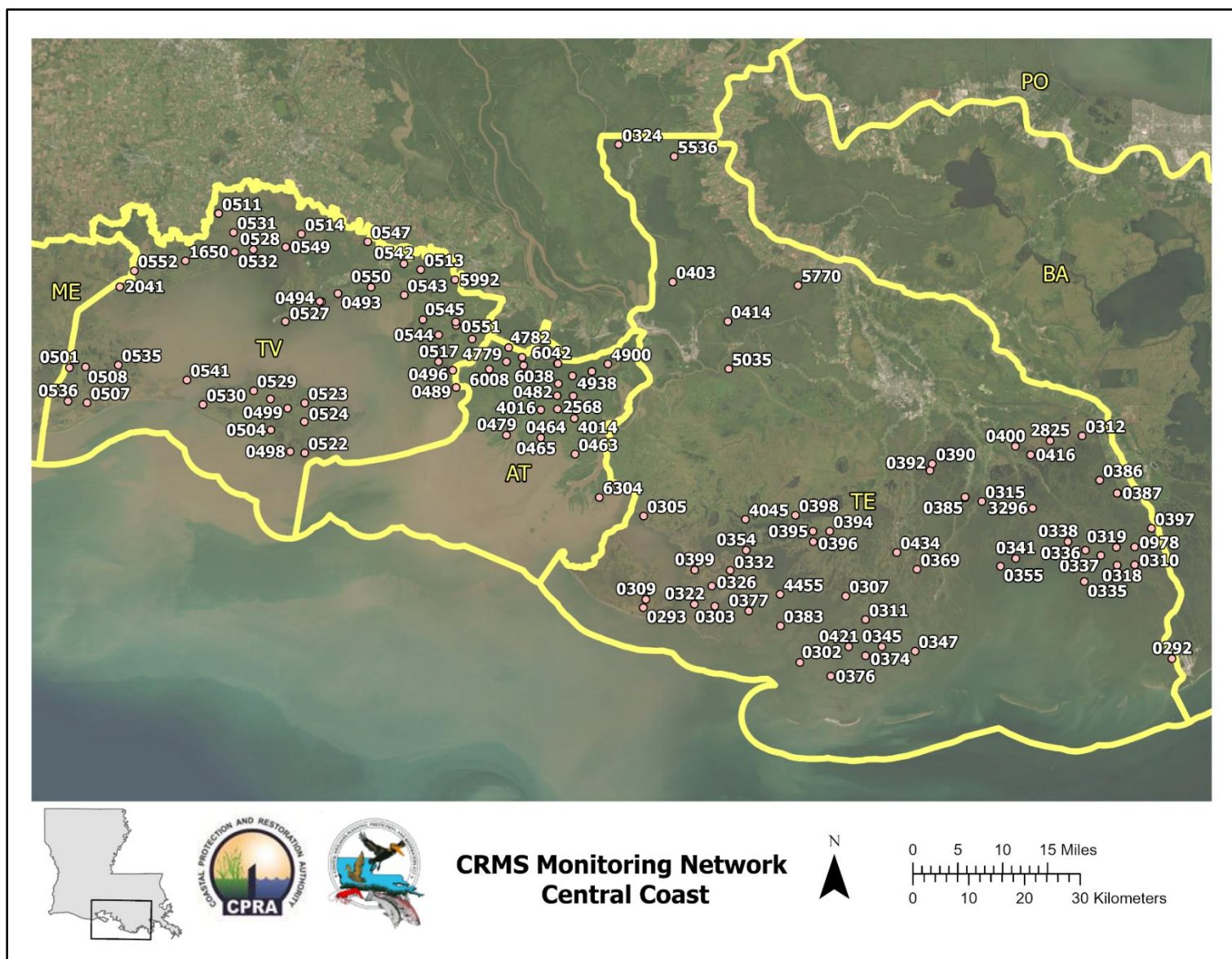


Figure A-2c. Location of the CRMS sites in Teche/Vermilion, Atchafalaya and Terrebonne basins

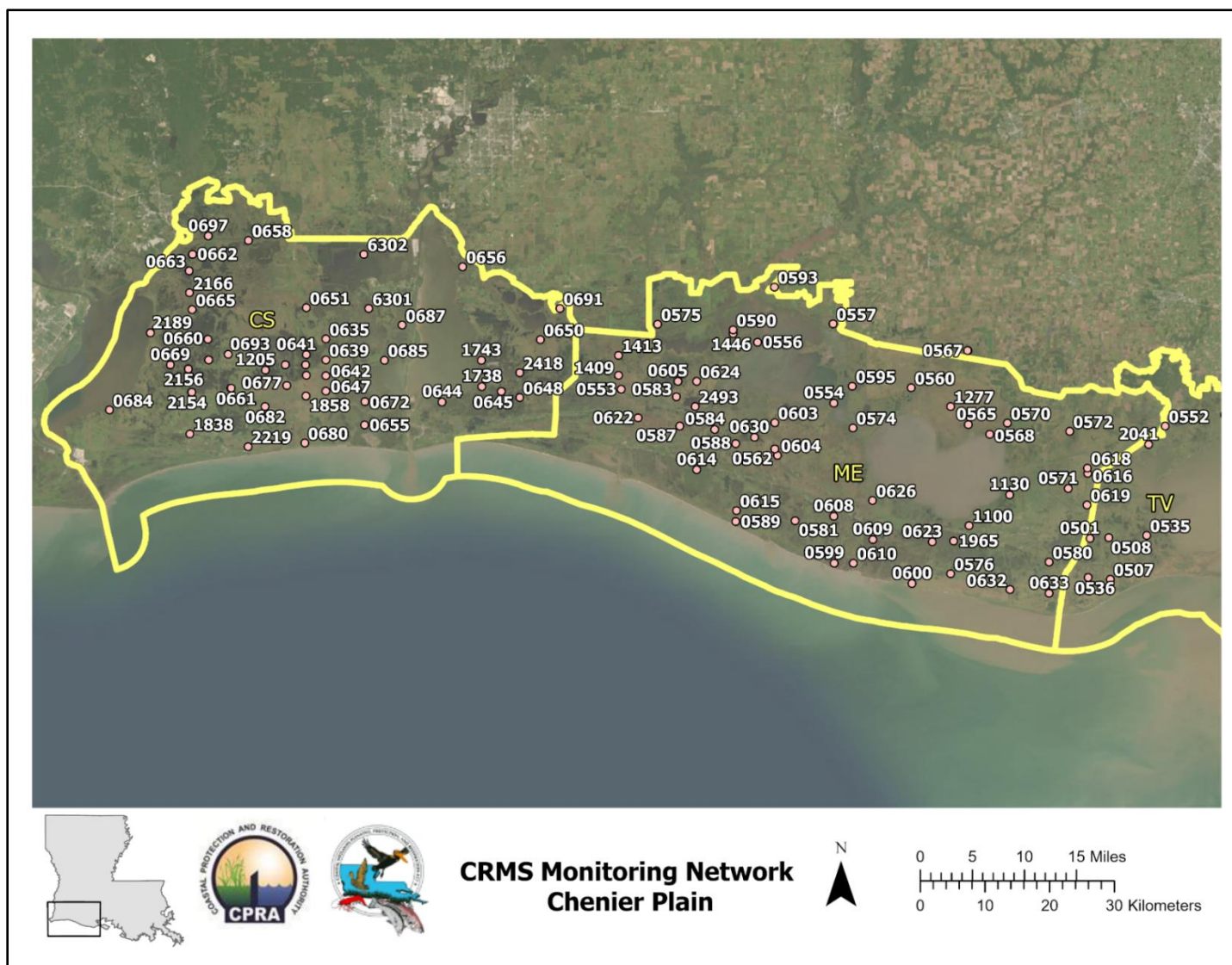


Figure A-2d. Location of the CRMS sites in Calcasieu/Sabine and Mermentau basins



Figure A-3. Continuous recorder site (pvc and electrical box) in open water environment. Orange flagging represents the “nail” or TBM to be surveyed.



