



Monitoring Coastal Topography at Gulf Coast Network Parks

Data Quality Standards

Natural Resource Report NPS/GULN/NRR—2017/1502





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Photograph of topography surveyor at Padre Island National Seashore

ON THE COVER

Photograph of visitor use area at Padre Island National Seashore.
Photograph courtesy of Joe Meiman, National Park Service.

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Abstract

The purpose of this report is to document the standards used by the Gulf Coast Network for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in the *Monitoring Coastal Topography at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017). The policies and procedures documented in this quality-assurance plan for activities complement the quality-assurance plans for other monitoring activities conducted by the Gulf Coast Network and supplement the National Inventory & Monitoring Division Quality Management Plan (In preparation). The plan also serves as a guide for all GULN personnel who are involved in protocol/program activities and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Protocol Overview

Coastal geomorphology was ranked as one of the top vital signs for monitoring following the Vital Sign prioritization process, which is documented in the *Gulf Coast Network Vital Signs Monitoring Plan* (Segura et al. 2007). The background and justifications for the Gulf Coast Network (GULN) to monitor coastal geomorphology align with those documented in Part 2, Coastal Topography, of the Northeast Coastal and Barrier Network's (NCBN) Coastal Geomorphology protocol, that states:

Changes in coastal topography, whether caused by erosion or accretion, vary both spatially and temporally. Understanding these variations is key to early recognition of potential problems affecting natural resources and cultural resources in coastal parks. For managers, an understanding of the spatial and temporal patterns of geomorphologic change is basic to optimal management of any coastal park because the interface of marine and land systems: (1) is highly dynamic and driven by multiple forcing mechanisms; (2) results in alterations to resource patterns and dynamics at habitat and ecosystem levels; and (3) can eventually result in the loss of static resources. The establishment of local, long-term monitoring programs provides metrics (SI, meters) to help understand the processes that are driving coastal change of beaches, dunes, and bluffs within the parks (Psuty et al. 2012, p. xiii).

The Gulf Coast Network will follow Northeast Coastal and Barrier Network's methods for monitoring coastal geomorphology, documented in Psuty et al. (2012), at Gulf Islands (GUIS) and Padre Island (PAIS) National Seashores. These methods will be used to create a network of permanently established reference points that will allow for the collection of highly accurate elevation data along beach/dune transects. Profiles created from these elevation data will be tracked through space and time to better understand geomorphic processes and spatial patterns as they relate to park resources.

Monitoring Objective: GULN's monitoring objective is to identify the biennial and long-term trends and variability in time and space of beach/dune/bluff morphology. This contrasts with NCBN's objective that includes seasonal variability and annual surveying (Psuty et al. 2012, p. 14). By reducing the sampling frequency, the Gulf Coast Network can maintain an achievable long-term workload while still providing meaningful information about geomorphological change on its seashore parks.

Protocol Activities and Modules

Data are collected or derived as a part of the *Monitoring Coastal Topography at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017) in 14 different activities or modules (Table 1).

Table 1. Protocol activity matrix for *Monitoring Coastal Topography at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017).

Activity Category	Activity no.	Activity detail	Description
Site Recon, Establishment, and Maintenance	1	Site Recon	GULN has visited the topographic transects that will be monitored as part of this protocol. The sites are known to be accessible by boat or UTV.
	2	Site Establishment	A foundational network of survey benchmarks exists at both parks being monitored that will serve as a means to anchor all field measurements. The benchmark network consists of variety of permanent physical markers or structures including: deep-rod survey monuments, park infrastructure (i.e. parking areas, buildings, etc), jetties, and pier and piles or any documented xyz location that is expected to stay fixed in physical space. Periodic assessment and cross-validation of the spatial accuracy of these benchmarks will ensure the accuracies of the topographic elevations. Guidance suggested by the National Geodetic Survey's (NGS) Online Positioning User Service (OPUS) for a quality solution should be followed when establishing the survey benchmarks coordinates. Currently this guidance suggests an overall positional RMS $\leq 3\text{cm}$. In addition to survey benchmarks, one transect benchmark is established along each transect. Transect benchmarks are established with stainless steel rods driven down to a depth of at least 4' below the topographic surface to serve as semi-permanent horizontal control for the transect.
	3	Site Maintenance	The condition of all benchmarks will be assessed with each monitoring visit. If it is deemed necessary to reestablish or resurvey a benchmark, GULN will note the benchmark location and take the necessary steps to resolve its condition prior to, or on, the next sampling visit.
Field Observations	4	Field Conditions	Any interruption or anomaly in the topographic elevation that would cause confusion in the interpretation of the topographic profile will be recorded on the field data sheet by the observer and photographed. Examples of these scenarios include limited transect access due to inundation or excavation/earthwork.
	5	Photopoint data	A standard set of photos will be taken to document field conditions at the time of the survey. Additional photos will be taken of any (1) anomalies encountered during the survey that would cause confusion in analysis and (2) each base station setup.
Sensor Data	6	GPS/GNSS	RTK GPS or GNSS devices will be used to record topographic elevation along fixed cross-shore transects.
External Data	7	Weather (NOAA NWS)	Weather and Tide data will be used in planning survey events and in reports

