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FOURTH ANNUAL POST-CONSTRUCTION MONITORING REPORT

POST-CONSTRUCTION BATHYMETRY, SHORELINE, AND STRUCTURAL MONITORING
MON LOUIS ISLAND RESTORATION PROJECT
USACE FINAL PERMIT# SAM-2014-01046-LET

FOWL RIVER, MOBILE COUNTY, ALABAMA

April 27, 2022

Prepared for:

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INTRODUCTION

The Mon Louis Island Restoration Project was implemented by the Mobile Bay National Estuary Program (MBNEP) with funding from the National Fish and Wildlife Foundation Gulf Environmental Benefit Fund (NFWF-GEBF). The restoration project included construction of an approximate 1,540-ft. continuous rock (rip-rap) dike breakwater (also referred to as the *rubble mound breakwater*), and 4 acres of tidal marsh along the bay side of the northern tip of Mon Louis Island (MLI) at the mouth of east Fowl River in Mobile County, Alabama. The project also included maintenance dredging of the Fowl River navigation channel with funding from the State of Alabama through the Deepwater Horizon Incident (DWHI) grant application program. The constructed breakwater/marsh system provides protection for approximately 8 acres of pre-existing tidal marsh restored during a previous project in 2005.

Project activities requiring approval from the U.S. Army Corps of Engineers (USACE) were authorized in Permit Number SAM-2014-01046-LET dated March 9, 2016. Among other conditions, the permit specifies the permittee perform various pre- and post-construction monitoring activities in accordance with the "*Proposed Bathymetry, Shoreline, and Structural Monitoring Plan, Mon Louis Island Marsh Restoration, Mobile Bay National Estuary Program," (*version *DRAFT, 9-11-2015)* which was submitted to the USACE by Thompson Engineering on 9-11-2015. This report provides an update on post-construction monitoring activities required in the permit, as described in the *2015 Monitoring Plan*.

CONSTRUCTION OVERVIEW

Project construction began in July 2016, with the construction of the temporary access channel and rubble mound breakwater. Following completion of the rubble mound breakwater in September 2016, dredging was conducted at a nearby off-shore disposal area to provide fill-material for marsh creation on the site. The Fowl River Navigation Channel dredging was completed in October 2016.

Following completion of the marsh fill, the project was left to settle for several months, during which time routine settlement monitoring was conducted. An additional topographic survey was performed on the marsh fill surface in late December 2016, when monitoring indicated the majority of the marsh settlement had occurred. The December 2016 topographic survey was then utilized to develop the final marsh grading and planting plan in January 2017. The final grading

plan included excavation (in the fill area) to create a tidal creek, and the construction of a minimal earthen berm on the east and west sides of the marsh fill. The berm, which was constructed with material from the tidal creek excavation, was created to provide short-term protection of the marsh fill prior to establishment of the permanent vegetative cover. Final marsh grading was performed in March and April 2017, and planting was completed in May 2017. Supplemental planting was performed in September 2017, following observation of some plant die-off.

