

NOAA COASTAL MAPPING PROGRAM PROJECT COMPLETION REPORT

PROJECT CA1212B

Petaluma River, California

Introduction

NOAA Coastal Mapping Program (CMP) Project CA1212B provides a highly accurate dataset of shoreline feature data including the Petaluma River. Project CA1212B is a subproject of a larger project CA1212, which covers the western & northern portions of the San Francisco Bay from the Golden Gate to the Sacramento & San Joaquin Rivers. 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

Project CA1212B was designed in response to a request from the Marine Chart Division (MCD) of the Office of Coast Survey, NOAA. Photographic mission instructions for CA1212 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.

Field Operations

Field operations for CA1212 consisted of the collection of static and kinematic GPS data and Inertial Measurement Unit (IMU) data, and the acquisition of digital aerial imagery. Aerial survey operations were conducted April 18, 2013 through April 16, 2014 with the NOAA King Air aircraft (N68RF). All project imagery was acquired with an Applanix DSS-439 dual head digital camera system (two 60 mm lenses) in coordination with both MLLW and MHW tide levels. Fifty-four (54) flight lines of natural color and near-infrared (NIR) imagery were acquired concurrently for CA1212, although six (6) flight lines (50-011 through 50-016) were used in the completion of subproject CA1212B. All imagery was acquired at a nominal altitude of 10,000 feet, resulting in an approximate ground sample distance (GSD) of 0.35 meters.

Direct Georeferencing Data Processing

The GPS/IMU data for Project CA1212 were processed by RSD personnel to yield precise camera positions and orientations. GPS base stations were established for use as reference stations for kinematic GPS processing operations. The positions of the base stations were 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 POSpac MMS 6.1 GPS/IMU software in November 11 & 14, 2013 & March 24, April 18 & June 13, 2014 for the photographs used for CA1212B. For further information refer to the Airborne

Positioning and Orientation Report (APOR) for GPS days 2362013, 2382013, 0552014, 0562014 and 1062014 on file with other project data within the RSD Applications Branch (AB) Project Archive.

For Project CA1212B, 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 an Excel spreadsheet based 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 1.4 meters for the imagery subset used to compile data for CA1212B.

Fourteen (14) NGS 3rd Order geodetic control stations were used as check points to test the horizontal integrity of the DG data, and the stereo-models were examined for excessive parallax. The imagery was determined to be suitable for mapping purposes.

Compilation

The data compilation phase of this project was accomplished by AB personnel in January 2015. Digital mapping was performed using the Feature Extraction software module within SOCET SET (ver. 5.6). 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 chart 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 CA1212B were determined according to standard Federal Geographic Data Committee (FGDC) practices. Cartographic features were compiled to meet a horizontal accuracy of 2.8 meters. 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)	Roll #	Photo #s	Tide Level*
08-24-2013	21:53 – 21:54	13NC56	12337 – 12345	1.8 m
08-24-2013	21:53 – 21:54	13NR51	11012 – 11020	1.8 m
08-24-2013	21:58 – 21:59	13NC56	12346 – 12354	1.8 m
08-24-2013	21:58 – 21:59	13NR51	11021 – 11029	1.8 m
08-24-2013	22:03 – 22:07	13NC56	12355 – 12382	1.8 – 1.7 m
08-24-2013	22:03 – 22:07	13NR51	11030 – 11057	1.8 – 1.7 m

08-27-2013	00:00 – 00:02	13NC58	12923 – 12937	1.7 m
08-27-2013	00:00 – 00:02	13NR53	11558 – 11572	1.7 m
08-27-2013	00:06 – 00:09	13NC58	12938 – 12961	1.8 m
08-27-2013	00:06 – 00:09	13NR53	11573 – 11596	1.8 m
08-27-2013	00:14 – 00:18	13NC58	12962 – 12990	1.9 – 1.8 m
08-27-2013	00:14 – 00:18	13NR53	11597 – 11625	1.9 – 1.8 m
02-24-2014	23:29 – 23:11	14NC22	05881 – 05895	0.1 m
02-24-2014	23:29 – 23:11	14NR17	03040 – 03054	0.1 m
02-25-2014	23:00 – 23:01	14NC28	07223 – 07231	0.1 m
02-25-2014	23:00 – 23:01	14NR20	04123 – 04131	0.2 m
02-25-2014	23:07 – 23:10	14NC28	07232 – 07259	0.2 – 0.3 m
02-25-2014	23:07 – 23:10	14NR20	04132 – 04159	0.2 – 0.3 m
02-25-2014	23:17 – 23:21	14NC28	07260 – 07288	0.3 – 0.1 m
02-25-2014	23:17 – 23:21	14NR20	04160 – 04188	0.3 – 0.1 m
02-25-2014	23:26 – 23:27	14NC28	07289 – 07297	0.1 m
02-25-2014	23:26 – 23:27	14NR20	04189 – 04197	0.1 m
04-16-2014	15:50 – 15:53	14NC35	08293 – 08316	0.1 m
04-16-2014	15:50 – 15:53	14NR28	05373 – 05396	0.1 m