Activity Category	Activity no.	Activity detail	Description
	8	Tide (NOAA COOPS)	Weather and Tide data will be used in planning survey events and in reports

Table 1 (continued). Protocol activity matrix for Monitoring Coastal Topography at Gulf Coast Network Parks: Protocol Implementation Plan (Bracewell 2017).

Activity Category	Activity no.	Activity detail	Description
Derived Data	9	Topographic Profile (Table of locations)	Data are downloaded from the datalogger and exported to a GIS format for error inspection.
	10	Topographic Profile	Error checked locations are graphed to calculate standard morphologic metrics including profile area.
	11	Profile Comparisons	Various tables and graphs will be used to assess and report on morphometric change.
Quality Control Data	12	GPS/GNSS observations of survey benchmarks (real-time)	Any time the base station is established or reestablished, and prior to surveying topographic transects, the surveyor will occupy a different survey benchmark and check that vertical and horizontal positional error does not exceed 0.05m.
	13	GPS/GNSS observations of transect benchmarks (real-time)	Transect benchmarks are visited before commencing with the survey to serve as a final horizontal positional check at the site level. Horizontal positional error should not exceed 0.05m. Vertical accuracy is not assessed at the transect benchmark as these are generally near-surface marks and subject to vertical movement.
	14	Post-Processed accuracy report	Exported tables will report spatial precision associated with each topographic point.

Sampling Design

Information regarding the sampling design is provided in Table 2.

Table 2. Activity-level sample design matrix for *Monitoring Coastal Topography at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017). Numbers (left column) match those in the Protocol Activity Matrix (Table 1).

Activity Category	Activity no.	Activity detail	Sampling Design	Revisit Design
Field Observations	4	Field Conditions	Targeted – Field notes are taken to describe survey interruptions.	Biennial
	5	Photopoint data (Standard photos)	Targeted - Nine standard photos will be taken at each transect. Long-shore and cross-shore photos are taken along the transect at intersections with the dune crest (4 photos) and high tide swash line (4 photos), plus an oblique photo (1) is taken of the shoreward face of the primary dune from the dune base.	Biennial
	5	Photopoint data (Base station setup)	Photos of the real-time kinematic (RTK) base station setup will be taken to document antenna height	Biennial. Location and frequency will depend on the base station benchmarks used during the survey.
	5	Photopoint data (Field Conditions)	Targeted – Photos taken at areas where the survey is interrupted	Biennial. Location and frequency is dependent on number of interruptions and ambiguities

Activity Category	Activity no.	Activity detail	Sampling Design	Revisit Design
Sensor Data	6	GPS/GNSS (Transects)	Targeted – Potential transects were established using a random start, systematic approach. A framework of potential transects were spaced 1 km (0.6 mi) apart. Transects were sub-selected from the 1 km framework, also using an equal spacing rule. GUIS (Mississippi) - Five at Horn Island Sound-side (4 km spacing), Five at Horn Island Gulf-side (4 km spacing), Five at Petit Bois Island (2 km spacing), and One at USACE dredge disposal island west of Petit Bois. GUIS (Florida) - All transects within 3 km (1.8 mi) of Pensacola Pass were selected for monitoring. PAIS - Selection of monitored transects is based on GULN index areas selected for vegetation/bird Monitoring and park's management interests (1km or 2km spacing).	Biennial
Derived Data	11	Shoreline distance matrix	Systematic - distance measurements collected every 10 m along shoreline feature.	Established in project design. The matrix will be updated biennially
Quality Control Data	13	GPS/GNSS	RTK observations of benchmarks. Benchmark locations are selected using expert judgment and include the use of NGS published benchmarks where available.	Biennial

Data Quality Objectives

Data quality values and standards for implementation are provided in Table 3 through Table 5.

Table 3. Data Quality Values (DQVs) for *Monitoring Coastal Topography at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017).