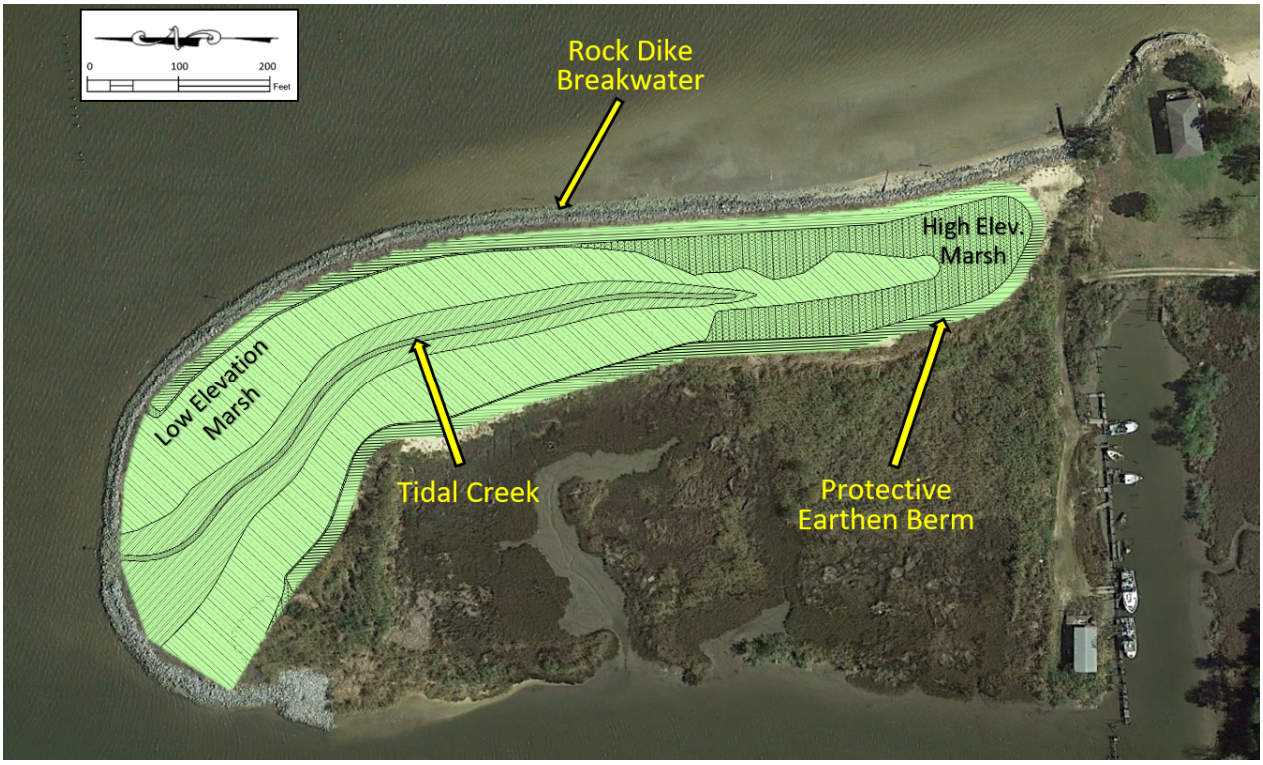


Figure 1. Constructed marsh and other site features.

SURVEY CONTROLS & DATA PROCESSING

Horizontal coordinates are referenced to Alabama State Plane Coordinate System, West zone (0102), established by Real Time Kinematic (RTK) GPS. Vertical datum is NAVD 88 established also by Real Time Kinematic GPS using 2009 geoid. Vertical control was tied to a temporary on-site benchmark previously established by Thompson Engineering.

The surveys were performed using both hydrographic (bathymetric) and topographic surveying techniques. Field survey data points were imported into AutoDesk Civil 3D, which was utilized to create a three-dimensional digital terrain model, allowing for data presentation as profile plots

for each transect. Additional specifics related to individual survey activities are found on the corresponding output figures found in Appendix A of this report.

BACKGROUND - 2018 MONITORING SITE TOPOGRAPHY/BATHYMETRY

Marsh Elevation

The Contractor provided an as-built marsh surface topographic survey, which was performed by Lawler and Co., on April 18, 2017, following completion of the final marsh grading activities. A subsequent marsh surface topographic survey was performed by Thompson Engineering in June 2018. For comparative purposes, 30 representative spot elevations were selected from the April 2017 survey and compared to the closest available spot elevation from the June 2018 survey.

Of these 30 points 18 (60%) points fell within one tenth of one foot (1.2 in.) of their closest relatable points and 25 (83%) fell within one quarter of one foot (3 in.) of their closest relatable points. The average of all 30 points from the 2018 survey was five one hundredths of a foot (0.6 in.) higher than the average of all 30 points from the 2017 survey. Potential sources of vertical error to consider include relative positioning of comparative points, GPS error, and marsh surface survey instrument impacts.

A review of the data indicated very little change in marsh surface elevations. As described in the Post-Storm Monitoring section, erosion of the protective berm along the eastern side of the marsh (adjacent to the rock breakwater) during Tropical Strom Cindy caused a lowering in elevation at the berm location and a raising of surface elevations just to the west. Generally, the survey data along with field observations did not indicated any appreciable changes in marsh surface elevations.

Per the *2015 Monitoring Plan*, no future surveys are required for this task.

Rock Dike Breakwater

A post-construction survey of the breakwater was performed by Thompson Engineering in December 2016 following the initial marsh fill settlement period. The survey included transects of dike cross-sections at a spacing of 100 feet. A similar survey of the breakwater elevations was performed by Thompson Engineering again in June 2018. Visual surveys with photographic documentation (See Figures 2 and 3, dated August 9, 2018) were performed to document any mobilization or fracturing of rip-rap. A figure depicting the location of the breakwater transects,

and additional figures comparing cross-sections at each station in both years surveyed was provided in Appendix B of the 2018 monitoring report.

Figure 2. Rock dike breakwater, view south.

A review of the comparative transects indicated some of the June 2018 transects are slightly lower than some of the December 2016 transects. This may indicate some slight settlement at these areas. Potential sources of vertical error to consider include, relative positioning of comparative cross-section survey lines, GPS error, and the large rock size. Because some of the rip-rap pieces are three to four feet in diameter, the specific location a cross-section elevation shot is taken may result in different transect line shapes. Field observations did not indicate any displacement or fracturing of rip-rap, nor did they indicate any changes on overall cross-section.

Per the *2015 Monitoring Plan*, no future surveys are required for this task.

Figure 3. Rock dike breakwater, view north.

Near-Shore Bathymetry Immediately Adjacent to Breakwater

As depicted in Appendix C of the 2018 monitoring report, a bathymetric survey of nearshore water bottoms (within 200 feet of the rock dike breakwater alignment) was performed in July 2016, prior to construction. A post-construction survey of this same area was performed in June 2018. These surveys were conducted from a boat using echo sounding equipment to find the water bottom relative to the water surface. Areas too shallow to access by boat were surveyed on foot with a pole mounted survey GPS unit, whereby the pole was placed on the mudline to find the water bottom. Potential sources of vertical error to consider for those portion of the survey accessed on foot include GPS error, and mudline surface survey instrument impacts. Potential sources of vertical error to consider for those portions of the survey accessed by boat include echo sounding error, wave effects, and water level variations during the survey.