Figure A-4. Photo of a mounted staff gauge.

All Screws, Bolts, Washers and Nuts are to be Hot-dipped Galvanized

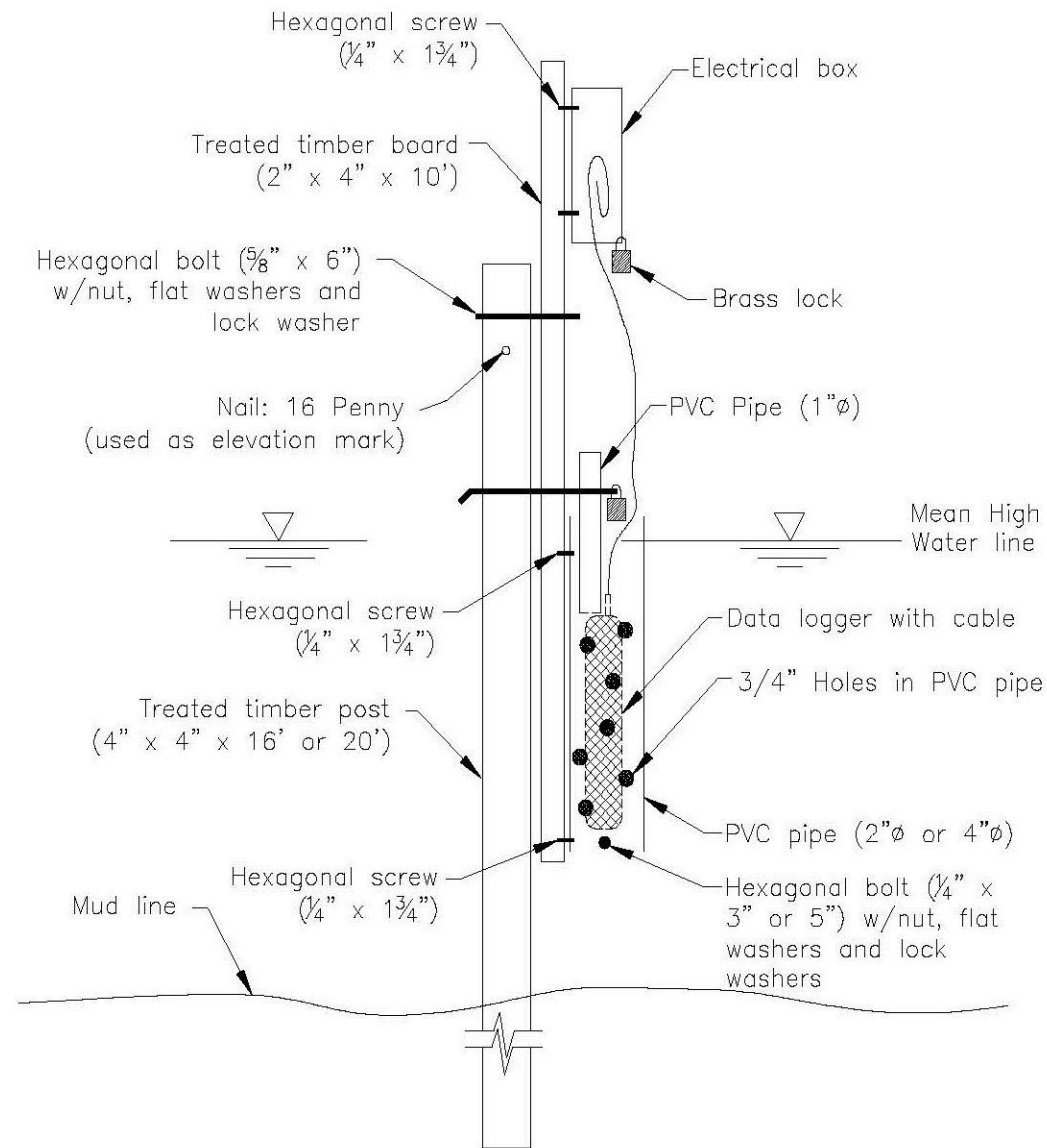


Figure A-5. Schematic of a typical open water continuous recorder installation.

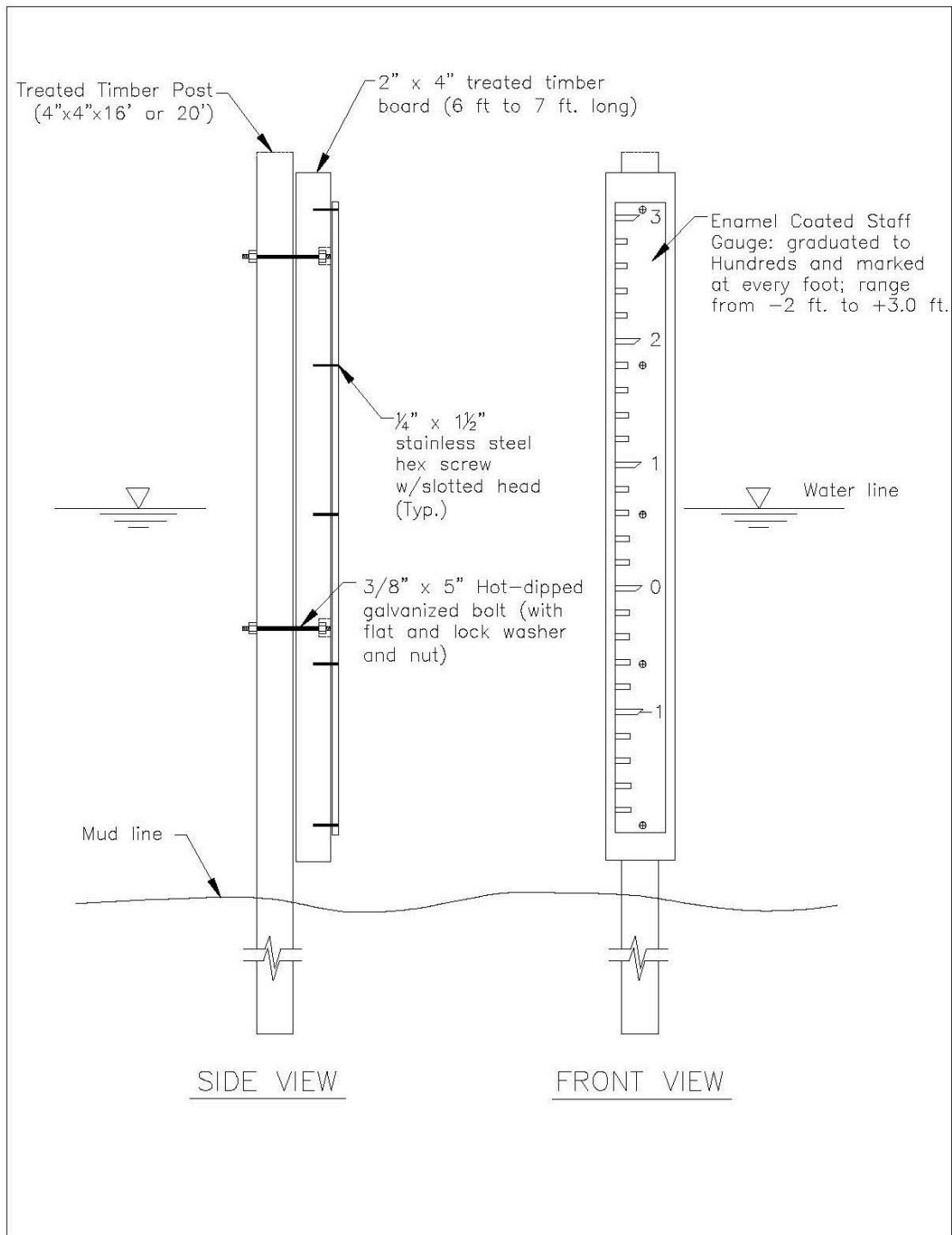


Figure A-6. Schematic of a typical staff gage installation. The design has changed with respect to the 2" galvanized pipe. It is now a 4"x4" wooden post.



