

# **NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT**

## ***PROJECT MI1603A-CS-N***

### ***Port of Marine City, Michigan***

#### **Introduction**

NOAA Coastal Mapping Program (CMP) Project MI1603A-CS-N provides highly accurate digital shoreline data for key areas of change in the St Clair River for the Port of Marine City, Michigan, and vicinity. 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 the project 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 digital 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 complete. Refer to the RB CSCAP Memorandum for Project MI1607-CS-T dated August 4, 2016 for details of the chart comparison process.

#### **Field Operations**

The field operations consisted of the collection of static and kinematic Global Positioning System (GPS) data and Inertial Measurement Unit (IMU) data and the acquisition of aerial imagery. Color digital images utilized for this project were acquired with the NOAA King Air aircraft on September 12, 2016 using an Applanix Digital Sensor System (DSS) aerial camera at a nominal altitude of 10,500 feet, resulting in an approximate ground sample distance (GSD) of 0.33 meters. Near-Infrared (NIR) images were also acquired, but were not used for this project. The project was not planned in coordination with any particular water level, but at the time of acquisition the levels in the project area were near the Low Water Datum (LWD).

#### **Direct Georeferencing Data Processing**

The GPS/IMU data were processed by RSD personnel to yield precise camera positions and orientations for direct geo-referencing (DG) of the imagery. A local GPS base station was established for use as a reference station for kinematic GPS processing operations. 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. Airborne kinematic data was processed using Applanix POSPac MMS 7.1 software in November 2016. For further information refer to the Airborne Positioning and Orientation Report (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 camera centers required for digital feature extraction. The 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 for all project imagery was calculated to be 0.86 meters. Previously compiled feature data from CMP Project MI0906C (GC10802) was used to verify the horizontal integrity of the DG data. All stereo models were examined and found to have acceptable levels of parallax for mapping purposes.

## Compilation

The data compilation phase of this project was accomplished by a member of RSD in July 2017. Digital feature data was compiled using SOCET SET (ver. 5.6) software. Feature identification and attribution within the GC were based on image analysis of the digital photographs and information extracted from the appropriate 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.

Spatial data accuracies for Project MI1603A-CS-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 1.7 meters at the 95% confidence level. This predicted accuracy of compiled well-defined points is derived by doubling the horizontal uncertainty calculated from the EO-TPU tool.

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

Date	Time (UTC)	Roll #	Photo #s	River Level*
09-12-2016	13:55 – 13:58	16VC73	17793 – 17804	175.6 – 176.0 m
09-12-2016	14:02 – 14:05	16VC73	17805 – 17816	175.6 – 176.0 m

\* River water levels are given in meters above IGLD 1985 and based on verified observations at NOS water level stations near the project area (Algonac MI/#9014070, St Clair State Police MI/#9014080). The Low Water Datum (LWD) for the portion of the St. Clair River covered by this project varies between 174.6 – 175.1 meters above IGLD 1985.

## Quality Control / Final Review

The final review of the project was completed by a senior member of RSD in September 2017, and included analysis of DG results and assessment of the identification and attribution of digital feature data within the Geographic Cell (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 ArcGIS 10.4.1 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 Completion Report (PCR)
- Project database
- GC11340 in shapefile format
- CEF in shapefile format