A review of the survey data indicated some near shore accretion may have occurred, in areas adjacent to the southern end of the rock dike breakwater. Survey data indicated possible accretion of 0.5 ft. to 1.0 ft. at varying locations south of approximate Station 8+00 and between 0.0 ft. to

0.5 ft. up-station from approximate Station 8+00. This accretion was potentially the result of sedimentation occurring during and shortly after placement of fill material, which was used to create the marsh. As coverage of marsh vegetation continues to stabilize those soils, the apparent accretion may decrease in the nearshore areas along the breakwater. No appreciable change in elevation was noted for portions of the transects lying further offshore. As expected, deeper 2018 elevations were observed at Stations 14+00 and 15+00, and are considered to be the direct result of dredging the Fowl River Navigation Channel.

Per the *2015 Monitoring Plan*, no future surveys are required for this task.

Bathymetric Monitoring of Shoreline Change Transects

A series of bathymetric monitoring transects, extending 1,800-ft. offshore, were established to aid in the identification of potential changes to shorelines adjacent to, and south of the restoration project. The beginning of each transect located south of the proposed breakwater were fixed at the mean high water (MHW) line at the time of the pre-construction survey. Transects adjacent to the breakwater began at the point where the mean high water (MHW) line would be intersecting the proposed rubble mound breakwater.

A pre-construction bathymetric survey along the 1,800-ft. long transects, was performed in June 2016. The first post-construction survey along the transects was performed in June 2018, following final construction. Survey methods and potential sources of error for this task were as described in the previous section, *Near-Shore Bathymetry Immediately Adjacent to Breakwater*.

In Appendix D of the 2018 monitoring report, a figure depicts the location of the 1,800-ft. long transects for profile comparison. Also provided were additional figures comparing profile views at each station in both years surveyed.

A review of the transects {June 2016, June 2018, October 2019, October 2020 (post Hurricane Sally), November 2020 (post Hurricane Zeta), and February 2022} adjacent to and south of the marsh restoration construction indicated no discernable bottom changes (Appendix A).

Post-Storm Monitoring

In late June 2017, Tropical Storm Cindy traversed the northern Gulf of Mexico and created high water in Mobile Bay, sufficient to inundate the entire project site. East-northeast to southeasterly winds created significant waves at the project site. Peak sustained winds were in the range of 18

knots between 6-21-17 00:00 GMT and 6-22-17 00:00 GMT as indicated at NOAA/NOS/CO-OPS: Coast Guard Sector Mobile, AL. A peak water level of +3.6 feet-NAVD88 was observed on 6-21-17 17:12 GMT and a peak water level of 3.8 feet-NAVD88 was observed on 6-22-17 14:00 GMT as indicated at NOAA/NOS/CO-OPS: East Fowl River Bridge, AL. A post-storm inspection revealed erosion of most of the bayside berm and some of the landside berm. Earthen material from the bayside berm was shifted and spread out just to the west of its original location. Where erosion was observed on the interior berm, earthen material primarily flattened out and spread in-place. The marsh plantings were observed to be in relatively good condition with little to no damage following this event. No damage to the rubble mound breakwater was observed following this event.

In early October 2017, Hurricane Nate traversed the northern Gulf of Mexico, and created high water in Mobile Bay sufficient to inundate the entire project site. East-southeast to southerly winds created significant waves at the project site. Peak sustained winds were in the range of 25 knots at approximately 10-8-17 07:00 GMT as indicated at NOAA/NOS/CO-OPS, Coast Guard Sector Mobile, AL. A peak water level of +4.7 feet-NAVD88 was observed on 10-8-17 6:24 GMT as indicated at NOAA/NOS/CO-OPS: East Fowl River Bridge, AL. A post-storm inspection revealed minor erosion along an approximate 10-ft. wide strip on the eastern side of the newly constructed marsh, adjacent to the rubble mound breakwater. Minimal plant damage was observed in this area following this event. No damage to the rubble mound breakwater was observed following this event.

Hurricane Sally made landfall September 16, 2020 around 09:45 GMT near Gulf Shores, Alabama. On its approach, the storm surge that entered Mobile Bay created high water conditions sufficient to inundate the project site. South-southwest to south-southeast winds created significant waves at the project site. Peak sustained winds were in the range of 37 knots at approximately 09-16-2020 12:00 GMT as indicated at NOAA/NOS/CO-OPS: Coast Guard Sector Mobile, AL. A peak water level of +3.45 feet-NAVD88 was observed on 09-15-2020 18:24 GMT as indicated at NOAA/NOS/CO-OPS: East Fowl River Bridge, AL. No significant erosion was observed as a result of this event. No damage to the rubble mound breakwater was observed and only minimal plant damage occurred. Bathymetry data was collected post storm. However, due to timing issues, a survey of the rock dike breakwater could not be completed prior to the next storm. The bathymetry data is represented by “October 2020” data line depicted in the cross section figures in Appendix A. No significant changes were observed within the data set.

Hurricane Zeta made landfall in Cocodrie, Louisiana on October 27, 2020 at 21:00 GMT. As it moved west, northwest the storm brought surge that resulted in a peak water level of +4.51 feet-NAVD88 as observed on 10-29-2020 05:30 GMT as indicated at NOAA/NOS/CO-OPS, East Fowl River Bridge, AL. North-northwest to north-northeast winds created significant waves at the project site. Peak sustained winds were in the range of 25 knots at approximately 10-29-2020 01:00 GMT as indicated at NOAA/NOS/CO-OPS: Coast Guard Sector Mobile, AL. No significant erosion was observed as a result of this event. No damage to the rubble mound breakwater was observed and only minimal plant damage occurred. Survey data was collected and is presented as the "November 2020" cross section figures in Appendix A. No significant changes were observed within the data set.

