U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science Directorate
Geologic Resources Division

Padre Island National Seashore

GRI Ancillary Map Information Document

Produced to accompany the Geologic Resources Inventory (GRI) Digital Geologic Data for Padre Island National Seashore

pais_geology.pdf

Version: March 2012

Geologic Resources Inventory Map Document for Padre Island National Seashore

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Geologic Resources Inventory Map Document

Padre Island National Seashore, Texas

Document to Accompany Digital Geologic-GIS Data

pais_geology.pdf

Version: March 2012

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Padre Island National Seashore, Texas (PAIS).

Attempts have been made to reproduce all aspects of the original source products, including the geologic units and their descriptions, geologic cross sections, the geologic report, references and all other pertinent images and information contained in the original publication.

National Park Service (NPS) Geologic Resources Inventory (GRI) Program staff have assembled the digital geologic-GIS data that accompanies this document.

For information about the status of GRI digital geologic-GIS data for a park contact:

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About the NPS Geologic Resources Inventory Program

Background

Recognizing the interrelationships between the physical (geology, air, and water) and biological (plants and animals) components of the Earth is vital to understanding, managing, and protecting natural resources. The Geologic Resources Inventory (GRI) helps make this connection by providing information on the role of geology and geologic resource management in parks.

Geologic resources for management consideration include both the processes that act upon the Earth and the features formed as a result of these processes. Geologic processes include: erosion and sedimentation; seismic, volcanic, and geothermal activity; glaciation, rockfalls, landslides, and shoreline change. Geologic features include mountains, canyons, natural arches and bridges, minerals, rocks, fossils, cave and karst systems, beaches, dunes, glaciers, volcanoes, and faults.

The Geologic Resources Inventory aims to raise awareness of geology and the role it plays in the environment, and to provide natural resource managers and staff, park planners, interpreters, researchers, and other NPS personnel with information that can help them make informed management decisions.

The GRI team, working closely with the Colorado State University (CSU) Department of Geosciences and a variety of other partners, provides more than 270 parks with a geologic scoping meeting, digital geologic-GIS map data, and a park-specific geologic report.

Products

Scoping Meetings: These park-specific meetings bring together local geologic experts and park staff to inventory and review available geologic data and discuss geologic resource management issues. A summary document is prepared for each meeting that identifies a plan to provide digital map data for the park.

Digital Geologic Maps: Digital geologic maps reproduce all aspects of traditional paper maps, including notes, legend, and cross sections. Bedrock, surficial, and special purpose maps such as coastal or geologic hazard maps may be used by the GRI to create digital Geographic Information Systems (GIS) data and meet park needs. These digital GIS data allow geologic information to be easily viewed and analyzed in conjunction with a wide range of other resource management information data.

For detailed information regarding GIS parameters such as data attribute field definitions, attribute field codes, value definitions, and rules that govern relationships found in the data, refer to the NPS Geology-GIS Data Model document available at: http://science.nature.nps.gov/im/inventory/geology/GeologyGISDataModel.cfm

Geologic Reports: Park-specific geologic reports identify geologic resource management issues as well as features and processes that are important to park ecosystems. In addition, these reports present a brief geologic history of the park and address specific properties of geologic units present in the park.

For a complete listing of Geologic Resource Inventory products and direct links to the download site visit the GRI publications webpage http://www.nature.nps.gov/geology/inventory/gre_publications.cfm

GRI geologic-GIS data is also available online at the NPS Data Store Search Application: http://irma.nps.gov/App/Reference/Search. To find GRI data for a specific park or parks select the appropriate park

(s), enter “GRI” as a Search Text term, and then select the Search Button.

For more information about the Geologic Resources Inventory Program visit the GRI webpage: http://www.nature.nps.gov/geology/inventory, or contact:

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The Geologic Resources Inventory (GRI) program is funded by the National Park Service (NPS) Inventory and Monitoring (I&M) Division.

Map Unit List

The map units present in the digital geologic-GIS data produced for Padre Island National Seashore, Texas (PAIS) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., M1 - Vegetated spoil mound). Information about each geologic unit is also presented in the Map Unit Information (UNIT) table included with the GRI geology-GIS data.