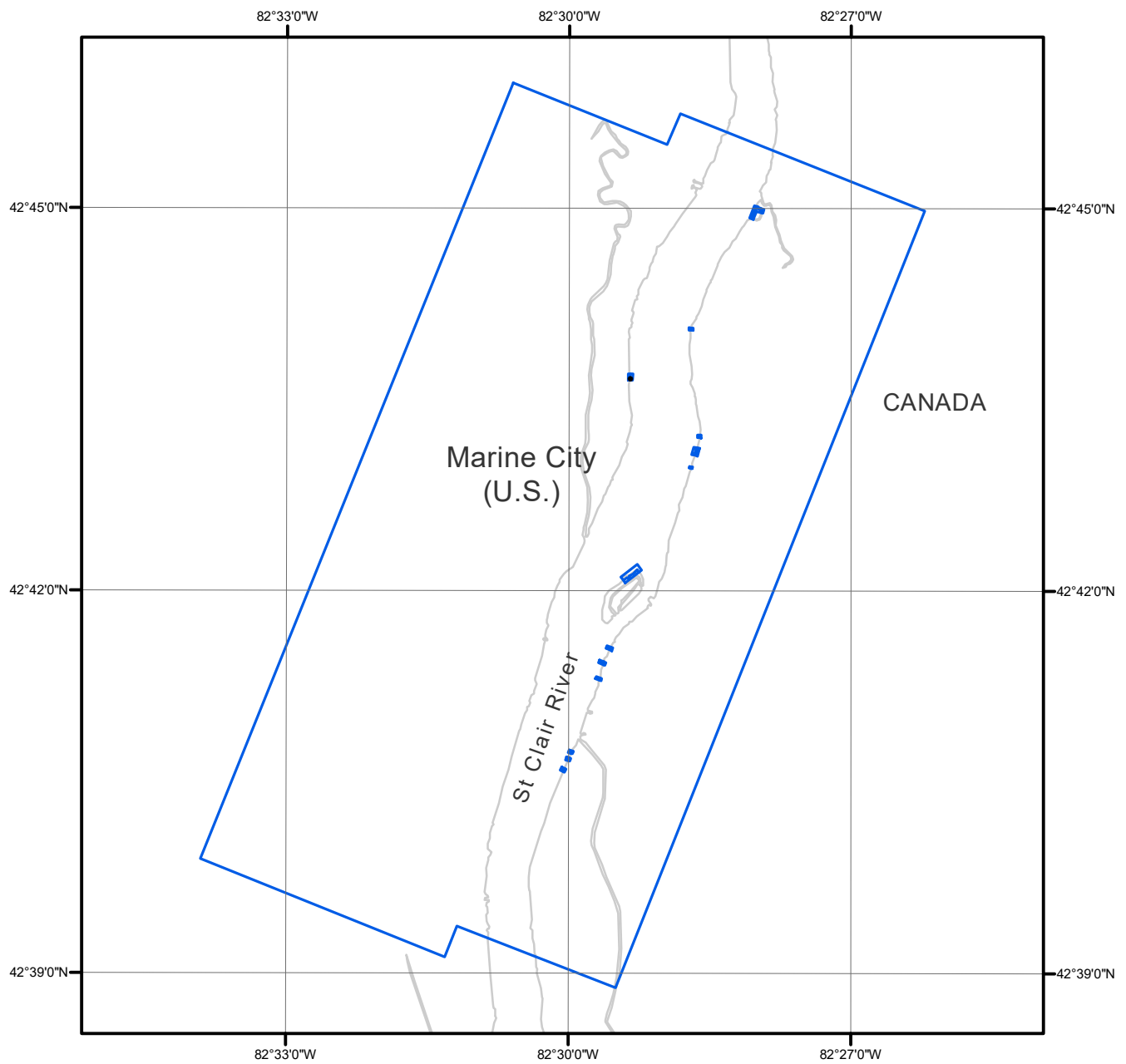
### **NOAA Shoreline Data Explorer**

- GC11340 in shapefile format
- Metadata file for GC11340
- Digital copy of the PCR in Adobe PDF format

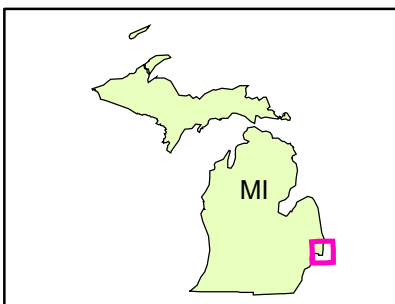
## **End of Report**

# PORT OF MARINE CITY

## MICHIGAN



Overview



MI1603A-CS-N

GC11340