

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT WA0902-CM-N

Lake Washington, Washington

Introduction

Coastal Mapping Program (CMP) Project WA0902-CM-N provides highly accurate digital shoreline data for Lake Washington, in the state of Washington. 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 Requirements Branch (RB) of the Remote Sensing Division (RSD) formulated photographic mission instructions for this project following standard mission guidelines. The instructions discussed the project's purpose, geographic area of coverage, scope and priority; photographic requirements; flight line priority; Global Positioning System (GPS) data collection procedures and guidelines for both kinematic and static surveys; data recording and handling instructions; and contact and communication information. RB created a Project Layout Diagram, flight maps and input files for the aircraft's flight management system.

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 digital aerial imagery. Aerial survey operations were conducted on August 12, 2010 with the NOAA King Air aircraft (N68RF). Five strips (50-013 through 50-017) of natural color photographs used for this project were acquired with an Applanix DSS 439 medium format digital camera with a ground sample distance (GSD) of 0.35 meters. The collection of these photographs was not tide coordinated.

Direct Georeferencing Data Processing

GPS/IMU data were processed by RSD personnel to yield precise camera positions and orientations for direct georeferencing (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. The airborne kinematic data was processed using Applanix POSPAC (ver. 6.1) software in January 2013. For further information refer to the Airborne Positioning and Orientation Report (APOR) that is 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 an Exterior Orientation Total Propagated Uncertainty (EO-TPU) tool developed by NGS. Using this tool, the predicted horizontal uncertainty at the 95% confidence level (CE95) was calculated to be 1.04 meters.

Compilation

The data compilation phase of this project was accomplished by personnel of the Applications Branch of RSD in August 2019. Digital mapping was performed using the Feature Extraction module of BAE's SOCET SET (ver. 5.6.) photogrammetric software suite on a Windows-based stereo-enabled workstation. 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, U.S. Coast Guard Light List, 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.

Subsequent to completion of compilation, one WorldView-3 orthorectified panchromatic commercial satellite image from DigitalGlobe, Inc. was obtained in order to provide the alignment of a new bridge across Lake Washington with more recent imagery. This image was adjusted to match the positioning of existing features in the GC using the Georeferencing tool within Esri's ArcGIS (ver. 10.8) desktop GIS software.

Spatial data accuracies for Project WA0902-CM-N were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 2.1 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:

Aerial Imagery				
Date	Time (UTC)	Roll #	Strip / Image#s	Tide Level*
8/12/2010	23:03 – 23:05	10NC51	50-017 / 21248 – 21260	N/A
8/12/2010	23:31 – 23:37	10NC51	50-015 / 21343 – 21380	N/A
8/12/2010	23:42 – 23:46	10NC51	50-013 / 21381 – 21413	N/A
8/12/2010	23:57 – 00:04	10NC51	50-014 / 21414 – 21457	N/A
8/13/2010	00:14 – 00:21	10NC51	50-016 / 21458 – 21495	N/A
Satellite Imagery				
Date	Time (UTC)	Sensor	Source File ID	Tide Level*
7/26/2020	19:10:00	WorldView-3	20200726 WV03 ORI dup mos.jp2	N/A

* Lake Washington is non-tidal.

Quality Control / Final Review

The final review of the project was completed by a senior member of RSD in December 2019, 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 ArcGIS (ver. 10.8.1) desktop GIS software. All project data was evaluated for compliance to CMP requirements.

Comparisons of the largest scale NOAA nautical charts with project imagery and compiled data resulted in creation of the Chart Evaluation File (CEF). The following nautical chart was used in the comparison process:

18447, Lake Washington Ship Canal and Lake Washington, 30th Ed., Sep. 2012

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

- Project database
- Airborne Positioning and Orientation Report (APOR)
- GC11110 in shapefile format
- Project Completion Report (PCR)
- CEF in shapefile format

