NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT

PROJECT NH1102A-CM-N

Great Bay, New Hampshire

Introduction

NOAA Coastal Mapping Program (CMP) Project NH1102A-CM-N provides a highly accurate dataset of shoreline feature data for Great Bay in New Hampshire. NH1102A-CM-N is a subproject of a larger acquisition project, NH1102-SP-N, which covers three separate areas including Durham, Great Bay, and the mouth of the Piscataqua River. 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

NH1102-SP-N was designed to support research at the University of New Hampshire's Center for Coastal and Ocean Mapping/Joint Hydrographic Center (CCOM/JHC). Photographic mission instructions for NH1102-SP-N were formulated by the Requirements Branch (RB) of the Remote Sensing Division (RSD) following the guidelines of RSD's Photo Mission Standard Operating Procedures. The instructions discussed the project's purpose, geographic area of coverage, scope and priority, image requirements, Global Positioning System (GPS) data collection procedures and guidelines, instructions for data recording and handling, and mission communication protocols. RB created a Project Layout Diagram, flight maps and input files for the aircraft flight management system.

Subsequent to the compilation phase, one orthorectified panchromatic commercial satellite image, with a ground sample distance (GSD) of 0.5 meters, was obtained in order to provide the completed alignment of a new bridge constructed after the project imagery was acquired. The image was adjusted to match the positioning of the feature data for NH1102A-CM-N, and features were compiled using Esri's ArcGIS (ver. 10.8.1) desktop GIS software.

Field Operations

Field operations for NH1102-SP-N consisted of the collection of static and kinematic GPS data and Inertial Measurement Unit (IMU) data, and the acquisition of digital aerial imagery and lidar data. Aerial survey operations were conducted in October 2011 with the NOAA King Air aircraft (N68RF). All project imagery was acquired with an Applanix DSS 439 dual camera system below Mean High Water (MHW) tide levels. Fourteen lines of color (RGB) imagery were acquired for NH1102-SP-N, with eight flight lines used for subproject NH1102A-CM-N. All imagery was acquired at a nominal altitude of 5,000 feet, resulting in an approximate GSD of 0.18 meters. Lidar data acquired for NH1102-SP-N was not used for data compilation purposes.

Direct Georeferencing Data Processing

The GPS/IMU data for Project NH1102-SP-N were processed by RSD personnel to yield precise camera positions and orientations for direct georeferencing (DG) of the imagery. A GPS base

station was established for use as a reference station for kinematic GPS processing. The position of the base station was determined using the NGS Online Processing User Service (OPUS), which computed fixed baseline solutions from nearby CORS stations. Kinematic data was processed using POSPac MMS (ver. 5.3.3) GPS/IMU software in May 2012. For further information refer to the Airborne Positioning and Orientation Report (APOR) on file with other project data within the RSD Electronic Data Library.

For Project NH1102A-CM-N, no aerial triangulation processing was conducted. Upon completion of the processing of GPS/IMU data, the processed data were used to derive precise exterior orientation (EO) values of the camera centers required for digital feature extraction. A predicted horizontal accuracy of the imagery was determined by propagating sensor EO and image measurement uncertainties through the photogrammetric collinearity equations using the 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 for the imagery subset used to compile data for NH1102A-CM-N. Stereo-models were examined for parallax and found to be acceptable.

Compilation

The data compilation phase of this project was accomplished by RSD Applications Branch personnel in January 2021. Digital mapping was performed using the Feature Extraction module within BAE's SOCET SET (ver. 5.6) photogrammetric software suite. Feature identification and attribution within the GC were based on image analysis of the aerial imagery and information extracted from the largest scale NOAA nautical charts 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 NH1102A-CM-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 well-defined points measured during the compilation phase was derived by doubling the imagery accuracy computed from the EO-TPU tool.

The following table provides information on the imagery used to complete this project:

Date	Time (UTC)	Color Aerial Imagery		Tide Level*
		Roll	Flight Line / Images	
10-07-2011	16:50 – 16:53	11NC71	25-003 / 22127 – 22159	1.1 m
10-07-2011	16:58 – 17:01	11NC71	25-004 / 22160 – 22198	1.0 m
10-07-2011	17:06 – 17:10	11NC71	25-005 / 22199 – 22237	1.0 m
10-07-2011	17:14 – 17:17	11NC71	25-006 / 22238 – 22270	0.9 m
10-07-2011	17:22 – 17:23	11NC71	25-007 / 22271 – 22285	0.9 m
10-07-2011	17:28 – 17:29	11NC71	25-008 / 22286 – 22299	0.8 m

Date	Time (GMT)	Sensor	Satellite Image Source File ID	Tide Level
10-07-2011	17:34 – 17:35	11NC71	25-009 / 22300 – 22311	0.8 m
10-07-2011	17:39 – 17:40	11NC71	25-010 / 22312 – 22322	0.8 m
07-24-2021	18:34	WorldView-1	20210724_WV01_ORI_R1C1.jp2	n/a

* Tide levels are given in meters above MLLW and were calculated using the Pydro software tool with a TCARI grid referenced to verified water level observations at the time of photography from various NOS gauges in the vicinity of the project. The elevation of the MHW tidal datum in the project area is 2.5 meters above MLLW.

Quality Control / Final Review

Quality control tasks were conducted during all phases of project completion by a senior member of RSD. The final QC review was completed in January 2021. The review process included analysis of the 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 (ver. 10.8.1) desktop GIS software. All project data was evaluated for compliance to CMP requirements.