Map Units

water - Water
B9a - Dredged channel
M1 - Vegetated spoil mound
M2 - Barren spoil mound
M3 - Subaqueous spoil
M4 - Modified land
B1 - Beach
B2 - Coppice dunes
B3 - Fore-island dune ridge
B4 - Vegetated barrier flat
B4a - Temporarily flooded brackish to fresh marsh
B4b - Salt marsh
B4c - Seasonally flooded brackish to fresh marsh
B4d - Semipermanently flooded brackish to fresh marsh
B5 - Sparsely vegetated barrier flat
B5a - Stabilized dune
B7 - Storm washover channel
B7a - Storm washover fan
B8 - Wind-deflation flat
B8a - Sand flat
B10 - Active dunes
B11 - Back-island sand flat
L1 - Wind-tidal flat with small dunes
L2 - Wind-tidal flat with firm sand and mud
L3 - Wind-tidal flat with algal mats
L4 - Vegetated sand and shell berms
L5 - Lagoon-margin sand
L6 - Grassflat

Map Unit Descriptions

Descriptions of all geologic map units, are presented below.

Water (B9)

B9 Ephemeral fresh- to brackish-water ponds and marshes occupying wind-deflation troughs, generally parallel trailing (gulfward) edge of large back-island dune fields. Photo: Water-filled wind-deflation trough, past source of sand for back-island dune field in distance (Q-3)

GRI Source Map ID (7457)

B9a - Dredged channel

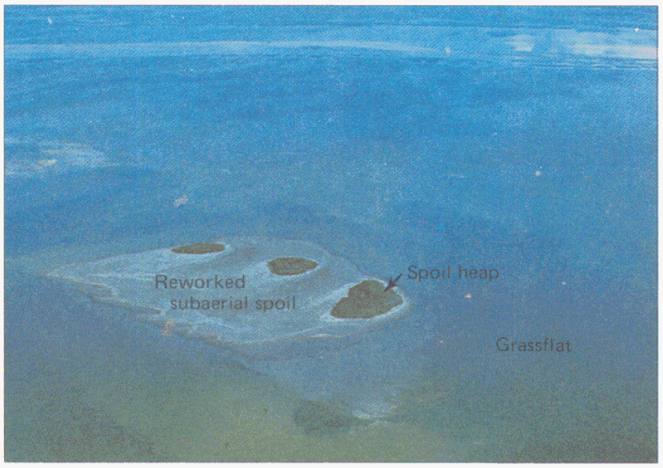
Dredged channel. *GRI Source Map ID* 7457 (TBEG digital data)

M1 - Vegetated spoil mound

M1 Spoil heap or mound, subaerial, partially vegetated, locally reworked, includes small areas of made land. Aerial photo: Vegetated spoil heaps fringed by barren, reworked subaerial spoil along Intracoastal Waterway; mainland shoreline in distance (S-8, T-8)

GRI Source Map ID 7457 (TBEG digital data)

M2 - Barren spoil mound



M2 Subaerial spoil, reworked, barren, local algal mats. Aerial photo: Barren subaerial spoil reworked from spoil heaps, direction of spoil transport primarily toward dredged channel in lower left; grassflats surrounding reworked spoil and heaps (C-2, D-2)

GRI Source Map ID 7457 (TBEG digital data)

M3 - Subaqueous spoil

M3 Subaqueous spoil, reworked, local marine grass. Aerial photo: Subaqueous spoil (depths less than 3 feet) encircling subaerial heaps along Intracoastal Waterway; grassflat surrounding spoil (U-2, west of Intracoastal Waterway)

GRI Source Map ID 7457 (TBEG digital data)

M4 - Modified land

M4 Land modified by human activity, designated by label or symbol. Aerial photo: A purposeful land modification—Malaquite Beach Development with parking lot, visitor facilities, and maintained beach (Q-4)

GRI Source Map ID 7457 (TBEG digital data)

B1 - Beach

The beach area is bound to the east by marine open waters of the Gulf of Mexico. The gulfward shoreline was captured from 2000 Lidar data. The beach is bound landward by a prominent fore-island beach ridge.