Figure A-7. The photos display USGS/Real-Time (H01-RT) 3' x 5' wooden platforms that function as continuous recorder sites. The continuous recorders are mounted inside the PVC pipes that extend to the top of the platforms. The platforms decks, catwalk grating (left) or wooden (right) have different configurations for the survey “mark”. Note, the detached 4”x4” posts installed next to the platforms (top) are the support poles for staff gauges and the old “typical” sonde post which will also be surveyed.

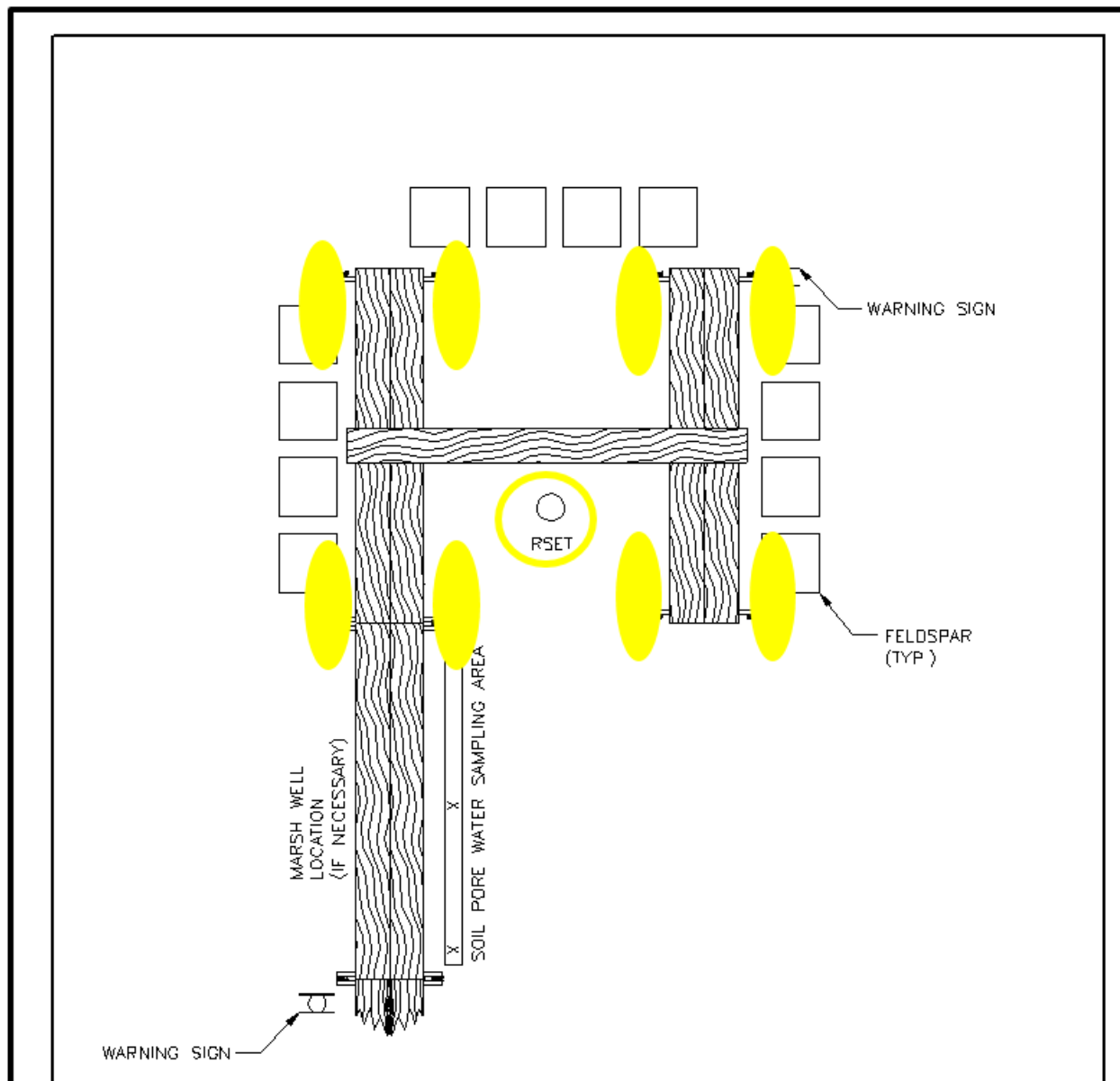


Figure A-8. Schematic of a boardwalk with the RSET rod in the center. The board spanning the two boardwalks (~10 ft long) must be brought by the crew accessing the rod. All work must be conducted from the boardwalk without disturbing the marsh surface. Locations where marsh elevation is to be collected are highlighted in yellow.



Figure A-9. Example of a boardwalk in an attached marsh. RSET rod is between the two boardwalks. A board is brought and placed on top to access the rod.



Figure A-10. Rod surface elevation table (RSET) rod and collar.

