

*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:**

2014 U.S. Geological Survey CMGP LiDAR: Post Sandy (Connecticut)

**1.2. Summary description of the data:**

The LiDAR data were processed to a bare-earth digital terrain model (DTM). Detailed breaklines and bare-earth Digital Elevation Models (DEMs) were produced for the project area. Data was formatted according to tiles with each tile covering an area of 1500m by 1500m. A total of 1,974 tiles were produced for the project encompassing an area of approximately 1,526 sq. miles.

**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:**

2014-04-27 to 2014-05-29

**1.5. Actual or planned geographic coverage of the data:**

W: -72.593, E: -72.197, N: 42.049, S: 41.183

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

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

**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:

- 2014-05-01 00:00:00 - Data for the USGS Connecticut Sandy LiDAR project was acquired by Leading Edge Geomatics (LEG) The project area included approximately 1,526 contiguous square miles for portions of Connecticut. LiDAR sensor data were collected with the Riegl 680i LiDAR system. The data was

delivered in UTM Zone 18, horizontal datum NAD83(2011), vertical datum NAVD88, Geoid 12A. Deliverables for the project included a raw (unclassified) calibrated LiDAR point cloud, survey control, and a final acquisition/calibration report. A preliminary RMSEz error check is performed at this stage of the project life cycle in the raw LiDAR dataset against GPS static and kinematic data and compared to RMSEz project specifications. The LiDAR data is examined in open, flat areas away from breaks. Lidar ground points for each flightline generated by an automatic classification routine are used. Overall the LiDAR data products collected by LEG meet or exceed the requirements set out in the Statement of Work. The quality control requirements of LEGs quality management program were adhered to throughout the acquisition stage of this project to ensure product quality. LIDAR acquisition began on April 27, 2014 and was completed on May 29, 2014. A total of 40 survey missions were flown to complete the project. LEG utilized an Riegl 680i LiDAR system for the acquisition. The flight plan was flown as planned with no modifications. There were no unusual occurrences during the acquisition and the sensor performed within specifications. There were 428 flight lines required to complete the project. The initial step of calibration is to verify availability and status of all needed GPS and Laser data against field notes and compile any data if not complete. Subsequently the mission points are output using Trimble Business Center (TBC), initially with default values from Trimble or the last mission calibrated for system. The initial point generation for each mission calibration is verified within Microstation/Terrascan for calibration errors. If a calibration error greater than specification is observed within the mission, the roll pitch and scanner scale corrections that need to be applied are calculated. The missions with the new calibration values are regenerated and validated internally once again to ensure quality. All missions are validated against the adjoining missions for relative vertical biases and collected GPS validation points for absolute vertical accuracy purposes. On a project level, a supplementary coverage check is carried out to ensure no data voids unreported by Field Operations are present. The initial points for each mission calibration are inspected for flight line errors, flight line overlap, slivers or gaps in the data, point data minimums, or issues with the LiDAR unit or GPS. Roll, pitch and scanner scale are optimized during the calibration process until the relative accuracy is met. Relative accuracy and internal quality are checked using at least 3 regularly spaced QC blocks in which points from all lines are loaded and inspected. Vertical differences between ground surfaces of each line are displayed. Color scale is adjusted so that errors greater than the specifications are flagged. Cross sections are visually inspected across each block to validate point to point, flightline to flightline and mission to mission agreement. For this project the specifications used are as follow: Relative accuracy  $\leq 7\text{cm}$  RMSEZ within individual swaths and  $\leq 10\text{ cm}$  RMSEZ or within swath overlap (between adjacent swaths). UTM coordinate system, meters, zone 18, horizontal datum NAD83(2011), vertical datum NAVD88, Geoid 12A

- 2014-07-01 00:00:00 - Dewberry utilizes a variety of software suites for inventory management, classification, and data processing. All LiDAR related processes begin

by importing the data into the GeoCue task management software. The swath data is tiled according to project specifications (1,500 m x 1,500 m). The tiled data is then opened in Terrascan where Dewberry uses proprietary ground classification routines to remove any non-ground points and generate an accurate ground surface. The ground routine consists of three main parameters (building size, iteration angle, and iteration distance); by adjusting these parameters and running several iterations of this routine an initial ground surface is developed. The building size parameter sets a roaming window size. Each tile is loaded with neighboring points from adjacent tiles and the routine classifies the data section by section based on this roaming window size. The second most important parameter is the maximum terrain angle, which sets the highest allowed terrain angle within the model. Once the ground routine has been completed a manual quality control routine is done using hillshades, cross-sections, and profiles within the Terrasolid software suite. After this QC step, a peer review and supervisor manual inspection is completed on a percentage of the classified tiles based on the project size and variability of the terrain. After the ground classification corrections were completed, the dataset was processed through a water classification routine that utilizes breaklines compiled by Dewberry to automatically classify hydrographic features. The water classification routine selects ground points within the breakline polygons and automatically classifies them as class 9, water. During this water classification routine, points that are within 1 meter of the hydrographic features are moved to class 10, an ignored ground due to breakline proximity. In addition to classes 1, 2, 9, and 10, there is a Class 7, noise points. This class was used for both low and high noise points. The fully classified dataset is then processed through Dewberry's comprehensive quality control program. The data was classified as follows: Class 1 = Unclassified. This class includes vegetation, buildings, noise etc. Class 2 = Ground Class 7= Noise Class 9 = Water Class 10 = Ignored The LAS header information was verified to contain the following: Class (Integer) Adjusted GPS Time (0.0001 seconds) Easting (0.003 m) Northing (0.003 m) Elevation (0.003 m) Echo Number (Integer 1 to 4) Echo (Integer 1 to 4) Intensity (8 bit integer) Flight Line (Integer) Scan Angle (Integer degree)