There were no storm events classified as significant to impact the project site in 2021.

Open Water Dredge Material Placement Site / Borrow Area

Monitoring of the open water dredge material placement site / borrow area was conducted and included a pre-construction/pre-borrow hydrographic survey and a survey conducted after re-filling of the borrow area. Results and data associated with this task were previously submitted to the USACE following completion of each item.

Per the *2015 Monitoring Plan*, no future surveys are required for this task.

Fowl River Navigation Channel

Monitoring of the Fowl River Navigation Channel was conducted and included one comprehensive pre-construction survey followed by post-dredge survey of acceptance sections outlined in the final dredging specifications. Results and data associated with this task were submitted to the USACE in the past.

Per the *2015 Monitoring Plan*, no future surveys are required for this task.

Multi-Year Aerial Photo Analysis of Shoreline

Potential changes to shorelines north of the Fowl River navigation channel and shoreline areas adjacent to and south of the rock dike breakwater were evaluated utilizing existing or acquired aerial imagery to assess shoreline loss or accretion during the post-construction monitoring period. Shoreline change was evaluated by comparing available (and suitably geo-referenced) pre-project baseline aerial imagery to imagery available post-project. Shoreline change data was compiled and presented in the January 24, 2020 Shoreline Monitoring Report.

Drone imagery was collected in January 2021 and was depicted in Appendix B, Figure 2: Ortho Imagery of the 2020 Monitoring Report.

Per the *2015 Monitoring Plan*, no future surveys are required for this task.

Marsh Restoration Success Monitoring

The USACE permit specifies the permittee will implement the *Proposed Tidal Marsh Restoration Success Monitoring* (prepared by Barry A. Vittor & Associates, Inc., Version rev. 10-12-2015). The 2018, 2019, 2020, and 2021 post-construction annual inspection have been performed (reports dated December 2018, August 2019, July 2020, and September 2021).

Figure 4. Marsh, view north.

Marsh success criteria for faunal communities were exceeded during the 2020 monitoring period (Vittor and Associates, July 2020). Upon reviewing this information, the USACE provided correspondence dated December 8, 2020 stating that "faunal community monitoring will no longer be required for (*the*) project." In this same correspondence, the USACE made the following request: "Please provide a comparison of the vegetative cover of the restoration site to

the reference marsh site." A revised Tidal Marsh Restoration Success monitoring plan reducing the vegetative cover success criterion from 90 percent cover to 70 percent cover was provided to USACE on September 24, 2021, and the Mon Louis Island Marsh Monitoring report for 2021 was provided on October 8, 2021. In a letter dated January 19, 2022; the USACE approved the request to change the vegetative cover success criterion to 70 percent and that the average native vegetative cover of 85.9 percent allowed for the determination "that annual monitoring is no longer required."

Per January 19, 2022 correspondence with USACE, no additional monitoring is required for this project.

CURRENT MONITORING ACTIVITIES

Per January 19, 2022 correspondence with USACE, no additional monitoring is required for this project.

FUTURE MONITORING ACTIVITIES

Per January 19, 2022 correspondence with USACE, no additional monitoring is required for this project.

REFERENCES CITED

Barry A. Vittor & Associates, Inc., 10-12-2015. Proposed *Tidal Marsh Restoration Success Monitoring*. (Draft Marsh Success Monitoring Plan incorporated into U.S. Army Corps of Engineers (USACE) Permit Number SAM-2014-01046-LET dated March 9, 2016.)

Barry A. Vittor & Associates, Inc., December, 2018. Mon Louis Island Restoration, 2018 Marsh Monitoring.

Barry A. Vittor & Associates, Inc., August, 2019. Mon Louis Island Restoration, 2019 Marsh Monitoring.

Barry A. Vittor & Associates, Inc., July 2020. Mon Louis Island Restoration, 2020 Marsh Monitoring.

Barry A. Vittor & Associates, Inc., September 2021. Mon Louis Island Restoration, 2021 Marsh Monitoring.

Thompson Engineering, Inc., 9-11-2015. *Proposed Bathymetry, Shoreline, and Structural Monitoring*. (Draft Monitoring Plan incorporated into U.S. Army Corps of Engineers (USACE) Permit Number SAM-2014-01046-LET dated March 9, 2016.)