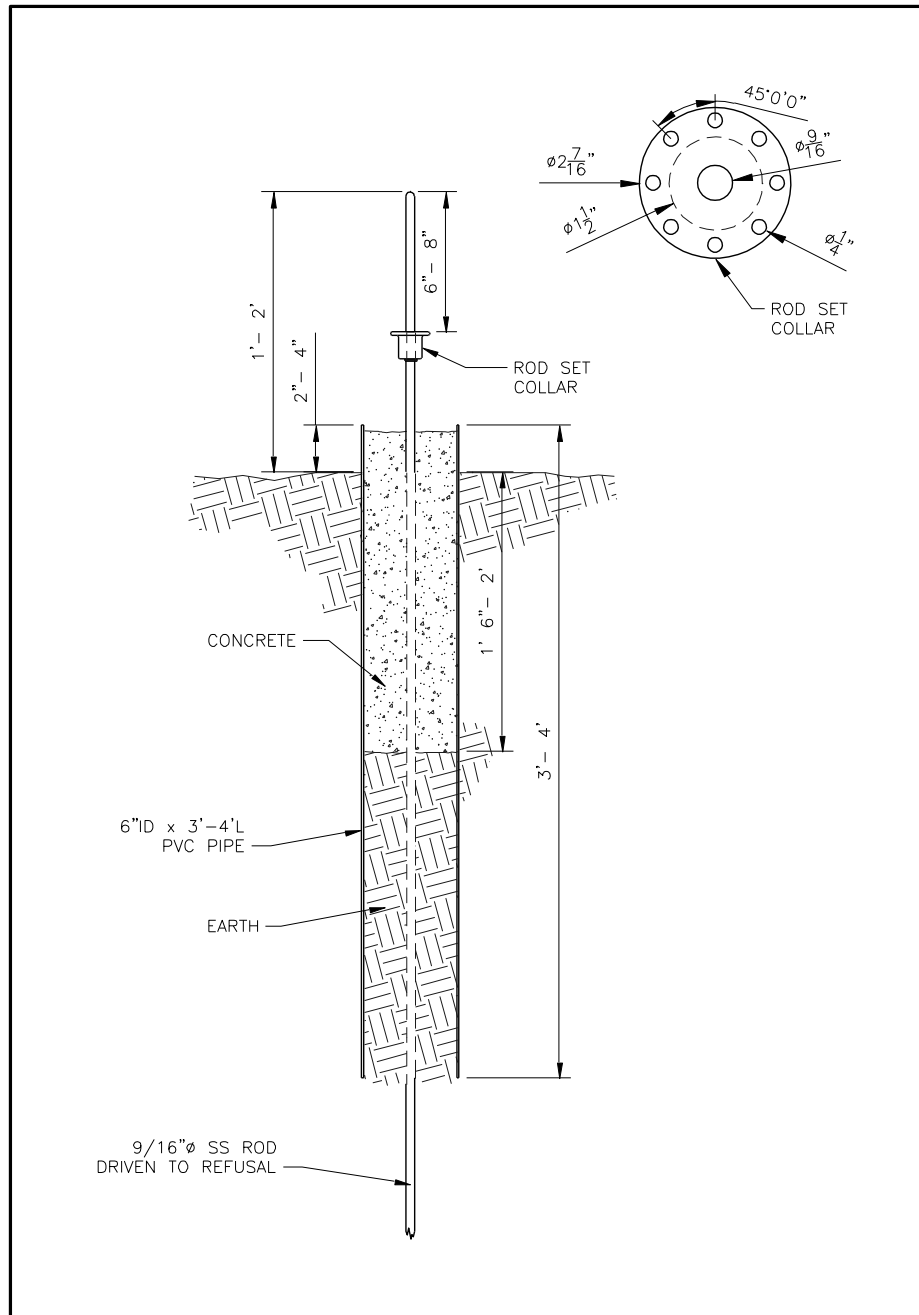


Figure A-11. Schematic drawing showing an installed RSET

APPENDIX B - Locations to be surveyed

Table B-1. Benchmarks and elevations from 2021 coastwide survey. (Attachment Filename: Table B-1_2021 Monument Elevations.xlsx)

Site ID	IDNUM	BASIN	2021 Monument ID	2021 Monument Elevation (ft NAVD 88) Geoid 12b	2021 Ellipsoid height (ft)	2021 Geoid height (ft)	Latitude (dms)	Longitude (dms)	2021 RSET survey precision
CRMS0002	2	PO	E 3146	5.34447207	-80.93479527	-86.27926734	30.07057081	-89.80149755	3-5 cm
CRMS0003	3	PO	CRMS0003-E01	-1.66338081	-89.28450762	-87.62112681	30.09938216	-89.27519223	3-5 cm
CRMS0006	6	PO	PO33 SM 01	1.12532469	-86.15787663	-87.28320132	30.26859101	-89.95577021	3-5 cm
CRMS0008	8	PO	PO29 SM 03	11.78474136	-75.03914376	-86.82388512	30.11432895	-90.58087065	3-5 cm
CRMS0030	30	PO	G 275	4.9868616	-82.43085375	-87.41771535	30.28923597	-90.40189773	3-5 cm
CRMS0033	33	PO	G 275	4.9868616	-82.43085375	-87.41771535	30.28923597	-90.40189773	3-5 cm

Table B-2. Survey overview including items to be surveyed by CRMS site and project. Additional detail provided in Tables B-2, B-3, B-4 and B-5. (Attachment Filename: Table B-2_Table B-2_CRMS Survey Overview.xlsx)

Project ID	BASIN	Siteld	CRMS IDNUM	Include Site 2027 survey	Hydro Survey Site Note	Active Hydro Station Name
CRMS	PO	CRMS0002	2	1	Survey Active CRMS Hydro Station	CRMS0002-H01
CRMS	PO	CRMS0003	3	1	Survey Active CRMS Hydro Station	CRMS0003-H01
CRMS	PO	CRMS0006	6	1	Survey Active CRMS Hydro Station	CRMS0006-H01
CRMS	PO	CRMS0008	8	1	Survey Active CRMS Hydro Station	CRMS0008-H02
CRMS	PO	CRMS0030	30	1	Survey Active CRMS Hydro Station	CRMS0030-H01
CRMS	PO	CRMS0033	33	1	Survey Active CRMS Hydro Station	CRMS0033-H01
CRMS	PO	CRMS0034	34	1	Survey Active CRMS Hydro Station	CRMS0034-H01

Hydro_Longitude	Hydro_Latitude	RSET Survey Note	Active RSET Station Name	RSET Latitude	RSET Longitude
-89.79156	30.10031	Survey Active RSET Station	CRMS0002-E01	30.10035038	-89.79177327
-89.25201	30.09988	Survey Active RSET Station	CRMS0003-E01	30.09938214	-89.2526921
-89.98233	30.2636	Survey Active RSET Station	CRMS0006-E01	30.263548	-89.98221662
-90.68524	30.22841	Survey Active RSET Station	CRMS0008-E01	30.22836389	-90.68527781
-90.32513	30.30395	Survey Active RSET Station	CRMS0030-E01	30.30389319	-90.32535058
-90.38704	30.27717	Survey Active RSET Station	CRMS0033-E02	30.276297	-90.387536
-90.38866	30.30562	Survey Active RSET Station	CRMS0034-E01	30.30544873	-90.38856046

Table B-3 - CRMS RSET Station Locations to be surveyed with current elevation. (Attachment Filenames: Table B-3_Active RSET Stations.xlsx)

Site ID	Station ID	RSET Collar 2026 (ft, NAVD88, G12b)	2021 RSET survey precision	Needs high precision survey 2027	Needs RTK survey	RSET Latitude	RSET Longitude
CRMS0002	CRMS0002-E01	1.54	3-5 cm	0	1	30.10035038	-89.79177327
CRMS0003	CRMS0003-E01	1.89	3-5 cm	0	1	30.09938214	-89.2526921
CRMS0006	CRMS0006-E01	1.96	3-5 cm	0	1	30.263548	-89.98221662
CRMS0008	CRMS0008-E01	2.67	3-5 cm	0	1	30.22836389	-90.68527781
CRMS0030	CRMS0030-E01	1.73	3-5 cm	0	1	30.30389319	-90.32535058
CRMS0033	CRMS0033-E02	2	3-5 cm	0	1	30.276297	-90.387536
CRMS0034	CRMS0034-E01	1.39	3-5 cm	0	1	30.30544873	-90.38856046
CRMS0035	CRMS0035-E01	3	3-5 cm	0	1	30.26713055	-89.66475275
CRMS0038	CRMS0038-E01	2.35	3-5 cm	0	1	30.2133806	-90.67752504
CRMS0039	CRMS0039-E01	1.87	3-5 cm	0	1	30.10733335	-90.68525004
CRMS0047	CRMS0047-E01	1.52	3-5 cm	0	1	30.13419656	-90.53390649
CRMS0056	CRMS0056-E01	2.22	3-5 cm	0	1	30.12573615	-90.44624444
CRMS0059	CRMS0059-E01	1.73	3-5 cm	0	1	30.09308888	-90.5430194

Table B-4 - CRMS Hydro Station Locations to be surveyed with current elevation. (Attachment Filenames: Table B-4_Active Hydro Stations.xlsx)