B1 Beach, sand and shell, cusps and berms locally pronounced. Photo: Malaquite Beach with Gulf on left and Malaquite visitor facilities and dune ridge on right (Q-4)

GRI Source Map ID 7457 (TBEG digital data)

B2 - Coppice dunes

Coppice dune field, commonly found landward of fore-island dune ridge. Also found within wind-tidal flats. Characteristic mound appearance.

B2 Sandflat and/or coppice dune field, active sand migration, wind-shadow dunes common, may include small remnants of larger dunes partially destroyed by wind or water, commonly found immediately landward of beach and fringing back-island dune fields. Photo: Coppice dunes, up to 15 inches in height, with beach and Gulf in distance (M-4)

GRI Source Map ID 7457 (TBEG digital data)

B3 - Fore-island dune ridge

Parallels the Gulf shoreline for entire length of the island. Vegetated surfaces interpreted primarily from 2003 photography. Boundary frequently interpreted through comparison with 2000 Lidar DEM. Aerial photography signature alone didn't provide sufficient information to delineate dune extent. The dune ridge becomes less prominent further south on the island. However, the high vertical resolution of the Lidar allowed delineation of the dune ridge throughout the entire length of the island.

B3 Fore-island dune ridge, sand, parallels Gulf shoreline, heavily vegetated on landward side, more sparsely vegetated on gulfward side, includes some fore-island stabilized blowout dunes. Photo: Continuous fore-island dune ridge immediately behind beach and narrow sandflat; highest ridge elevation approximately 20 feet (F-4)

GRI Source Map ID 7457 (TBEG digital data)

B4 - Vegetated barrier flat

Most common terrestrial environment. Heavily vegetated stabilized dunes are included.

B4 Barrier flat, sand and shell, heavily vegetated, local ponds and marshes, isolated stabilized dunes. Photo: Barrier flat heavily vegetated by grasses and small shrubs; back-island dune field in far distance (T-4)

GRI Source Map ID 7457 (TBEG digital data)

B4a - Temporarily flooded brackish to fresh marsh

Lightest marsh signature. Visible on 2003 photography but absent on 2002 and 1995 photography. *GRI Source Map ID* 7457 (TBEG digital data)

B4b - Salt marsh

Characteristic dark signature adjacent to salt water bodies or areas frequently flooded with salt water. *GRI Source Map ID* 7457 (TBEG digital data)

B4c - Seasonally flooded brackish to fresh marsh

Visible on 2003 and 2002 photography. Mostly absent from 1995 photography. *GRI Source Map ID* 7457 (TBEG digital data)

B4d - Semipermanently flooded brackish to fresh marsh

Darkest marsh signature. Visible on all vintages of photography. *GRI Source Map ID* 7457 (TBEG digital data)

B5 - Sparsely vegetated barrier flat

Highly fragmented vegetation.

B5 Barrier flat, sand and shell, sparsely to moderately vegetated. Photo: Barrier flat vegetated by sparse clumps of grasses that have migrated onto and partially stabilized a previously barren wind-deflation flat; active dunes in distance (L-4)

GRI Source Map ID 7457 (TBEG digital data)

B5a - Stabilized dune

Moderately vegetated blowout dunes in elongate or parabolic forms. Distinct from vegetated barrier flat through shape and bright signature of underlying dune sand. *GRI Source Map ID* 7457 (TBEG digital data)

B7 - Storm washover channel

Non-vegetated conduit for sand and water during storms. Found exclusively in the lower third of the map.