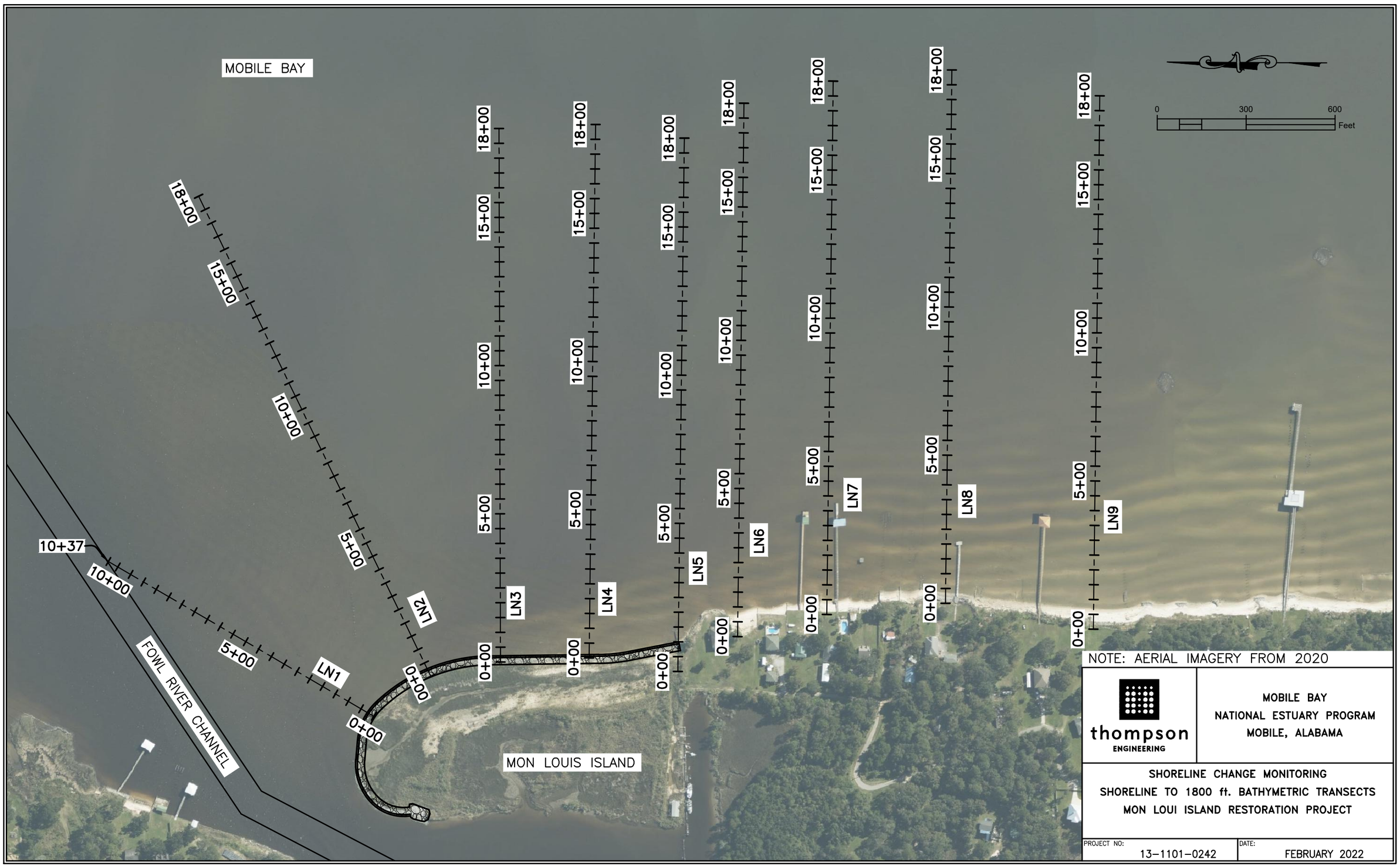
Thompson Engineering, Inc., 8-24-2018. 1st Annual Post-construction Monitoring Report. Post-construction Bathymetry, Shoreline, and Structural Monitoring, Mon Louis Island Restoration Project.

Thompson Engineering, Inc., October 2019. 2nd Annual Post-construction Monitoring Report. Post-construction Bathymetry, Shoreline, and Structural Monitoring, Mon Louis Island Restoration Project.

Thompson Engineering, Inc., February 2020. 3rd Annual Post-construction Monitoring Report. Post-construction Bathymetry, Shoreline, and Structural Monitoring, Mon Louis Island Restoration Project.

APPENDIX A

Shoreline Change Monitoring Figures



NOTE: AERIAL IMAGERY FROM 2020

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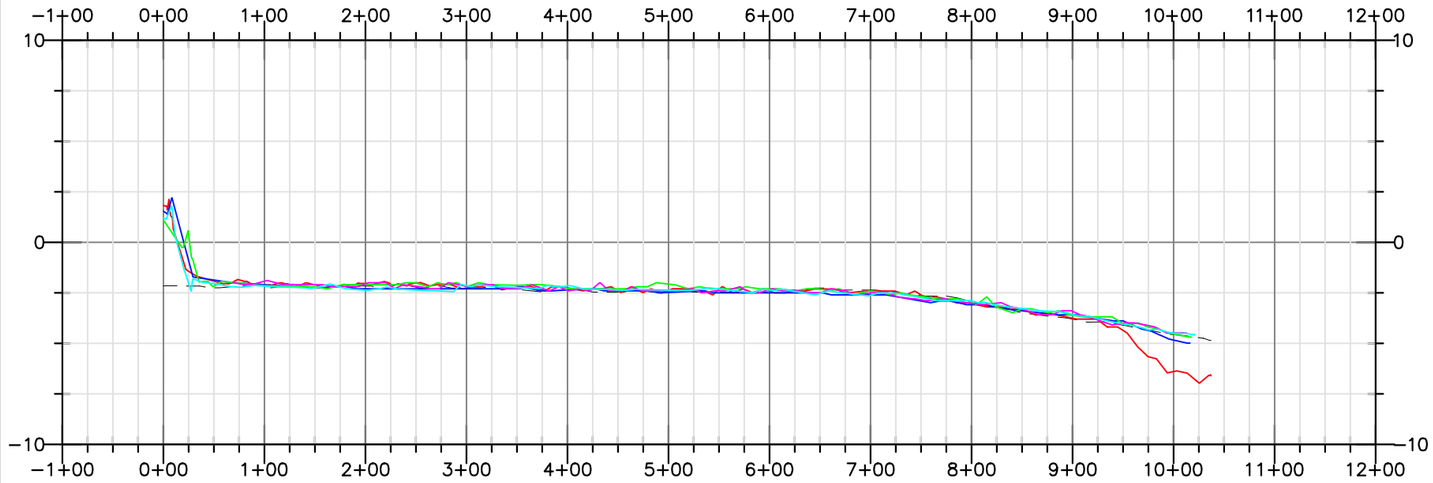