Project ID	Site ID	Station	Hydro Survey Site Note	2026 Mark_Elevation (ft, NAVD88, G12b)	Current Elevation Note	Hydro_Longitude	Hydro_Latitude
CRMS	CRMS0002	CRMS0002-H01	Survey Active CRMS Hydro Station	2.18		-89.79156	30.10031
CRMS	CRMS0003	CRMS0003-H01	Survey Active CRMS Hydro Station	3.87		-89.25201	30.09988
CRMS	CRMS0006	CRMS0006-H01	Survey Active CRMS Hydro Station	4.68		-89.98233	30.2636
CRMS	CRMS0008	CRMS0008-H02	Survey Active CRMS Hydro Station	4.57		-90.68524	30.22841
CRMS	CRMS0030	CRMS0030-H01	Survey Active CRMS Hydro Station	4.18		-90.32513	30.30395
CRMS	CRMS0033	CRMS0033-H01	Survey Active CRMS Hydro Station	3.86		-90.38704	30.27717
CRMS	CRMS0034	CRMS0034-H01	Survey Active CRMS Hydro Station	2.92		-90.38866	30.30562
CRMS	CRMS0035	CRMS0035-H01	Survey Active CRMS Hydro Station	3.98		-89.66461	30.26729
CRMS	CRMS0038	CRMS0038-H01	Survey Active CRMS Hydro Station	4.1		-90.67751	30.21345
CRMS	CRMS0039	CRMS0039-H01	Survey Active CRMS Hydro Station	6.82		-90.68524	30.10734
CRMS	CRMS0047	CRMS0047-H01	Survey Active CRMS Hydro Station	3.38		-90.53439	30.13387
CRMS	CRMS0056	CRMS0056-H01	Survey Active CRMS Hydro Station	3.29		-90.44598	30.12553
CRMS	CRMS0058	CRMS0058-H02	Survey Active CRMS Hydro Station	5.97		-90.53783	30.16552
CRMS	CRMS0059	CRMS0059-H02	Survey Active CRMS Hydro Station	5.48		-90.54301	30.09312
CRMS	CRMS0061	CRMS0061-H02	Survey Active CRMS Hydro Station		new station replaces USGS Real-time	-90.63932	30.22038

Special Cases

Table B-3. CRMS sites used as surrogates for nearby sites with the same hydrology. H0X stations are not active in the field though data is available in CIMS.

CRMS Surrogate Hydro Station Summary	
Active Hydro Station	Site without hydro station
CRMS0174-H01	CRMS0176-H0X
CRMS0253-H01	CRMS0220-H0X
CRMS0411-H01	CRMS2881-H0X
CRMS0553-H02	CRMS1409-H0X
CRMS0590-H01	CRMS1446-H0X
CRMS0661-H01	CRMS2154-H0X
CRMS0669-H01	CRMS2156-H0X

Table B-4. CRMS sites without active RSET stations and a note on whether active hydro stations remain.

Site ID	Site has an active RSET station	Site has an active Hydro station	Survey Needs
CRMS0046	0	0	No Survey at this Site
CRMS0153	0	0	No Survey at this Site
CRMS0355	0	0	No Survey at this Site
CRMS0397	0	0	No Survey at this Site
CRMS0414	0	0	No Survey at this Site
CRMS0464	0	0	No Survey at this Site
CRMS0465	0	0	No Survey at this Site
CRMS3590	0	0	No Survey at this Site
CRMS5373	0	0	No Survey at this Site
CRMS5770	0	0	No Survey at this Site
CRMS0121	0	1	Survey Hydro Station and nearby marsh
CRMS0174	0	1	Survey Hydro Station and nearby marsh
CRMS0176	0	0	Survey nearby fringe marsh
CRMS0178	0	1	Survey Hydro Station and nearby marsh
CRMS0190	0	1	Survey hydro station and nearby marsh
CRMS0386	0	1	Survey Hydro Station and nearby marsh
CRMS0511	0	1	Survey Hydro Station and nearby marsh
CRMS3565	0	1	Survey Hydro Station and nearby marsh
CRMS0302	0	1	Survey Hydro Station and install TBM for Vegetation Surveys



Figure B-1a. Locations where marsh elevation is to be surveyed in the fringe marsh that surrounds CRMS0121.



Figure B-1b. Locations where marsh elevation is to be surveyed in the fringe marsh near CRMS0174.



Figure B-1c. Locations where marsh elevation is to be surveyed in the fringe marsh near CRMS0176.

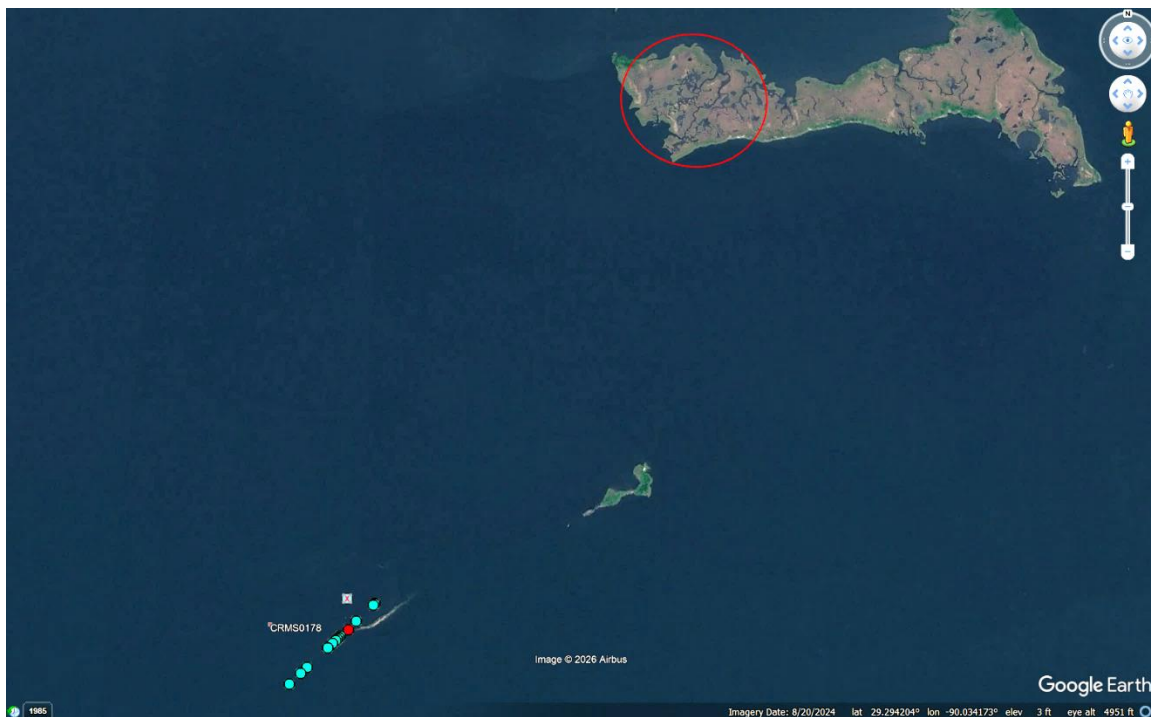


Figure B-1d. Locations where marsh elevation is to be surveyed in the fringe marsh near CRMS0178.



Figure B-1e. Locations where marsh elevation is to be surveyed in the fringe marsh near CRMS0190.

