

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT MD2202-CS-N

Port of Annapolis, Maryland

Introduction

NOAA Coastal Mapping Program (CMP) Project MD2202-CS-N provides highly accurate digital shoreline data for key areas of change within the port of Annapolis, Maryland. The Geographic Cell (GC) may be used in support of the NOAA Nautical Charting Program (NCP) as well as geographic information systems (GIS) for a variety of coastal zone management applications.

Project Design

The design of Project MD2202-CS-N was accomplished by the Requirements Branch (RB) of the Remote Sensing Division (RSD) in response to the need for timely updates to the NOAA chart suite within key U.S. ports. Project requirements were formulated as a result of analysis conducted within the Coast and Shoreline Change Analysis Program (CSCAP), in which NOAA nautical chart products are compared to contemporary high-resolution imagery in order to ascertain the need for more current shoreline data. A Chart Evaluation File (CEF) was forwarded to the Applications Branch (AB) of RSD once the change analysis was completed. Refer to the CSCAP memorandum for Project MD2202-CS-N for details of the chart comparison process.

Field Operations

The field operations consisted of collection of static and kinematic Global Positioning System (GPS) and Inertial Measurement Unit (IMU) data, and the acquisition of aerial imagery. Two strips of color (RGB) and near-infrared (NIR) imagery were acquired concurrently with a NOAA King Air (N68RF) aircraft in October 2022 using an Applanix DSS 6150/6100 aerial camera at a nominal altitude of 10,500 feet, resulting in an approximate ground sample distance (GSD) of 0.23 meters for project imagery. NIR images were not used for this project. Although imagery was not acquired in strict coordination with local tides, the goal was to collect all imagery below Mean High Water (MHW).

Direct Georeferencing Data Processing

The GPS/IMU data were processed by RSD personnel to yield precise camera positions and orientations for direct georeferencing (DG) of the imagery. The airborne kinematic data for project MD2202-CS-N was processed in October 2022 using Applanix POSPac MMS (ver. 8.8) software, utilizing the IN-Fusion PP-RTX processing mode, which is an implementation of Trimble's *CenterPoint RTX* GNSS correction service. For further information refer to the Airborne Positioning and Orientation Reports (APOR) on file with other project data within the RSD Electronic Data Library.

The processed GPS/IMU data were used to derive precise exterior orientation (EO) values of the digital aerial imagery camera centers required for digital feature extraction. The predicted

horizontal accuracy of the imagery was calculated using an Exterior Orientation Total Propagated Uncertainty (EO-TPU) tool developed by NGS. Using this tool, the predicted horizontal uncertainty at the 95% confidence level was calculated to be 0.64 meters. Stereo models were examined in order to verify the quality of the DG data and ensure acceptable levels of parallax for mapping purposes.

Compilation

Data compilation was accomplished by a member of AB in May 2023. Digital feature data was compiled from aerial imagery, using stereo feature extraction capabilities within Esri's ArcGIS Pro software (ver. 3.1.0). Feature identification and attribution within the GC were based on image analysis of the aerial imagery and information extracted from the largest scale NOAA Electronic Navigational Charts (ENC) and other ancillary sources. Feature attribution was assigned in compliance with the Coastal Cartographic Object Attribute Source Table (C-COAST), which provides the definition and attribution scheme for the full range of cartographic features pertinent to the CMP. Selected features were further modified with additional descriptive information to refine general classification.

Spatial data accuracies for Project MD2202-CS-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.3 meters at the 95% confidence level. This predicted accuracy of compiled well-defined points is derived by doubling the imagery accuracy computed from the EO-TPU tool.

The following table provides information on the images used in the project completion:

Date	Time (UTC)	Flight Line / Images	Tide Level*
16-OCT-2022	16:31 – 16:33	61-002 / 61216 – 61226	0.3 m
16-OCT-2022	16:39 – 16:41	61-001 / 61227 – 61235	0.3 m

* Tide levels are given in meters above MLLW datum and were calculated using the Pydro software tool with a TCARI grid referenced to verified water level observations from various NOS gauges in the vicinity of the project. The elevation of MHW at the Annapolis, MD (#8575512) gauge is 0.364 meters above MLLW.

Quality Control / Final Review

The final review of the project was completed by senior CMP personnel in May 2023, and included analysis of DG results and assessment of the identification and attribution of digital feature data within the GC according to image analysis and criteria defined in C-COAST. The quality control process concluded with an inspection of topological connectivity within the GC using Esri's ArcGIS Pro software. All project data was evaluated for compliance to CMP requirements.

