*Please provide the following information, and submit to the NOAA DM Plan Repository.*

**Reference to Master DM Plan (if applicable)**

*As stated in Section IV, Requirement 1.3, DM Plans may be hierarchical. If this DM Plan inherits provisions from a higher-level DM Plan already submitted to the Repository, then this more-specific Plan only needs to provide information that differs from what was provided in the Master DM Plan.*

URL of higher-level DM Plan (if any) as submitted to DM Plan Repository:

## 1. General Description of Data to be Managed

### 1.1. Name of the Data, data collection Project, or data-producing Program:

2010 USACE Lidar: Columbia River (OR, WA, ID, MT)

### 1.2. Summary description of the data:

The Columbia River Light Detection and Ranging (LiDAR) survey project was a collaborative effort to develop detailed high density LiDAR terrain data for the US Army Corps of Engineers (USACE). The LiDAR will be used to support hydraulic modeling work associated with proposed 2014 Columbia River treaty negotiations. The dataset encompasses approximately 2836 square miles of territory in portions of Oregon, Washington, Idaho and Montana within the Columbia River drainage. This survey was under the jurisdiction of three Corps districts: Portland (CENWP), Seattle (CENWS), and Walla Walla (CENWW). CENWP was the project lead and primary contracting organization.

Bare earth point data are classified as either ground (2), model key point (8) or water (9) and represent the earth's surface with all vegetation and human-made structures removed. Model key points were generated to represent the bare earth surface within a 0.07 m tolerance. Ground points (class 2) are the remaining ground points not classed as model key. Both ground and model key classes are needed for display of all bare earth points. Water classification was used for those bare earth/ground classified points that fell inside a water boundary as determined using softcopy photogrammetry with stereograms generated from LiDAR intensities. All remaining points received the default classification (1). In some areas of heavy vegetation or forest cover, there may be relatively few ground points in the LiDAR data.

The RMSE of the data for open, hard-packed surfaces is 0.046 meters as assessed from 40, 266 ground survey (real time kinematic) points taken on hard-packed road surfaces. This value is representative of anticipated accuracies in open, evenly sloped or flat terrain where maximum point densities were achieved.

The project was completed for the US Army Corps of Engineers, Portland District, to support hydraulic modeling related to the ACOE Columbia River Treaty project. Data acquisition, bare earth processing, and development of final tiled LiDAR deliverables and DEM's was performed by Watershed Sciences, Inc. Overall project management,

photogrammetric quality control review using LiDAR stereograms, water delineation and breakline development was performed by David C. Smith & Associates, Inc. Professional Surveyor oversight of ground control data, ground control data processing and ground control publication was performed by David Evans and Associates, Inc. Final quality control review in ArcGIS of all final deliverables, including preparation of point density rasters and reach based geo-databases incorporating all deliverables, was performed by CC Patterson and Associates.

NOTE ON DATUM ISSUES: All ground control and subsequent LiDAR data deliverables were developed and delivered at NAD '83 CORS 96 horizontal and NAVD '88 Geoid '09 vertical datums as processed in OPUS-DB. Due to limitations in the transformations supported by ESRI, NAD '83 and NAVD '88 datums were temporarily assigned to the ESRI deliverables and ESRI .prj file even though the actual coordinate values in the data files are at the original NAD '83 CORS 96 and NAVD '88 Geoid '09 datums. In many instances, a temporary assignment of NAD '83 HARN or HPGN may better approximate local conditions. Plain NAD '83 was used for the primary deliverable in order to avoid any implication of higher precision; however, the user may want to evaluate other approximations for specific applications. At such time as ESRI includes support for NAD ' 83 CORS '96, the temporary NAD '83 assignment in the .prj file should be replaced with NAD '83 CORS '96 without further reprojection.

The NOAA Office for Coastal Management has converted the data to ellipsoid heights ( using Geoid09) and NAD 83 geographic coordinates for data storage and Digital Coast provisioning purposes.

In addition to these lidar point data, the bare earth Digital Elevation Models (DEM) created from the lidar point data, and the breaklines are also available. These data are available for custom download at the links provided in the URL section of this metadata record.

Original contact information:

Contact Name: Jacob MacDonald

Contact Org: US Army Corps of Engineers, Portland District

Phone: 503-808-4844

Email: jacob.macdonald@usace.army.mil

**1.3. Is this a one-time data collection, or an ongoing series of measurements?**
One-time data collection

**1.4. Actual or planned temporal coverage of the data:**
2009-11-16 to 2010-07-02

**1.5. Actual or planned geographic coverage of the data:**
W: -124.125759, E: -113.9414, N: 49.004158, S: 44.77523

**1.6. Type(s) of data:**

*(e.g., digital numeric data, imagery, photographs, video, audio, database, tabular data, etc.)*
Point Cloud (Digital)

**1.7. Data collection method(s):**
*(e.g., satellite, airplane, unmanned aerial system, radar, weather station, moored buoy, research vessel, autonomous underwater vehicle, animal tagging, manual surveys, enforcement activities, numerical model, etc.)*