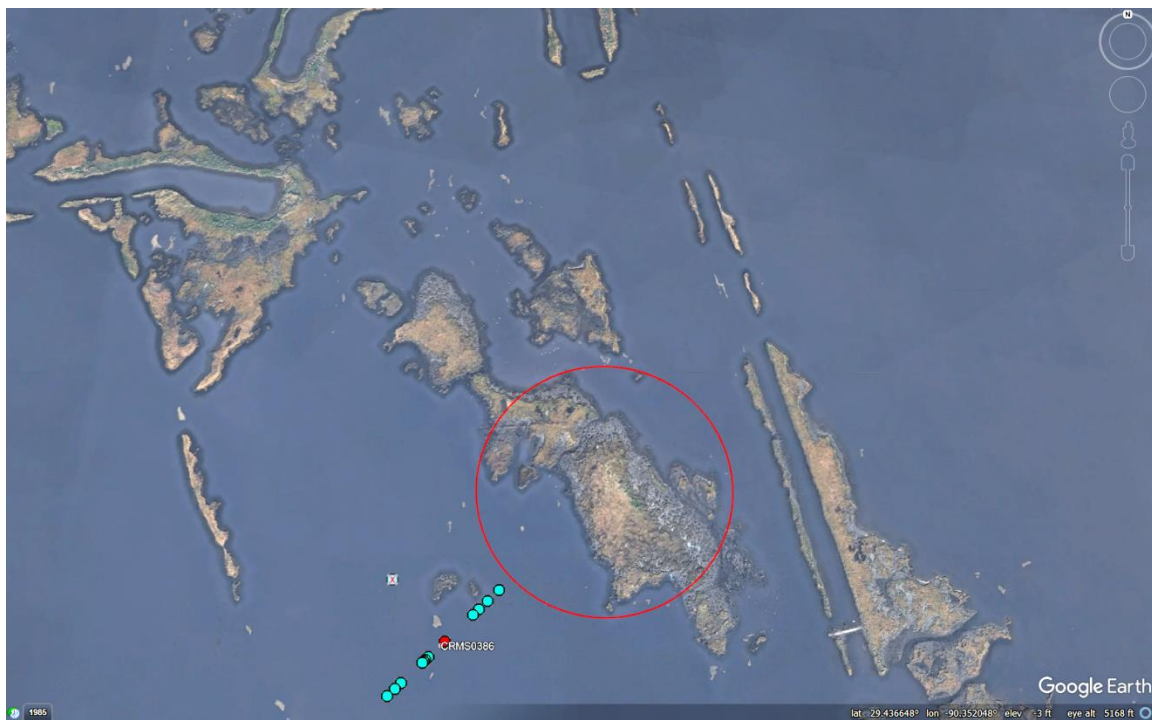


Figure B-1f. Locations where marsh elevation is to be surveyed in the fringe marsh near CRMS0386.



Figure B-1g. Locations where marsh elevation is to be surveyed at CRMS0511. The landowner does not allow CRMS to access the site with an airboat. The Hydro station (blue square) is accessed by walking over the levee to a small boardwalk. Vegetation elevation should be taken within reach of the boardwalk.



Figure B-1h. Locations where marsh elevation is to be surveyed in the fragmented marsh that surrounds CRMS3565.

APPENDIX C - Landowner Information

Table C-1. CRMS landowner contact information (Attachment Filename: Appendix C - Landowner Contact Information.xlsx)

CRMS Site No	Parish	Landowner	Contact Company	Contact	Email
0002	Orleans		Bayou Sauvage National Wildlife Refuge	Shelly Stiaes	shelley.stiaes@fws.gov
0003				Floyd Gue	floydgue@gmail.com
0006	St. Tammany		Big Branch Marsh National Wildlife Refuge	Jimmy Laurent	jimmy_laurent@fws.gov
0008	Livingston			Elizabeth Richards	elizabethrichards@gmail.com
0030	Tangipahoa			David McDonald	
0033	St. John the Baptist	Manchac WMA	LA Dept. of Wildlife & Fisheries	Rhett Desselle	
0034	Tangipahoa	Wendy Lauderdale	Southeastern Louisiana University	Linette Bourgeois	
0035	St. Tammany	Pearl River Wildlife Mgmt. Area	LA Dept. of Wildlife & Fisheries	Rhett Desselle	
0038	Livingston	Maurepas Swamp Wildlife Mgmt Area	LA Dept. of Wildlife & Fisheries	Forest Burks (MSWMA Biologist)	fburks@wtf.la.gov
0038	Livingston	Maurepas Swamp Wildlife Mgmt Area	LA Dept. of Wildlife & Fisheries	Shane Granier (Biologist Manager)	sgranier@wtf.louisiana.gov

Telephone	Cell Phone	Preferred boat	Boat to Sonde	Boat to Boardwalk	Comments
985-882-2000		airboat			
	504-512-9571	outboard			
985-882-2030		airboat			
225-921-7040	225-773-4178	surface drive			Boardwalk, RSET and Accretion Stations, Vegetation Plots behind his house
800-999-5788	n) 985-898-0794				
225-765-2969		surface drive			
985-549-2239		surface drive			
225-765-2969		surface drive			
985-543-4782		surface drive			
985-543-4777					

APPENDIX D - Deliverable Formats

CRMS Station	Date	Time	Continuous Recorder Gauge (H01)				
			Top of Recorder Support Pole (4x4 Post, Cap of Pipe, etc.)	Top of Support Pole to Nail or Top of 1/4" Hole	Nail or Hole Elevation	Top of Recorder Support Pole to Top of Water Distance	Water Elevation
			(NAVD 88, Ft.)	(Ft.)	(NAVD 88, Ft.)	(Ft.)	(NAVD 88, Ft.)
318	5/22/2014	1:15 PM	5.77		4.59		0.31
Calculated Differences (Leveling) =				1.18		5.46	
Tape Measurements =				1.17		5.40	
Differences =				0.01		0.06	

CRMS Station	Date	Time	Staff Gauge (H01)								
			Existing Staff Gauge Reading (Upon Arrival)	Top of Support Pole to Nail or Top of 1/4" Hole	Nail or Hole Elevation	Top of Staff Gauge Support Pole	Top of Staff Gauge Support Pole to Top of Water Distance	Water Elevation	Staff Gauge Reading (After Establishment or Adjustment)	Computed Difference (Water Elevation vs. Staff Gauge)	Correction Factor
			Old Datum	(Ft.)	(NAVD 88, Ft.)	(NAVD 88, Ft.)	(Ft.)	(NAVD 88, Ft.)	(NAVD 88, Ft.)		
318	5/22/2014	1:15 PM	1.41		4.38	5.97		0.31	NA	1.10	
Calculated Differences (Leveling) =				1.59			5.66				
Tape Measurements =				1.59			5.64				
Differences =				0.00			0.02				

Rod Sets (E01) & Marsh Wells (W01)							
CRMS Station	Date	Elevation at Top of ROD SET	Top of Rod Set to Top of Collar	Elevation of Rod Set Collar at Point #1	Elevation at Top of Marsh Well Post	Top of Post to Nail	Marsh Well Elevation at TBM Nail
		(NAVD 88, Ft.)	(Ft.)	(NAVD 88, Ft.)	(NAVD 88, Ft.)	(Ft.)	(NAVD 88, Ft.)
318	5/22/2014	1.86		1.26	NA	NA	NA
Calculated Differences (Leveling) =			0.60				
Tape Measurements =			0.60				
Differences =			0.00				

Figure D-1. Example spreadsheet that shall be completed to verify that the Continuous Recorder Gauge (H0#), Staff Gauge (H0#), and RSET (E0#) elevations are measured accurately (LRO does not have Marsh Wells for this survey).