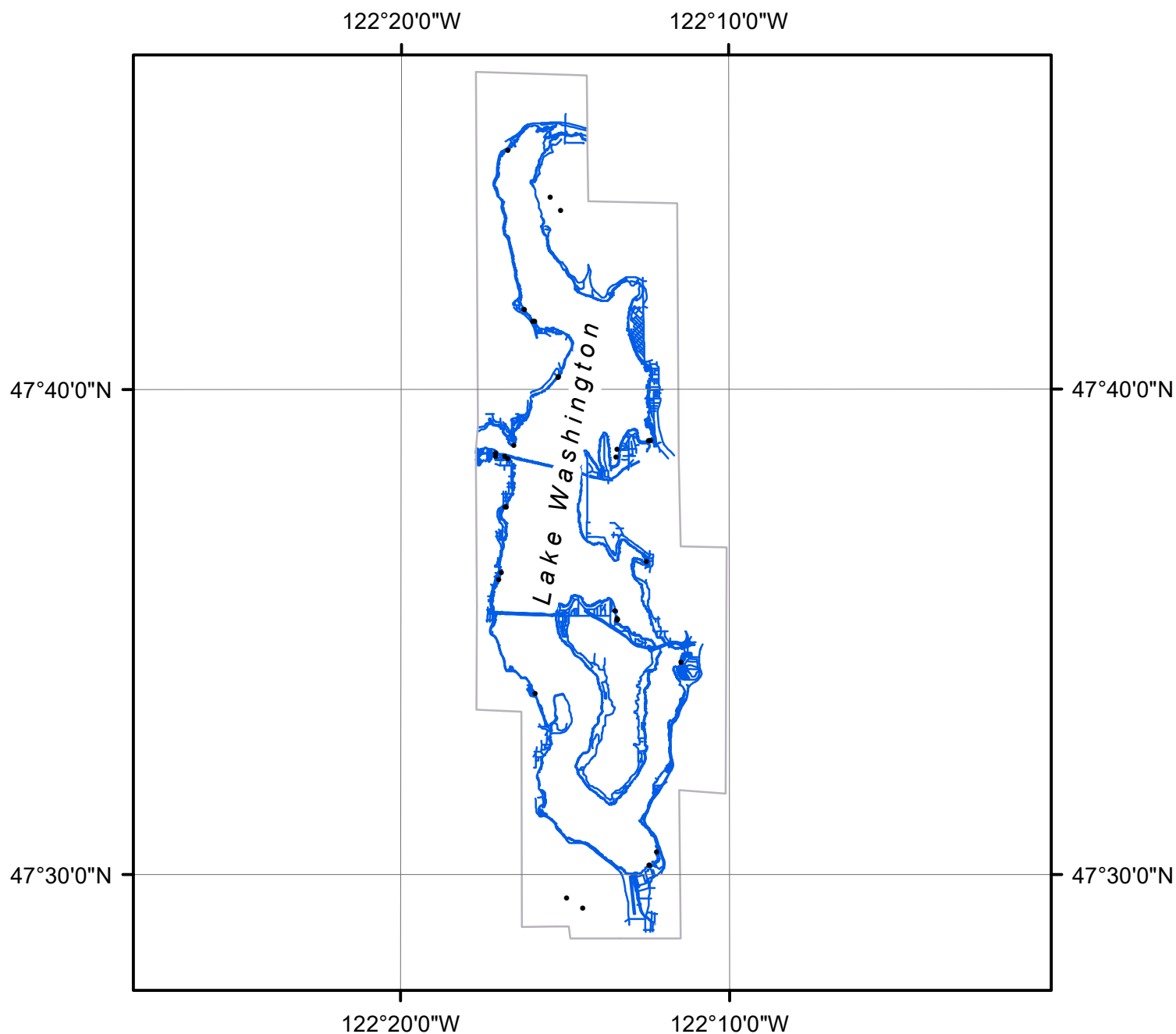
CEF in shapefile format NOAA Shoreline Data Explorer

- GC11110 in shapefile format
- Metadata file for GC11110
- PCR in Adobe PDF format

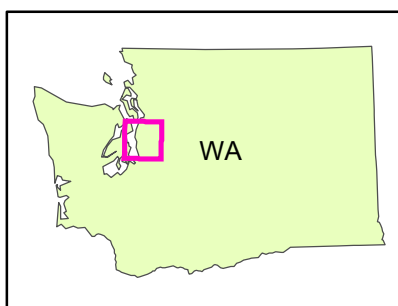
End of Report

LAKE WASHINGTON

WASHINGTON



Overview



WA0902-CM-N

GC11110