B7 Washover channel, sand, active during storms, generally perpendicular to shoreline, may form ponds between storms. Aerial photo: Storm washover channel cut through dune ridge and barrier flat; view from Gulf westward over barrier island (E-11)

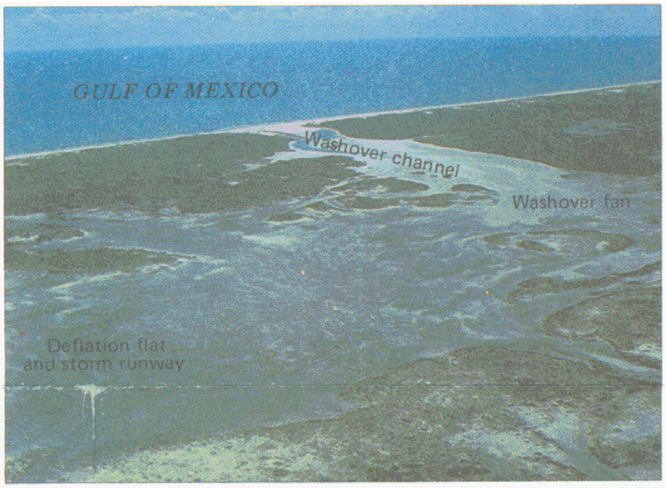
GRI Source Map ID 7457 (TBEG digital data)

B7a - Storm washover fan

Non-vegetated sand deposit from washover channel. Slight topographic relief on gulfward end but grades imperceptibly into back-island environments. *GRI Source Map ID* 7457 (TBEG digital data)

B8 - Wind-deflation flat

Washover fan deposit and storm runway. Algal mats common. Transitional between barrier and lagoon environments in lower third of the map.



B8 Wind-deflation flat, washover fan, and storm runway, sand and mud, algal mats. Aerial photo: Deflation flat and storm runway parallel to shoreline; washover fan spreading from washover channel onto flat (E-11)

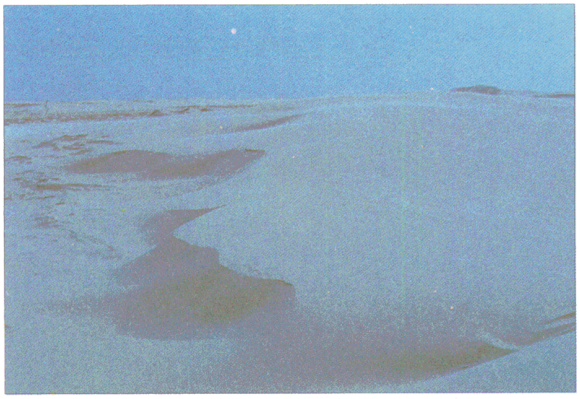
GRI Source Map ID 7457 (TBEG digital data)

B8a - Sand flat

Non-vegetated, high sand flat. Frequently fringing back-island vegetated flats and coppice dunes. *GRI Source Map ID* 7457 (TBEG digital data)

B10 - Active dunes

Back-island dune field and fore-island blowout dunes. Bright, nearly white signature on photography.



B10 Back-island dune field and fore-island blowout dunes, sand, longitudinal dune types common, active sand migration. Photo: Back-island dune field with sand migrating from back right to fore left (P-3)

GRI Source Map ID 7457 (TBEG digital data)

B11 - Back-island sand flat

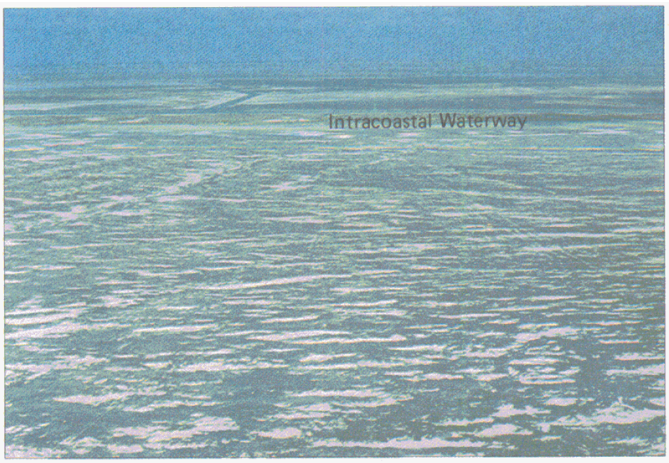
Non-vegetated, small migrating dunes. Transitional from back-island dune field to wind-tidal flat.