Marsh Elevation Survey Data:					
CRMS-Wetlands					
Personnel:				Organization:	
Site / Station:		Ancillary Data		Survey Report Data: Elevations (NAVD88, FT)	
Date and Time:		Rod to Collar (mm):		RSET:	
Staff Gauge Reading:		Boardwalk Elev 1 (S/C)	/	Top of Cont. Rec. Post:	
Marsh Flooded:		Boardwalk Elev 2 (S/C)	/	Top of Staff Gauge Post:	
Point Number	CRMS Plot / Location	Easting (UTM_NAD83_METERS)	Northing (UTM_NAD83_METERS)	Raw Data (Feet)	Notes (Surface / Crown)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
AVERAGE CROWN ELEVATION					
AVERAGE SURFACE ELEVATION					
AVERAGE ELEVATION					

Figure D-2. Marsh elevation data collection deliverable format.



VICINITY MAP: Scale: 1"=2000'

2013 NAIP imagery provided by USDA Farm Service Agency

Station Name: "CRMSTE-SM-07"

Monument Location: From Bayou Black Marina in Gibson, Louisiana, proceed southerly in an unnamed canal approximately 0.2 miles to Shell Canal, then proceed westerly in Shell Canal approximately 1.4 miles, then proceed southerly in Shell Canal approximately 1.5 miles to the Intracoastal Waterway, then proceed southwesterly in the Intracoastal Waterway approximately 3.0 miles to Copasaw Canal, then proceed southerly in Copasaw Canal approximately 2.2 miles to Bayou Copasaw, then proceed in Bayou Copasaw approximately 1.4 miles southerly to Huth Canal, then proceed southerly in Huth Canal approximately 5.2 miles to a trenasse located on the southeast bank of a pipeline canal and on the east bank of Huth Canal, leading into a pipeline canal, then proceed down the trenasse into the pipeline canal, then proceed easterly in the pipeline canal approximately 2.8 miles to the monument located on the south bank of the pipeline canal

Monument Description: NGS Style floating sleeve monument; 9/16" stainless steel rods driven 100 feet to refusal, set in a sand filled 6" PVC pipe with access cover.

Stamping: CRMSTE-SM-07

Installation Date: 09/26/07 **Date of Survey:** May 2014

Monument Established By: Morris P. Hebert, Inc.
For: Louisiana Department of Natural Resources, CRD

Adjusted NAD 83 Geodetic Position

Lat. 29° 27' 33.3003" N

Long. 90° 53' 03.1969" W

Adjusted NAD 83 Datum LSZ (1702) Ft

N= 349,127.76

E= 3,423,761.95

Adjusted UTM, NAD 83 Datum (Zone 15) Meters

N= 3,260,732.043

E= 705,183.434

Adjusted NAVD88 (2011) Height

Elevation Geoid12A = 2.75 feet (0.839 mtrs)

Elevation Geoid99 = 3.50 feet (1.068 mtrs)

Geoid12A Height = -24.903 mtrs.

Ellipsoid Height = -24.064 mtrs.

Geoid99 Height = -25.132 mtrs.

Ellipsoid Height = -24.064 mtrs.



Adjusted position determined by T. Baker Smith, LLC for Coastal Protection and Restoration Authority

Figure D-3. GPS Monument example data sheet. Photo shall be updated with current photograph of the monument.



VICINITY MAP: Scale: 1"=2000'

2013 NAIP imagery provided by USDA Farm Service Agency

Station Name: CRMS0190-CR-H01

Location: This Station is located in Bayou de la Gauche in Lafourche Parish and is approximately 4.4 miles easterly from the LA Highway 308 in Cut Off, Louisiana.

Gauge Description: The gauge is a continuous recorder type gauge attached to a 4" x 4" treated wood post with data collector box and a Reference Nail driven horizontally.

Date of Survey: June 2014

Continuous Recorder Gauge

NAD83 Geodetic Position:

Lat. 29° 32' 23.505"N
Long. 90° 15' 53.064"W

UTM, NAD 83 Meters (Zone 15) Coordinates

N= 3,270,921.14
E= 765,070.13

NAD83 Datum LSZ (1702) Ft:

N= 379,746.6
E= 3,620,632.7

Top of 4x4 Post Elevation – NAVD 88 (2011)

4.42 feet Geoid12A
5.09 feet Geoid99

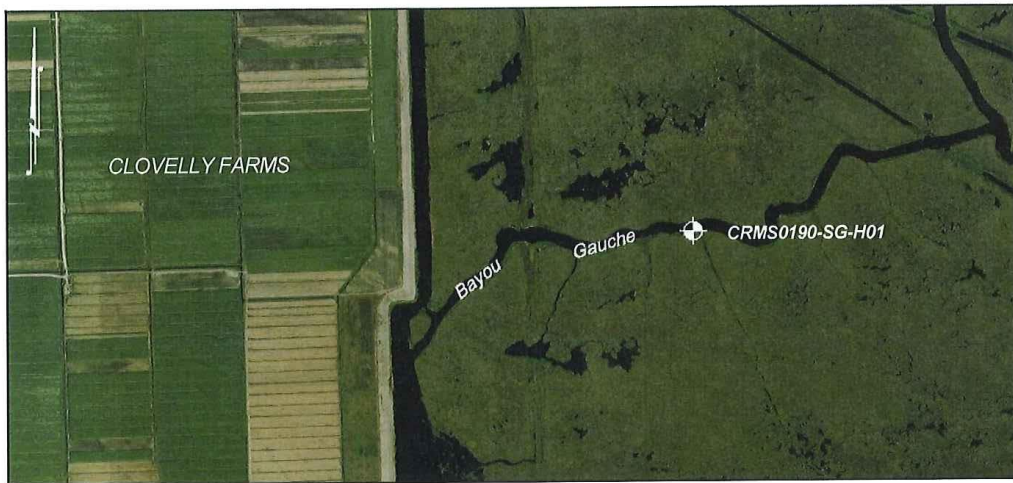
Top of Nail Shank Elevation – NAVD88 (2011)

2.53 feet Geoid12A
3.20 feet Geoid99



*Position Determined by using Real-Time Kinematic (RTK) survey from Secondary GPS Monument "BA02-SM-01"
Adjusted Position Established by T. Baker Smith, LLC for the Coastal Protection and Restoration Authority*

Figure D-4. Continuous Recorder example data sheet. Photo shall be updated with current photograph of the station.



VICINITY MAP: Scale: 1"=2000'

2013 NAIP Imagery provided by USDA Farm Service Agency

Station Name: CRMS0190-SG-H01

Location: This Station is located in Bayou de la Gauche in Lafourche Parish and is approximately 4.4 miles easterly from the LA Highway 308 in Cut Off, Louisiana.

Gauge Description: The gauge is a ceramic coated tide gauge attached to a 4" x 4" Treated Post.

Date of Survey: June 2014

Staff Gauge

NAD83 Geodetic Position:

Lat. 29° 32' 23.518" N
Long. 90° 15' 53.023" W

UTM, NAD 83 Meters (Zone 15) Coordinates

N= 3,270,921.55
E= 765,071.22

NAD83 Datum LSZ (1702) Ft:

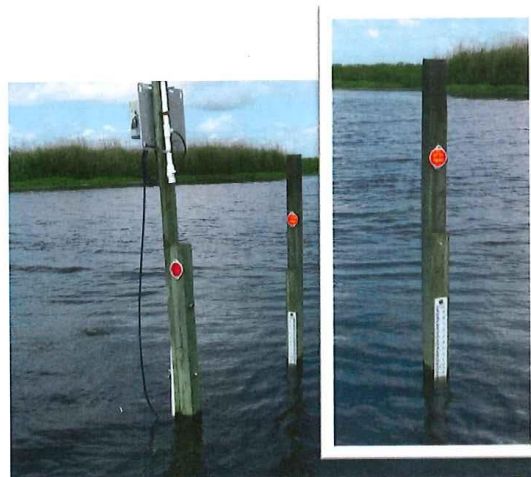
N= 379,747.9
E= 3,620,636.3

Top of 4x4 Post Elevation – NAVD 88 (2011)

6.04 feet Geoid12A
6.71 feet Geoid99

Top of Nail Shank Elevation – NAVD88 (2011)

2.95 feet Geoid12A
3.62 feet Geoid99



Position Determined by using Real-Time Kinematic (RTK) survey from Secondary GPS Monument "BA02-SM-01"
Adjusted Position Established by T. Baker Smith, LLC for the Coastal Protection and Restoration Authority

Figure D-5. Staff Gauge example data sheet. Photo shall be updated with current photograph of the station.