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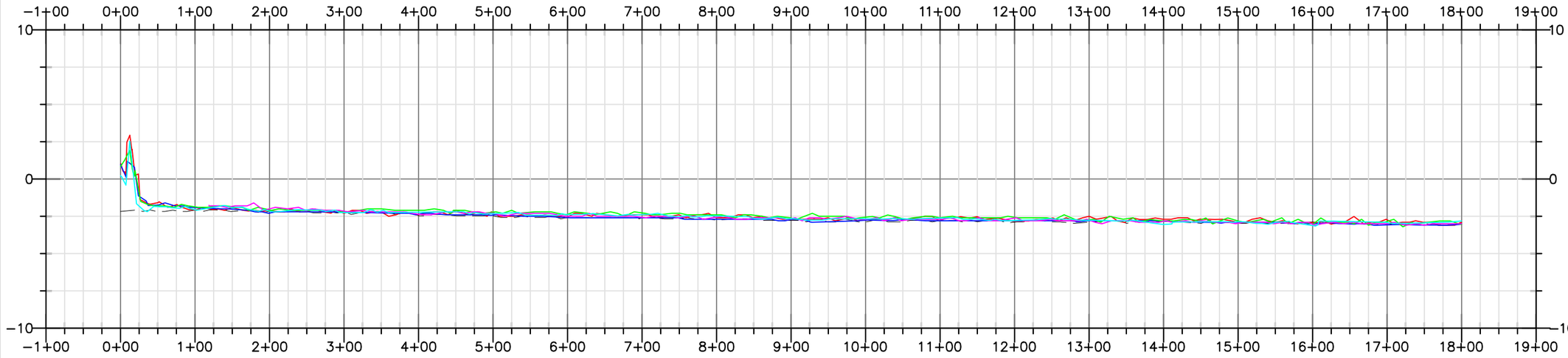

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LEGEND

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- JUNE 2018
- OCTOBER 2019
- OCTOBER 2020
- NOVEMBER 2020
- FEBRUARY 2022

HORIZONTAL DATUM IS STATE PLANE ALABAMA WEST ZONE U.S. SURVEY FOOT NAD83. VERTICAL DATUM IS NAVD88.

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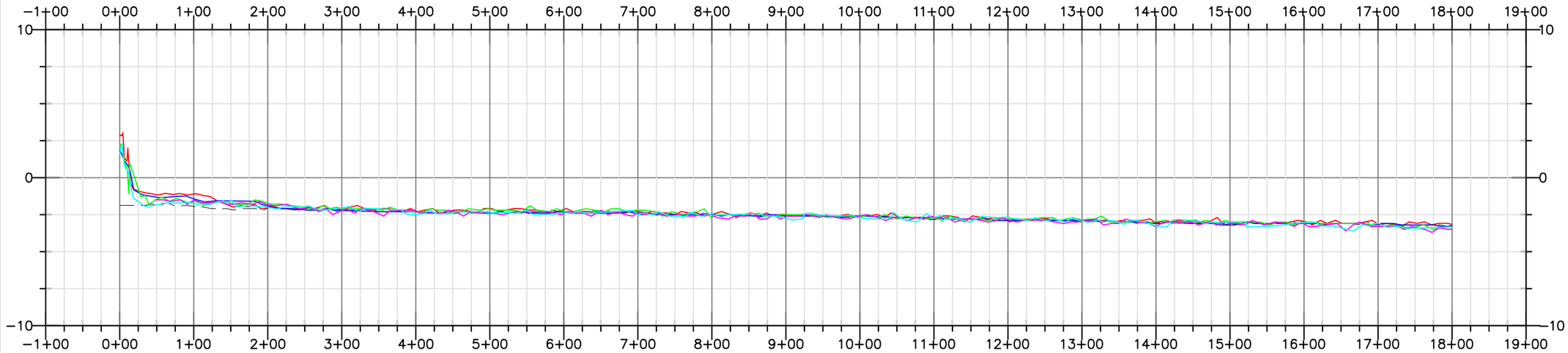