B11 Back-island sandflat with small migrating dunes, unvegetated, rapidly changing environment transitional from back-island dune field to wind-tidal flat. Aerial photo: Back-island sandflat with small migrating dunes, transitional with wind-tidal flat in distance (D-10, E-10)

GRI Source Map ID 7457 (TBEG digital data)

L1 - Wind-tidal flat with small dunes

Loose wind-blown sand, rarely flooded.

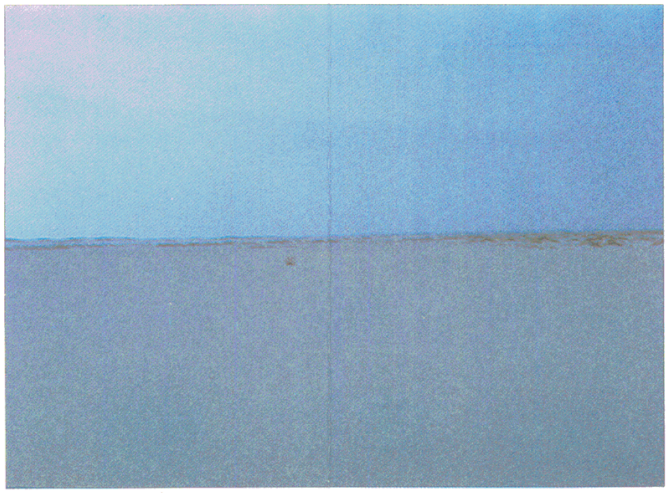


L1 Wind-tidal flat, loose wind-blown sand forming small dunes, local algal mats, rarely flooded. Aerial photo: Wind-tidal flat with loose sand blowing over and forming dunes on algal mats; Intracoastal Waterway in distance parallel to horizon (F-9)

GRI Source Map ID 7457 (TBEG digital data)

L2 - Wind-tidal flat with firm sand and mud

Higher areas rarely flooded.

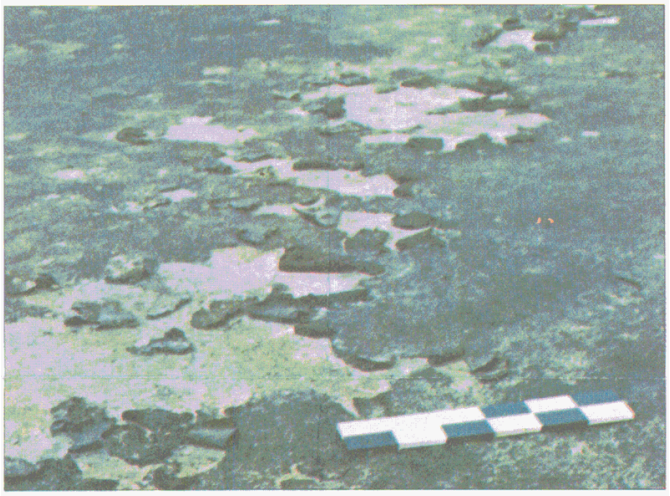


L2 Wind-tidal flat, sand and mud, firm, upper part rarely flooded. Photo: Barren wind-tidal flat of firm sand and mud, rarely inundated by lagoon water; isolated vegetation clump approximately 2 feet in height, active dunes in far distance (P-3)

GRI Source Map ID 7457 (TBEG digital data)

L3 - Wind-tidal flat with algal mats

Sand and mud, alternately emergent-submergent.