VICINITY MAP: Scale: 1" = 2000'

2013 NAIP IMAGERY PROVIDED BY USDA FARM SERVICE AGENCY

Station Name: CRMS0292-E01

Location: Near the west bank of Bayou Lafourche, approximately 2 miles north of Port Fourchon, in Lafourche Parish, LA.

Monument Description: 9/16" stainless steel rod driven to refusal in a 6" PVC sleeve. Number of rods used: 20 Total Rod
Length: 79.38 feet. Top of collar to top of rod distance: 0.63 feet.

Date Of Survey: June 2014

Monument Established By: T. Baker Smith, LLC

Deep Rod RSET

NAD 83 Geodetic Position:

Lat. 29° 08' 28.4267" N
Long. 90° 13' 41.0109" W

UTM, NAD 83, Meters (Zone 15) Coordinates

N= 3,226,811.041
E= 769,674.792

NAD 83 Datum LSZ (1702) Feet

N= 234,901.18
E= 3,633,694.82

Top of Rod Elevation – NAVD 88 (2011)

2.60 feet Geoid12A
3.36 feet Geoid99

Top of RSET Collar Elevation – NAVD 88 (2011)

1.96 feet Geoid12A
2.72 feet Geoid99



*Position Determined by using Real-Time Kinematic (RTK) survey from Secondary GPS Monument "TE23-SM-01"
Position established by T. Baker Smith, LLC for the Coastal Protection And Restoration Authority.*

Figure D-6. RSET example data sheet. Photo shall be updated with current photograph of the station.

Water Bottom and Marsh Edge Survey Report Format				
Observation number	Latitude	Longitude	Elevation	Survey Note
CRMS0000-H01	29.001	-90.001	-4.1	water bottom
CRMS0000-H01	29.002	-90.002	0.5	edge
CRMS0000-H01	29.003	-90.003	1.2	within vegetation

Figure D-7. Deliverable format for ancillary water bottom and marsh elevation surveys.

APPENDIX E – USGS Real-Time Station Details

USGS Real-Time Stations

CRMS0061



Figure F-1. Photo of CRMS0061-H02 which is mounted on a post next to the old USGS real-time four post platform. Survey the CR and SG as with any other site and ignore the old USGS four post platform.



Figure F-2. Photo of CRMS0282-H02 which is mounted onto the USGS four post platform. Survey the CR and the SG and be sure to indicate the station is –H02 which differentiates the site from the old USGS real-time station that was on the same platform. Note: No new staff gauge was added when the new station was added to the platform.

CRMS0411



Figure F-3. Photo of CRMS0411-H02 which is mounted onto the USGS four post platform. Survey the CR and SG and be sure to indicate the station is –H02 which differentiates the site from the old USGS real-time station that was on the same platform. Note: No new staff gauge was added when the new station was added to the platform.

CRMS0568



Figure F-4. Photo of CRMS0568-H02 which is mounted onto the USGS four post platform. Survey the CR and SG and be sure to indicate the station is –H02 which differentiates the site from the old USGS real-time station that was on the same platform. The current active station is the one with equipment attached to it in the foreground. A new staff gauge was added when the station was set-up. Only survey the new staff gauge.

CRMS0609



Figure F-5. Photo of CRMS0609-H02 which is mounted onto a post adjacent to the USGS four post platform. Survey the CR and SG of the active station and be sure to indicate the station is – H02 which differentiates the site from the old USGS real-time station that was on the same platform. A new staff gauge was added when the station was set-up. Only survey the new staff gauge.

CRMS0615



Figure F-6. Photo of CRMS0615-H02 which is mounted onto the USGS four post platform. Survey the CR and SG and be sure to indicate the station is –H02 which differentiates the site from the old USGS real-time station that was on the same platform. A new staff gauge was added when the station was set-up. Only survey the new staff gauge.

CRMS0651



Figure F-6. Photo of CRMS0651-H02 which is mounted onto the USGS four post platform. Survey the CR and SG and be sure to indicate the station is –H02 which differentiates the site from the old USGS real-time station that was on the same platform. A new staff gauge was added when the station was set-up. Only survey the new staff gauge.

CRMS2418



Figure F-4. Photo of CRMS2418-H02 which is mounted onto the USGS four post platform. Survey the CR and SG and be sure to indicate the station is –H02 which differentiates the site from the old USGS real-time station that was on the same platform. A new staff gauge was added when the station was set-up. Only survey the new staff gauge.

CRMS2166

CRMS2166 has both a USGS four post platform and a typical CRMS hydrology station on a single pole (not pictured). For this survey effort, the station on the USGS platform does not need to be surveyed. The active station is a typical setup on a single 4x4 post.

APPENDIX F – Water Bottom Elevations

Locations where water bottom elevations are needed. To be collected opportunistically while surveying CRMS sites.

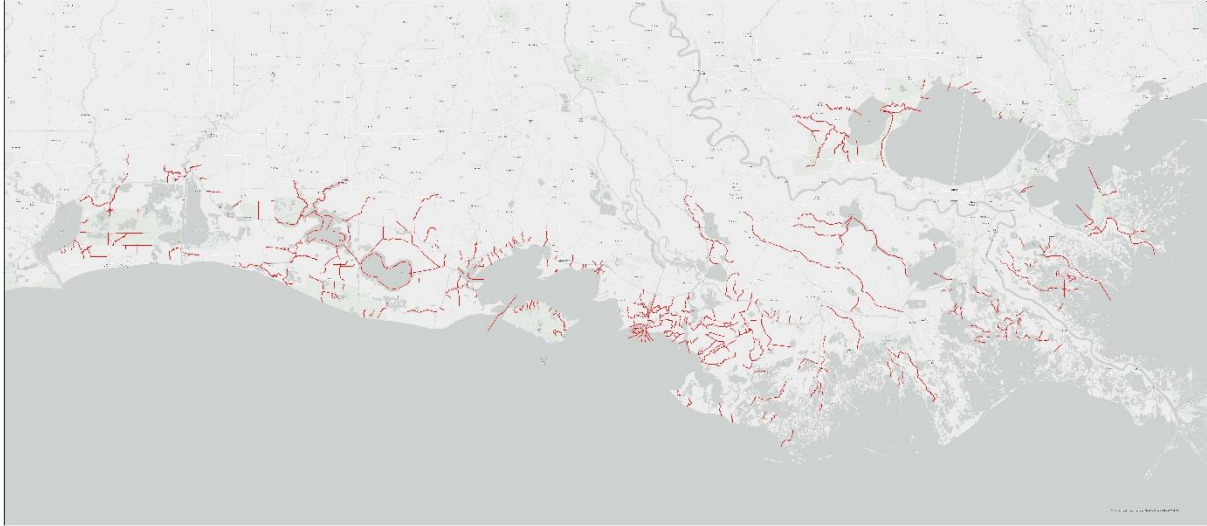


Figure E-1. Areas where additional information about water bottom elevation has been requested. Data available in attached shapefile “MP29_ICM_Hydro_Links_to_survey_20260707.shp”