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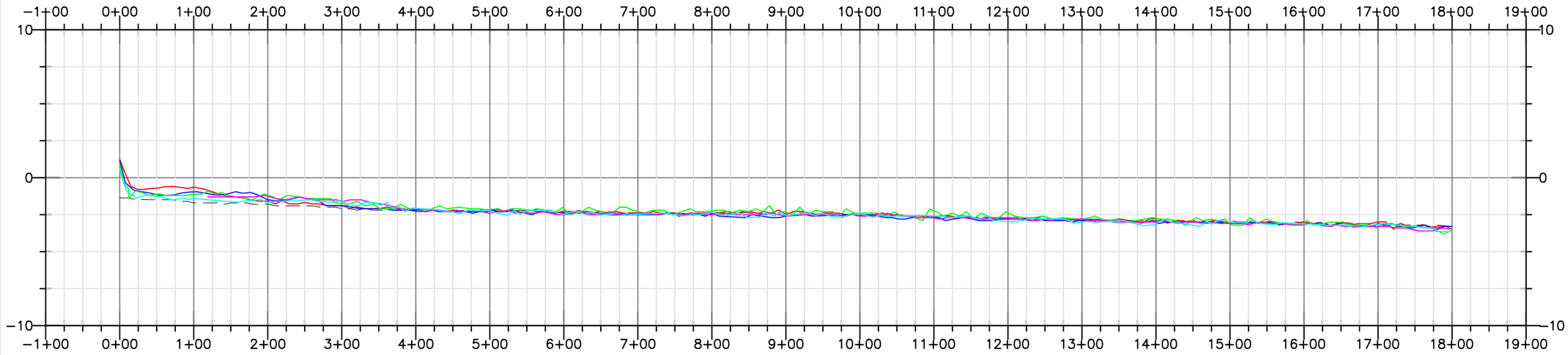

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- NOVEMBER 2020
- FEBRUARY 2022

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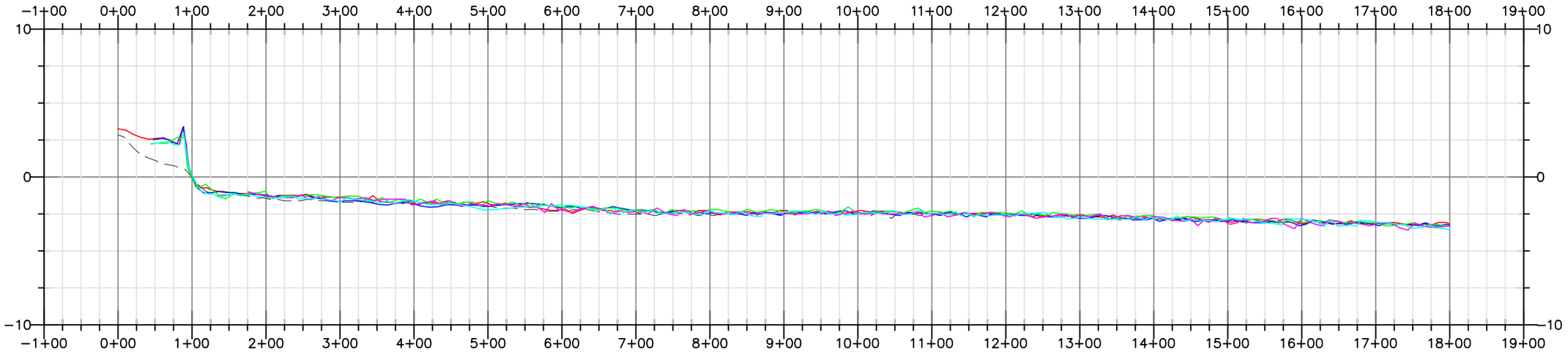

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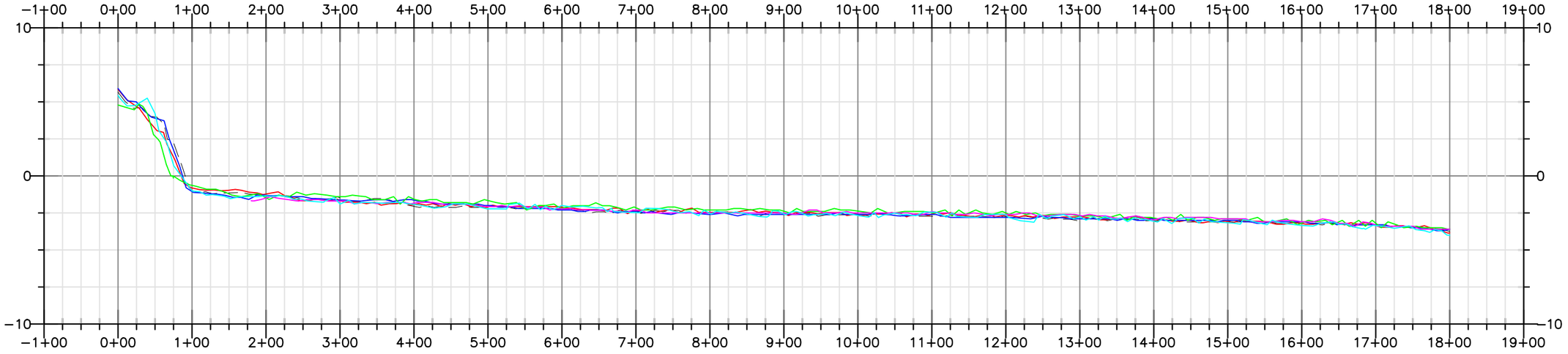