Data Quality	Value	Definition	Protocol Considerations
Intrinsic Data Quality	Accuracy	Measurements reflect the true value of the parameter being observed. This applies to measures (length, width, position) or classes (species, types, or categories). Includes components of precision and bias.	Total Accuracy of the shoreline position is an estimated 5 meters. This total positional uncertainty is related to the following potential sources of error: GPS/GNSS accuracy, differential tide position, meteorological effects (waves), and Interpretation of the line (Psuty et al 2012).
	Representativeness	Measurements represent conditions at the time of sampling. Combined with accuracy, leads to repeatable data collection.	<u>ALL</u> : Topographic measurements are representative of springtime beach/dune morphology. Survey transects are equally spaced and spatially fixed. <u>PAIS</u> : Survey transects occur on the Gulf shore and are spatially associated with other GULN vital signs monitoring projects or park management areas of interest. <u>GUIS Horn and Petit Bois Islands</u> : Transects are distributed around entire island. <u>GUIS Perdido Key and Fort Pickens</u> : Transects are distributed to focus on up-drift and down-drift areas adjacent to Pensacola Pass.
Contextual Data Quality	Comparability	The degree to which data can be compared among sample locations, data sources, or periods of time.	Coastal topography is sampled biennially in the same season. Efforts are made to ensure surveys do not directly follow weather-related events that might cause short-term changes to beach morphology. Whereas this protocol will implement the sampling protocol established in Psuty et al (2012), with minor modifications, GULN results will be park-specific and comparisons will not be made among GULN parks or with NCBN coastal parks.
	Timeliness / Currency	How recent the data need to be to be considered valid for their intended use. Data represents conditions and/or is available and in a format for use at the appropriate time in the decision-making process.	Data processing occurs in a timely fashion based on certification requirements and intended use of data. Where certified data cannot be provided for resource management decisions in a timely manner, requirements for provisional use of data are defined and documented prior to data dissemination and use.

Table 3 (continued). Data Quality Values (DQVs) for *Monitoring Coastal Topography at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017).

Data Quality	Value	Definition	Protocol Considerations
Contextual Data Quality (continued)	Completeness	All data and measures required to evaluate accuracy and representativeness are present; incomplete data sets (either at a location, across sampling locations, or over time) lose utility or relevance. Data records contain values as planned across the period of record.	It is always the goal of the coastal topography surveyor to survey all transects in their entirety. When this is not possible: (1) The absence of, or gaps within a survey transect will be self-evident and explained by complementary datasets (field notes, location info, and photos). (2) Where the topographic survey is conducted outside of ideal conditions established by the protocol, those features will be clearly flagged in the coastal topography database.
Representational Data Quality	Consistent Representation	Use of standard definitions when describing data quality or resource quality based on data	Data quality is defined as “fit for analysis” or “not fit for analysis.” Data collection should (1) occur during similar seasonal conditions and (2) measurements should be taken along the same transect as defined by the GULN coastal topography protocol implementation plan to ensure that topographic features are comparable across time. Data collected outside of these conditions will be clearly flagged in the shoreline database as unfit for analysis.
Data Accessibility	Secure	Access to data, products, and systems limited to appropriate audiences.	All Accepted (QA/QCed) data and products generated from this monitoring effort will be available to the public via IRMA. Raw and Provisional Data will also be published on IRMA, but their distribution will be limited to network staff and will be made available upon request.

Table 4. Measurement Quality Objectives for *Monitoring Coastal Topography at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017).

Measure	Indicator	Quality objective
Survey Benchmark (Initial Measurement).	Location Accuracy (survey grade)	Positional instrument accuracy ≥ 0.03 meters horizontal circular and vertical positional error using repeated independent measurements from at least three observations separated by at least 24 hours.
	Location Description Detail	Description and photo provided with enough detail to relocate the physical benchmark without use of GPS equipment
Survey Benchmark (During topographic survey)	Location Accuracy (real-time field check)	Accuracy checks will place the RTK receiver (rover) on survey benchmarks. The difference between the rover coordinates and the validated coordinates should not exceed 0.05 meters horizontal or vertical.
Positional Accuracy During Survey	Location Accuracy (estimated)	Accuracy $\geq 0.05\text{m}$ horizontal and vertical (estimated). This instrument accuracy estimate reports the root mean square positional error at the rover in real-time.
Photopoints	Image resolution	Set to highest available
	Image format	.jpg w/ embedded EXIF metadata

Table 5. Data Protection standards for *Monitoring Coastal Topography at Gulf Coast Network Parks: Protocol Implementation Plan* (Bracewell 2017). With the exceptions noted, all data collected are to be made publicly available in a timely fashion.

Type of Data	Level of Protection	Rules for Dissemination
<u>Location Data and Information</u>		
Raw and Provisional Data	Operationally protected	Data provided upon request only. Includes: Raw and corrected GPS/GNSS files, Exported shapefile, Edited shapefile
<u>Personally Identifiable Information</u>		
Non-NPS Staff Information	Legally Protected	All but first name and last initial redacted from public release

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