End Products and Deliverables

The following specifies the location and identification of end products generated during the completion of this project:

Remote Sensing Division Electronic Data Library

- CSCAP evaluation memorandum
- Airborne Positioning and Orientation Report (APOR)
- Project database
- Project Completion Report (PCR)
- GC11938 in shapefile format
- CEF in shapefile format

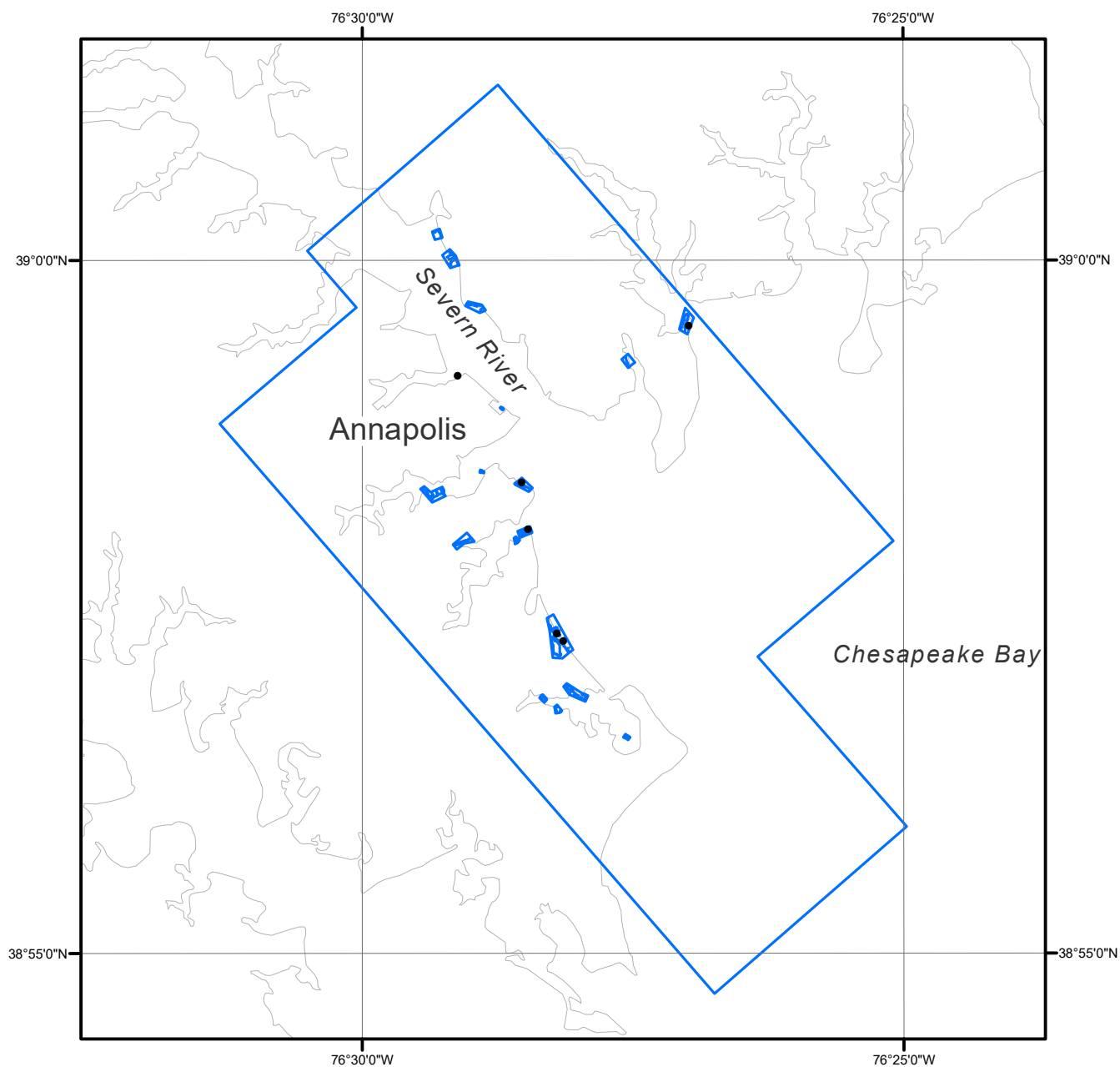
NOAA Shoreline Data Explorer

- GC11938 in shapefile format
- Metadata file for GC11938
- PCR in Adobe PDF format

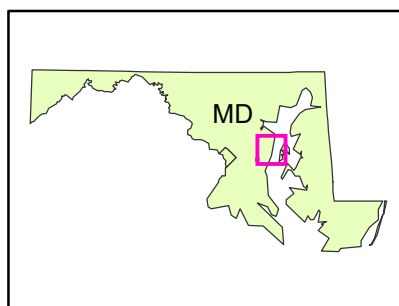
End of Report

PORT OF ANNAPOLIS

MARYLAND



Overview



MD2202-CS-N

GC11938