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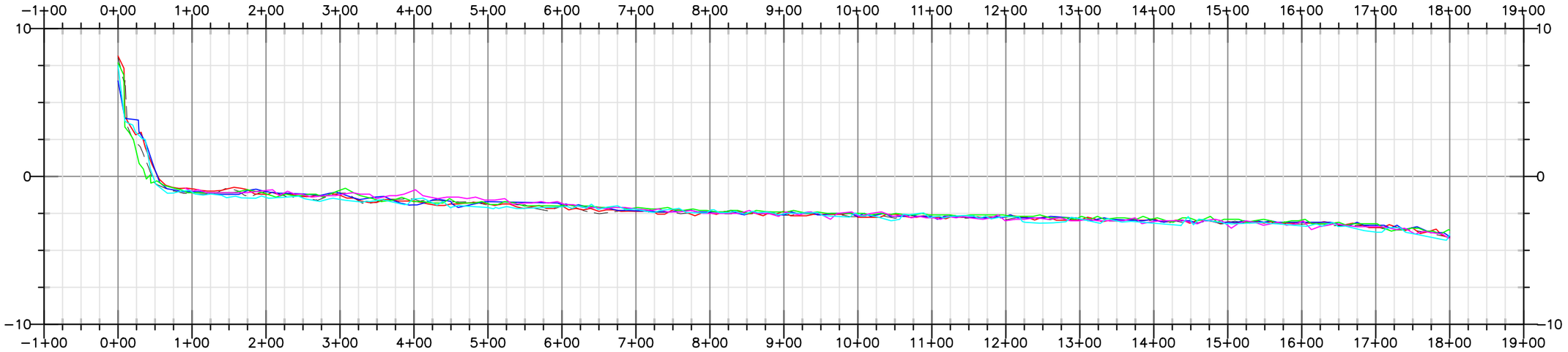

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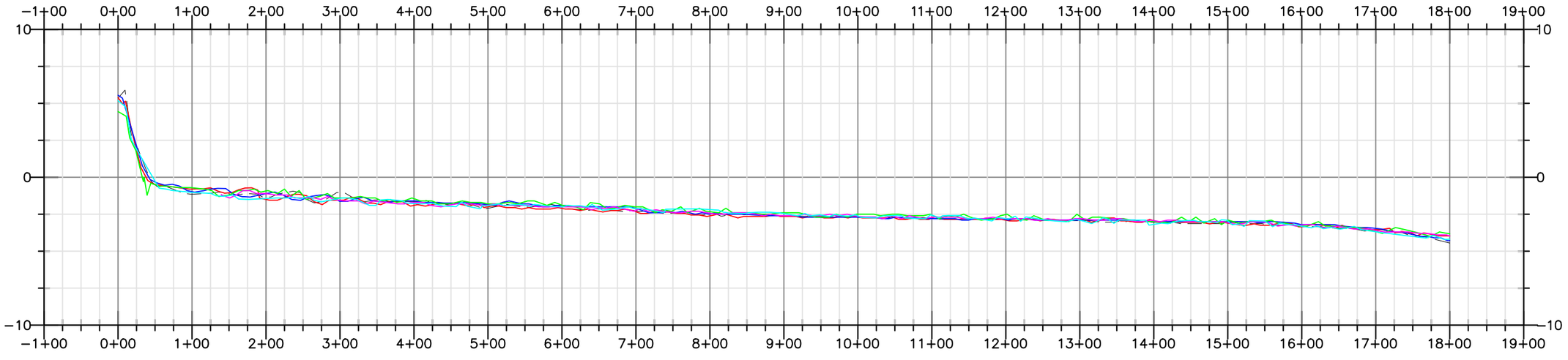

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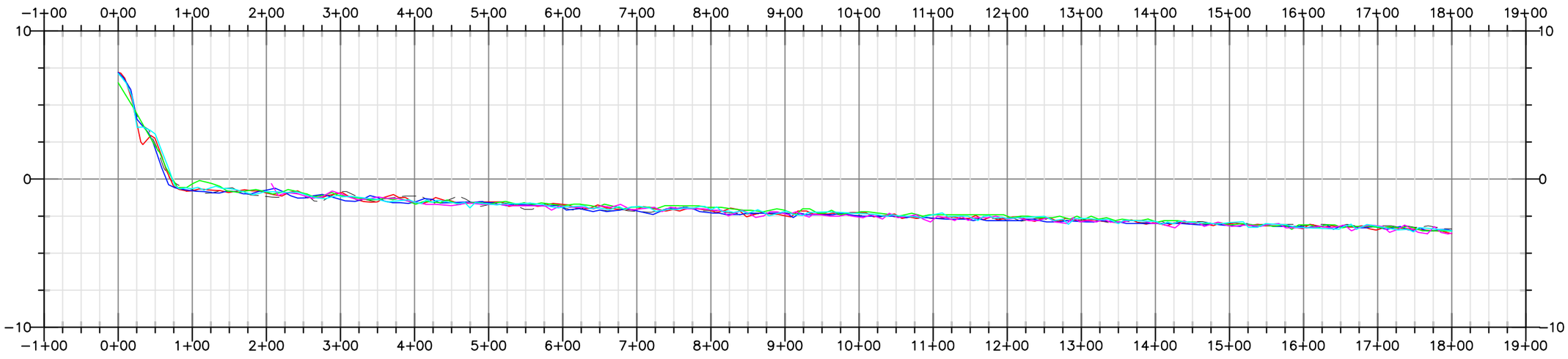

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