- 2014-08-01 00:00:00 - Dewberry used GeoCue software to develop raster stereo models from the LiDAR intensity. The raster resolution was 0.3 m.
- 2014-08-01 00:00:00 - LiDAR intensity stereopairs were viewed in 3-D stereo using Socet Set for ArcGIS softcopy photogrammetric software. The breaklines are collected directly into an ArcGIS file geodatabase to ensure correct topology. The LiDARgrammetry was performed under the direct supervision of an ASPRS Certified Photogrammetrist. The breaklines were stereo-compiled in accordance with the Data Dictionary. Inland Lakes and Ponds, Streams and Rivers, Tidal Waters, and Bridge Breaklines were collected according to specifications for the Connecticut LiDAR Project.
- 2015-01-01 00:00:00 - Dewberry used ESRI software to generate bare earth elevation rasters. Bare earth elevation rasters do not contain bridges. As bridges are removed from bare earth DEMs but DEMs are continuous surfaces, the area

between bridge abutments must be interpolated. The rasters are reviewed to identify locations where the interpolation between bridge abutments created bridge saddles.

- 2015-01-01 00:00:00 - The locations of identified bridge saddles are loaded into Terrascan software. LiDAR points and surface models created from ground LiDAR points are reviewed and 3D bridge breaklines are compiled in Terrascan. Typically, two breaklines are compiled for each bridge-one breakline along the ground of each abutment. The bridge breaklines are placed perpendicular to the bridge deck and extend just beyond the extents of the bridge deck. Extending the bridge breaklines beyond the extent of the bridge deck allows the compiler to use ground elevations from the ground LiDAR data for each endpoint of the breakline. The 3D endpoints of each breakline are used to enforce a continuous slope on the ground under the bridge deck along the collected breakline. These breaklines are used in the final DEM production and help to reduce the appearance of bridge saddles.

- 2015-01-01 00:00:00 - Breaklines are reviewed against LiDAR intensity imagery to verify completeness of capture. All breaklines are then compared to ESRI terrains created from ground only points prior to water classification. The horizontal placement of breaklines is compared to terrain features and the breakline elevations are compared to LiDAR elevations to ensure all breaklines match the LiDAR within acceptable tolerances. Some deviation is expected between breakline and LiDAR elevations due to monotonicity, connectivity, and flattening rules that are enforced on the breaklines. Once completeness, horizontal placement, and vertical variance is reviewed, all breaklines are reviewed for topological consistency and data integrity using a combination of ESRI Data Reviewer tools and proprietary tools. Corrections are performed within the QC workflow and re-validated.

- 2015-01-01 00:00:00 - Class 2, ground, LiDAR points are exported from the LAS files into an Arc Geodatabase (GDB) in multipoint format. The 3D breaklines, Inland Lakes and Ponds, Streams and Rivers, Tidal Waters, and bridge breaklines are imported into the same GDB. An ESRI Terrain is generated from these inputs. The surface type of each input is as follows: Ground Multipoint: Masspoints Inland Lakes and Ponds: Hard Replace Streams and Rivers: Hard Line Tidal Waters: Hard Replace Bridge Breaklines: Hard Line

- 2015-01-01 00:00:00 - The ESRI Terrain is converted to rasters. The rasters are created to pre-defined extents so that multiple rasters are created over the project area. Creating multiple rasters rather than one large raster over a large project area makes the data more manageable to work with. The rasters are created with 2 tiles of overlap. This allows us to ensure seamless coverage and edge-matching in the final tiled product. These rasters were created with a 1 meter cell size.

- 2015-01-01 00:00:00 - The DEMs that are created over large areas are reviewed in ArcGIS with hillshades. Hillshades allow the analyst to view the DEMs in 3D and to more efficiently locate and identify potential issues. The first review is done on the area DEMs as this increases the efficiency of any corrections that may be performed.

Performing corrections on area DEMs allows the analyst to perform corrections on

multiple tiles at once and helps prevent errors from occurring along individual tile seamlines. Analysts review the area DEMs for incorrect water elevations and artifacts that are introduced during the raster creation process.

- 2015-01-01 00:00:00 - The corrected and final area DEMs are clipped to individual tiles. Dewberry uses a proprietary tool that clips the area DEMs to each tile located within the final Tile Grid, names the clipped DEM to the Tile Grid Cell name, and verifies that final extents are correct. All individual tiles are loaded into Global Mapper for the last review. During this last review, an analyst checks to ensure full, complete coverage, no issues along tile boundaries, tiles seamlessly edge-match, and that there are no remaining processing artifacts in the dataset.

- 2015-12-10 00:00:00 - The NOAA Office for Coastal Management (OCM) received the topographic files in classified LAZ format from USGS' ftp site. The data were received in UTM Zone 18N NAD83 coordinates (meters) and vertically referenced to NAVD88 using the Geoid12a model in meters. OCM performed the following processing for data storage and Digital Coast provisioning purposes: 1. LAS files were compressed to LAZ format with LASTools. 2. LAS points which were duplicate or extraneous points (below -25 m) were removed. 3. The LAS files were transformed to geographic (decimal degrees), ellipsoidal coordinates (meters) referenced to the Geoid12a model.

**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/49658>

**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](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=4968>

<https://noaa-nos-coastal-lidar-pds.s3.amazonaws.com/laz/geoid18/4968/index.html>

**7.3. Data access methods or services offered:**

This data can be obtained on-line at the following URL:

<https://coast.noaa.gov/dataviewer/#/lidar/search/where:ID=4968>;

**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.*