A Chart Evaluation File (CEF) resulted from the comparison of source imagery and compiled project data with the largest scale NOAA Electronic Navigational Chart (ENC) coverage within the project area. The following ENC was used for this comparison:

US5NH01M, 27th Ed., Feb. 2020

End Products and Deliverables

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

Remote Sensing Division Electronic Data Library
- Data Acquisition Summary Report for NH1102
- Airborne Positioning and Orientation Report (APOR)
- Project Completion Report (PCR)
- Project database
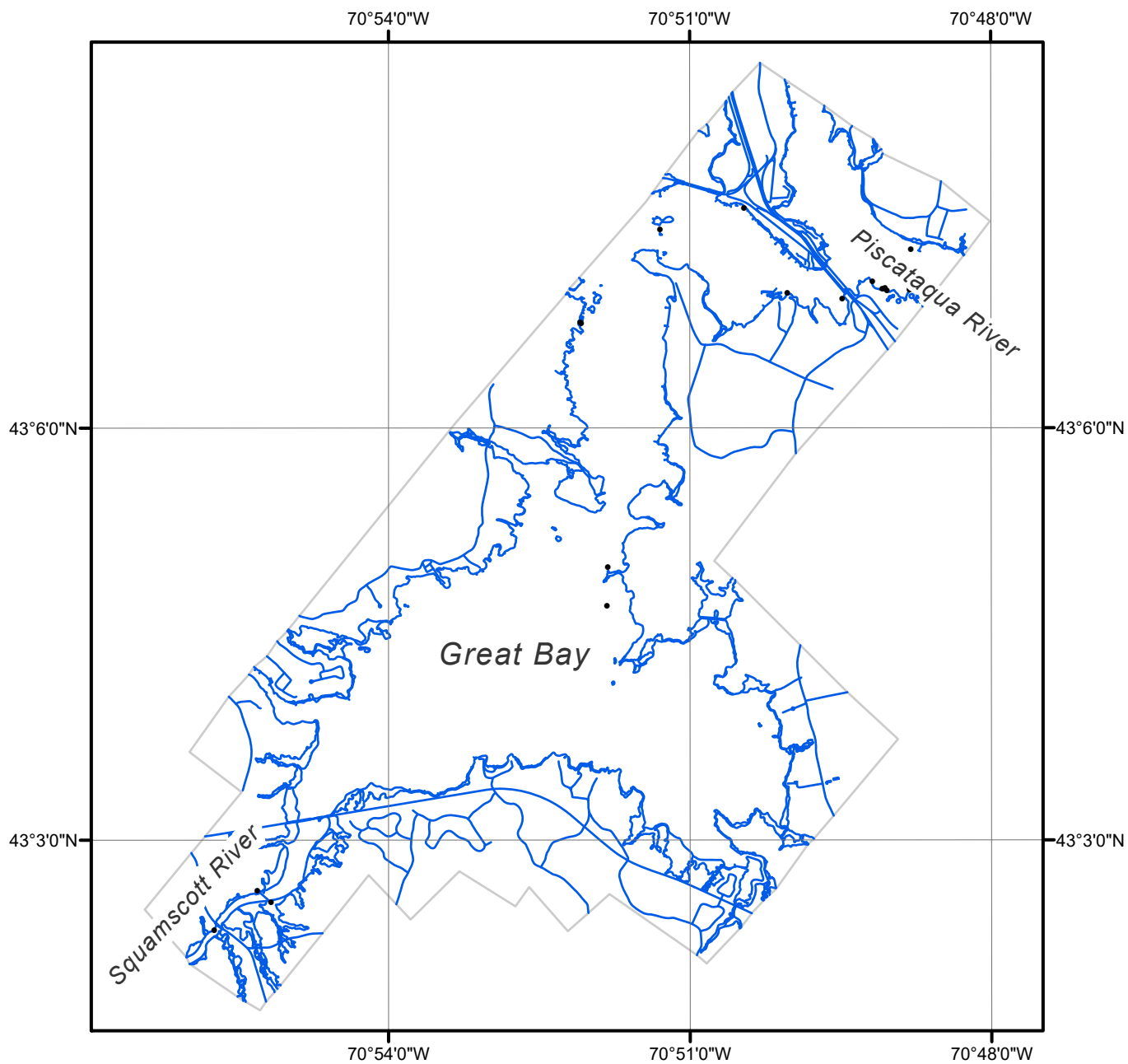- GC11681 in shapefile format
- CEF in shapefile format

NOAA Shoreline Data Explorer
- GC11681 in shapefile format
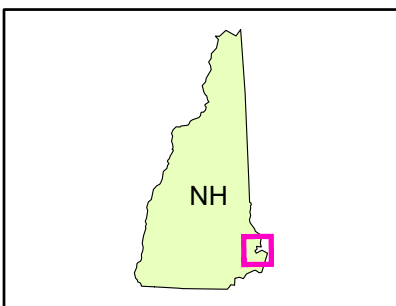- Metadata file for GC11681
- PCR in Adobe PDF format

End of Report

GREAT BAY

NEW HAMPSHIRE

70°54'0"W   70°51'0"W   70°48'0"W

43°6'0"N   43°6'0"N

Piscataqua River

Great Bay

43°3'0"N   43°3'0"N

Squamscott River

70°54'0"W   70°51'0"W   70°48'0"W

Overview

NH

NH1102A-CM-N

GC11681