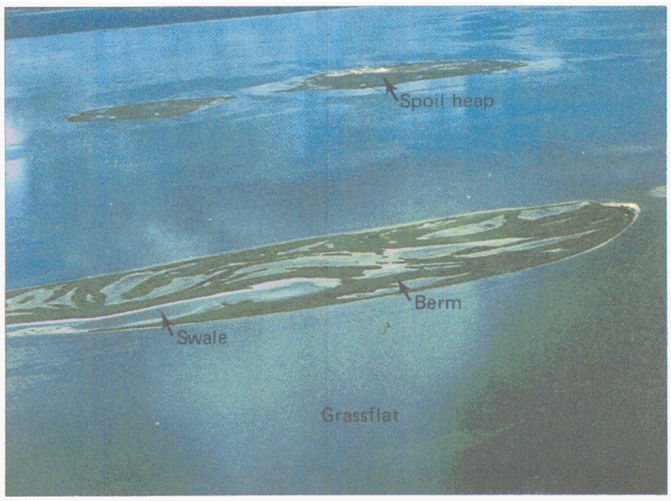


L3 Wind-tidal flat, sand and mud, extensive algal mats, alternately emergent-submergent. Photo: Wind-tidal flat with algal mat peeled from underlying sand and mud; scale 30 centimeters (11.8 inches) in length (X-11)

GRI Source Map ID 7457 (TBEG digital data)

L4 - Vegetated sand and shell berms

Vegetated, accretionary, subaerial. (N. and S. Bird Island)

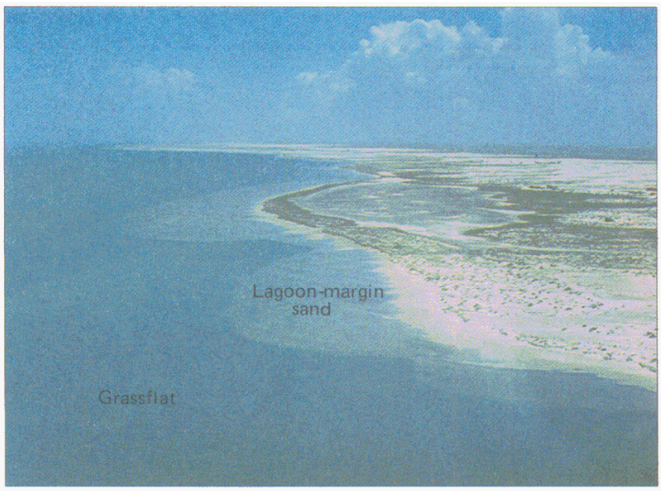


L4 Lagoon sand and shell berms, accretionary, subaerial, vegetated. Aerial photo: South Bird Island, a sand and shell island showing accretionary vegetated berms and barren swales; spoil along Intracoastal Waterway in distance (U-2)

GRI Source Map ID 7457 (TBEG digital data)

L5 - Lagoon-margin sand

Subaqueous to emergent, sand waves common.

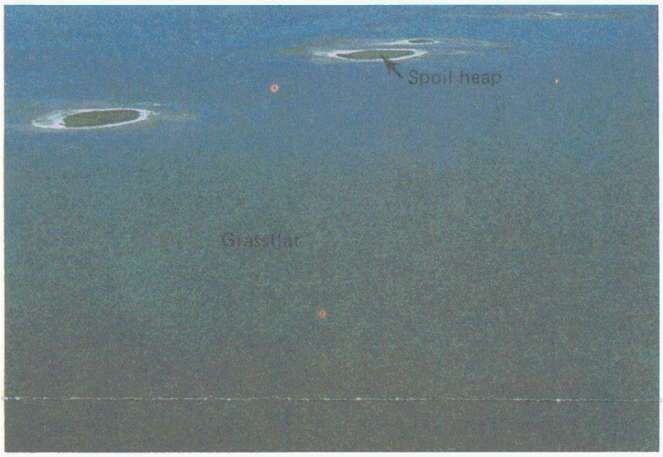


L5 Lagoon-margin sand, subaqueous, upper part often emergent, sand waves common, depths less than 3 feet. Aerial photo: Lobes of lagoon-margin sand fringing narrow field of coppice dunes at edge of back-island area (N-2)

GRI Source Map ID 7457 (TBEG digital data)

L6 - Grassflat

Marine grasses, muddy grass with shell, exposed at low tide, algae.