* Tide levels are given in meters above MLLW. For the lower part of the river tides 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 northern San Francisco Bay. For the upper part of the river tides were calculated based on verified water level observations at the NOS reference gauge in San Francisco (9414290), with time and height offsets applied to substations: Lakeville Petaluma R. (9415584) and Petaluma R. Upper Drawbridge (9415584). The elevation of the MHW tidal datum in the project area varies between 1.7 – 1.8 m. 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 2015. 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 ArcGIS 10.1 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 nautical chart covering the project area:

18654, San Pablo Bay & continuation of Petaluma River, 1:40,000, 45th Ed., Jan.1/11

End Products and Deliverables

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

RSD Applications Branch Archive

- Hardcopy of the Data Acquisition Summary for CA1212
- Hardcopy of the APORs for data used in CA1212B
- Hardcopy of the Project Completion Report (PCR)
- Page-size graphic plot of GC11123 file contents, attached to PCR

Remote Sensing Division Electronic Data Library

- Project database
- GC11123 in shapefile format
- Digital copy of the PCR in Adobe PDF format
- CEF in shapefile format

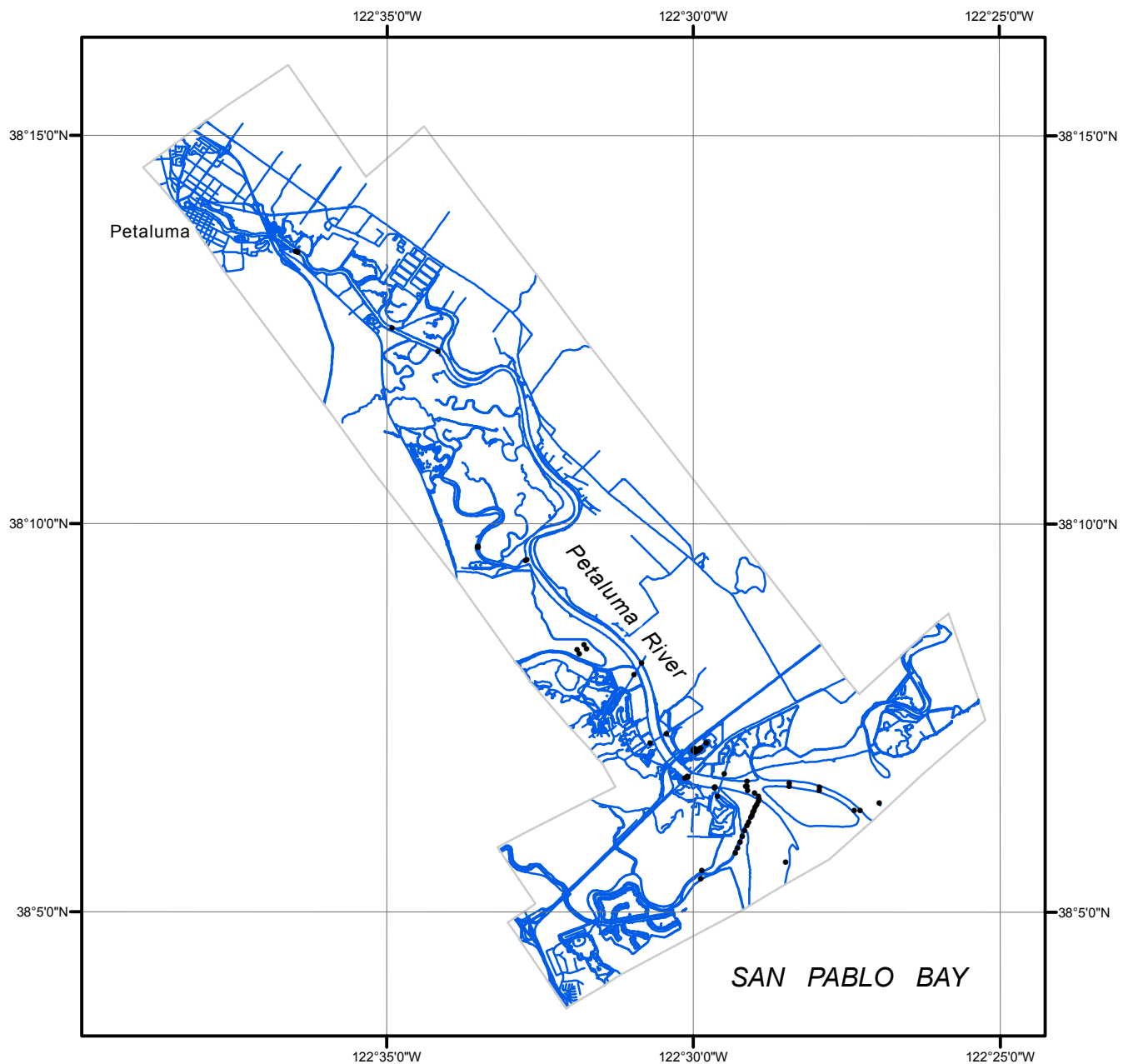
NOAA Shoreline Data Explorer

- GC11123 in shapefile format
- Metadata file for GC11123
- Digital copy of the PCR in Adobe PDF format

End of Report

PETALUMA RIVER

CALIFORNIA



Overview



CA1212B

GC11123