**1.8. If data are from a NOAA Observing System of Record, indicate name of system:**

**1.8.1. If data are from another observing system, please specify:**

**2. Point of Contact for this Data Management Plan (author or maintainer)**

**2.1. Name:**
NOAA Office for Coastal Management (NOAA/OCM)

**2.2. Title:**
Metadata Contact

**2.3. Affiliation or facility:**
NOAA Office for Coastal Management (NOAA/OCM)

**2.4. E-mail address:**
coastal.info@noaa.gov

**2.5. Phone number:**
(843) 740-1202

**3. Responsible Party for Data Management**
*Program Managers, or their designee, shall be responsible for assuring the proper management of the data produced by their Program. Please indicate the responsible party below.*

**3.1. Name:**

**3.2. Title:**
Data Steward

**4. Resources**
*Programs must identify resources within their own budget for managing the data they produce.*

**4.1. Have resources for management of these data been identified?**

**4.2. Approximate percentage of the budget for these data devoted to data management ( specify percentage or "unknown"):**

## 5. Data Lineage and Quality

*NOAA has issued Information Quality Guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information which it disseminates.*

### 5.1. Processing workflow of the data from collection or acquisition to making it publicly accessible

*(describe or provide URL of description):*

Process Steps:

- Acquisition The LiDAR data was collected between November 16th, 2009 and July 2, 2010. The survey used both the Leica ALS50 Phase II and ALS 60 laser systems mounted in a Cessna Caravan 208. Near nadir scan angles were used to increase penetration of vegetation to ground surfaces. Ground level GPS and aircraft IMU were collected during the flight.
- Point Cloud Processing 1. Flight lines and data were reviewed to ensure complete coverage of the study area and positional accuracy of the laser points. 2. Laser point return coordinates were computed using ALS Post Processor software, IPAS Pro GPS/ INS software, and Waypoint GPS, based on independent data from the LiDAR system, IMU, and aircraft. 3. The raw LiDAR file was assembled into flight lines per return with each point having an associated x, y, and z coordinate. 4. Visual inspection of swath to swath laser point consistencies within the study area were used to perform manual refinements of system alignment. 5. Custom algorithms were designed to evaluate points between adjacent flight lines. Automated system alignment was computed based upon randomly selected swath to swath accuracy measurements that consider elevation, slope, and intensities. Specifically, refinement in the combination of system pitch, roll and yaw offset parameters optimize internal consistency. 6. Noise (e.g., pits and birds) was filtered using ALS postprocessing software, based on known elevation ranges and included the removal of any cycle slips. 7. Using TerraScan and Microstation, ground classifications utilized custom settings appropriate to the study area. 8. The corrected and filtered return points were compared to the RTK ground survey points collected to verify the vertical and horizontal accuracies. 9. Points were output as laser points.
- Water Delineation and Breakline Integration 1) Photogrammetric review and evaluation of ground class model key points was performed using stereograms generated from LiDAR first return intensities using softcopy photogrammetry equipment. 2) Stereograms were generated at a 0.3 meter pixel resolution to support softcopy photogrammetry measurements. Based on an initial test of approximately 30 test points on hard flat surfaces, the softcopy photogrammetry measurements were found to be within a 5 cm to 7 cm RMSE of the source LiDAR values. Values were very evenly distributed as plus and minus (average error 1 cm) resulting in digitized breaklines being a consistent representation of the LiDAR surface well within project accuracy requirements. 3) 3D breaklines were digitized to delineate all readily identifiable water bodies down to 2 meters in width for the

purpose of a generally flattened cartographic appearance as well as delineating water polygons for points to reclassify as water in the ground surface model. Water surfaces were not artificially flattened; breaklines represent the best visual interpretation of the break between land and water points. Breaklines represent the water level at the time of flight. Hard breaks occur where the water level is significantly different between different flight days. 4) Additional supplemental breaklines were digitized for cliffs, hard breaks or other readily identifiable terrain features when not represented to within 0.5 m or less by the initial ground model classification. 5) Concurrent photogrammetric review was performed to identify any remaining ground classification edits required.
- Bare earth raster 1M ground surface rasters in ESRI grid format were developed from triangulated irregular networks (TINs) of the ground points and integrated breaklines. Ground class points within the water polygons were reclassified as water points and omitted from the ground model. Bare earth raster water elevations were interpolated from 3D water boundary breaklines.
- Geodatabase preparation and final quality control 1) As a final quality control step, all source .las points, breaklines, water delineation polygons, bare earth 1M DEM rasters, highest hit 1M DEM rasters and intensity images were imported into and ArcGIS geodatabase, tiled by USACE modeling reach. 2) Mosaics were created from bare earth and highest hit DEMs and reviewed for continuity and completeness. 3) Hillshades were generated and used for an overall, final visual review of the bare earth model.
- 2012-03-01 00:00:00 - The NOAA Office for Coastal Management (OCM) received the files in las format. The files contained LiDAR elevation and intensity measurements. The data were in UTM (Zones 10 and 11) coordinates and NAVD88 (Geoid 09) heights in meters. OCM performed the following processing for data storage and Digital Coast provisioning purposes: 1. The data were converted from UTM Zones 10 and 11 coordinates to geographic coordinates. 2. The data were converted from NAVD88 (orthometric) heights to GRS80 (ellipsoid) heights using Geoid 09. 3. Outliers were filtered.