L6 Grassflat, marine grasses, muddy sand with shell, shallowest parts exposed at lowest tides, algae common in shoal areas, depths generally less than 4 feet. Aerial photo: Extensive grassflat exhibiting mottled texture beneath shallow water; in distance, spoil heaps adjacent to small channel branching from Intracoastal Waterway (R-8, R-9)

GRI Source Map ID 7457 (TBEG digital data)

GRI Source Map Citation

The GRI digital geologic-GIS map for Padre Island National Seashore, Texas (PAIS) was compiled from the following source:

Padre Island Natural Environments Map

Gibeaut, Jim and Tremblay, Tom, 2005, Padre Island Natural Environments Map, Texas Bureau of Economic Geology, unpublished, 1:5000 scale (*GRI Source Map ID* 7457)

Mapping Notes

Methods
Mapping based (1:5,000 scale) upon 2003 GLO photography. 1995/96 DOQs, 2002 NAPP photography, and the original geology and natural environments map of Weise and White (1980) was consulted but habitat boundaries were captured from GLO photos. The beach boundaries were captured from 2000 lidar data. The gulf shoreline extracted as a line feature and the landward extent was defined by the DEM expression of the fore-island dune ridge.

Wetlands were mapped from the GLO photos with the aid of DOQs and NAPP photography and also 1992 NWI data. The NWI dataset provided an initial survey of possible wetland locations. The wettest (semipermanently flooded) fresh to brackish marsh had a characteristic dark or cattail signature and appeared as marsh on the 1995/96 DOQ photography. The seasonally flooded fresh marsh was apparent on the 2002 NAPP photos. And the temporarily flooded fresh marsh was absent from the 2002 photography. Salt marsh was not further subdivided and like the brackish to fresh marsh was mapped on the 2003 photography with the aid of ancillary information. The year 2003 was a relatively wet year. Therefore, marsh habitats occupy larger areas than normal when moisture conditions are drier.

Observations when comparing to 1978 map (1975 photography)
In general, the island appears to be covered with more vegetation. The once wide spread active dune fields are much less extensive. Frequently what remains is the arcuate rim of a former dune blowout. Coppice dune fields are also fewer. The dunes have been stabilized and are often imperceptible from the surrounding vegetated barrier flats. This may be due to increased moisture in the form of a higher groundwater table. And possibly the effect of park management practices such as the elimination of cattle grazing and controlled burning.

System classification and description, modified from Weise and White (1980).

Natural Environments Report

Padre Island National Seashore, A Guide to the Geology, Natural Environments, and History of a Texas Barrier Island

B.R. Weise and W.A. White

Bureau of Economic Geology, University of Texas at Austin, Austin, Texas, 1980, 1991.

Figures from Plate 1

- M1 - Vegetated spoil mound
- M2 - Barren spoil mound
- M3 - Subaqueous spoil
- M4 - Modified land
- B1 - Beach
- B2 - Coppice dunes
- B3 - Fore-island dune ridge
- B4 - Vegetated barrier flat
- B5 - Sparsely vegetated barrier flat
- B7 - Storm washover channel
- B8 - Wind-deflation flat
- B9 - Water
- B10 - Active dunes
- B11 - Back-island sand flat
- L1 - Wind-tidal flat with small dunes
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- L3 - Wind-tidal flat with algal mats
- L4 - Vegetated sand and shell berms
- L5 - Lagoon-margin sand
- L6 - Grassflat

GRI Digital Data Credits

This document was developed and completed by Ron Karpilo and updated to the GRI pdf format by Ian Hageman and Stephanie O'Meara (Colorado State University) for the NPS Geologic Resources Division (GRD) Geologic Resources Inventory(GRI) Program. Quality control of this document by Stephanie O'Meara.

The information contained here was compiled to accompany the digital geologic-GIS map for Padre Island National Seashore, Texas (PAIS) initially developed by Ron Karpilo using Texas Bureau of Economic Geology digital data. The GRI digital geologic map was then updated by Stephanie O'Meara to the present GRI data model (v. 2.1) and ancillary file formats.

GRI finalization by Stephanie O'Meara (Colorado State University).

GRI program coordination and scoping provided by Bruce Heise and Tim Connors (NPS GRD, Lakewood, Colorado).