#### 5.1.1. If data at different stages of the workflow, or products derived from these data, are subject to a separate data management plan, provide reference to other plan:

### 5.2. Quality control procedures employed (describe or provide URL of description):

## 6. Data Documentation

*The EDMC Data Documentation Procedural Directive requires that NOAA data be well documented, specifies the use of ISO 19115 and related standards for documentation of new data, and provides links to resources and tools for metadata creation and validation.*

### 6.1. Does metadata comply with EDMC Data Documentation directive?

No

**6.1.1. If metadata are non-existent or non-compliant, please explain:**

Missing/invalid information:
- 1.7. Data collection method(s)
- 3.1. Responsible Party for Data Management
- 4.1. Have resources for management of these data been identified?
- 4.2. Approximate percentage of the budget for these data devoted to data management
- 5.2. Quality control procedures employed
- 7.1. Do these data comply with the Data Access directive?
- 7.1.1. If data are not available or has limitations, has a Waiver been filed?
- 7.1.2. If there are limitations to data access, describe how data are protected
- 7.4. Approximate delay between data collection and dissemination
- 8.1. Actual or planned long-term data archive location
- 8.3. Approximate delay between data collection and submission to an archive facility
- 8.4. How will the data be protected from accidental or malicious modification or deletion prior to receipt by the archive?

**6.2. Name of organization or facility providing metadata hosting:**

NMFS Office of Science and Technology

**6.2.1. If service is needed for metadata hosting, please indicate:**

**6.3. URL of metadata folder or data catalog, if known:**

https://www.fisheries.noaa.gov/inport/item/49920

**6.4. Process for producing and maintaining metadata**

*(describe or provide URL of description):*

Metadata produced and maintained in accordance with the NOAA Data Documentation Procedural Directive: https://nosc.noaa.gov/EDMC/DAARWG/docs/EDMC_PD-Data_Documentation_v1.pdf

**7. Data Access**

*NAO 212-15 states that access to environmental data may only be restricted when distribution is explicitly limited by law, regulation, policy (such as those applicable to personally identifiable information or protected critical infrastructure information or proprietary trade information) or by security requirements. The EDMC Data Access Procedural Directive contains specific guidance, recommends the use of open-standard, interoperable, non-proprietary web services, provides information about resources and tools to enable data access, and includes a Waiver to be submitted to justify any approach other than full, unrestricted public access.*

**7.1. Do these data comply with the Data Access directive?**

**7.1.1. If the data are not to be made available to the public at all, or with**

**limitations, has a Waiver (Appendix A of Data Access directive) been filed?**

**7.1.2. If there are limitations to public data access, describe how data are protected from unauthorized access or disclosure:**

**7.2. Name of organization of facility providing data access:**
NOAA Office for Coastal Management (NOAA/OCM)

**7.2.1. If data hosting service is needed, please indicate:**

**7.2.2. URL of data access service, if known:**
https://coast.noaa.gov/dataviewer/#/lidar/search/where:ID=1122
https://noaa-nos-coastal-lidar-pds.s3.amazonaws.com/laz/geoid18/1122/index.html

**7.3. Data access methods or services offered:**
Data is available online for custom and bulk downloads.

**7.4. Approximate delay between data collection and dissemination:**

**7.4.1. If delay is longer than latency of automated processing, indicate under what authority data access is delayed:**

**8. Data Preservation and Protection**
*The NOAA Procedure for Scientific Records Appraisal and Archive Approval describes how to identify, appraise and decide what scientific records are to be preserved in a NOAA archive.*

**8.1. Actual or planned long-term data archive location:**
*(Specify NCEI-MD, NCEI-CO, NCEI-NC, NCEI-MS, World Data Center (WDC) facility, Other, To Be Determined, Unable to Archive, or No Archiving Intended)*

**8.1.1. If World Data Center or Other, specify:**

**8.1.2. If To Be Determined, Unable to Archive or No Archiving Intended, explain:**

**8.2. Data storage facility prior to being sent to an archive facility (if any):**
Office for Coastal Management - Charleston, SC

**8.3. Approximate delay between data collection and submission to an archive facility:**

**8.4. How will the data be protected from accidental or malicious modification or deletion prior to receipt by the archive?**

*Discuss data back-up, disaster recovery/contingency planning, and off-site data storage relevant to the data collection*

### 9. Additional Line Office or Staff Office Questions

*Line and Staff Offices may extend this template by inserting additional questions in this section.*