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 Lidar DEM; Horry County SC

1.2. Summary description of the data:

This data set is comprised of a hydro-flattened digital elevation model (DEM). The total area collected for Horry County, SC for this project is approximately 1092 square miles. Lidar data was collected and processed to meet the requirements of the project task order. The lidar collection was a collaborative effort between two data acquisition firms. While Woolpert was responsible for collection of the majority of the county, the coastal portion of the data was collected by Quantum Geospatial and is detailed in the processing steps of the metadata. Lidar data is a remotely sensed high resolution elevation data collected by an airborne platform. The lidar sensor uses a combination of laser range finding, GPS positioning, and inertial measurement technologies. The lidar systems collect data point clouds that are used to produce highly detailed Digital Elevation Models (DEMs) of the earth's terrain, man-made structures, and vegetation. The task required the LiDAR data to be collected at a nominal pulse spacing (NPS) of 0.7 meters. The final products include classified LAS, four (4) foot pixel raster DEMs of the bare-earth surface in ERDAS IMG Format. Each LAS file contains lidar point information, which has been calibrated, controlled, and classified. Ground conditions: Water at normal levels; no unusual inundation; no snow. The bare earth DEMs along the coast may have a variance in the water heights due to temporal differences during the lidar data acquisition and will be represented in DEM as a seam-like anomaly. One coastal elevation was applied to entire project area. Due to differing acquisition dates and thus differing tide levels there will be areas in the DEM exhibiting what appears to be " digging" water features. Sometimes as much as approximately 2.5 feet. This was done to ensure that no coastal hydro feature was "floating" above ground surface. This coastal elevation will also affect connected river features wherein a sudden increase in flow will be observed in the DEM to accommodate the coastal elevation value. During Hydrologic breakline collection, Woolpert excluded obvious above-water piers or pier-like structures from the breakline placement. Some features extend beyond the apparent coastline and are constructed in a manner that can be considered an extension of the ground. These features were treated as ground during classification

and subsequent hydrologic delineation. In all cases, professional practice was applied to delineate what appeared to be the coast based on data from multiple sources; Due to the many substructures and the complexity of the urban environment, interpolation and apparent "divots" (caused by tinning) may be evident in the surface of the bare earth DEM. In all cases, professional practice was applied to best represent the topography.

The data received by the NOAA OCM are topographic data in LAS 1.2 format, classified as unclassified (1), ground (2), all noise (7), water (9), ignored ground (10), overlap unclassified (17), and overlap ground (18). Digital Elevation Models (DEMs) and breakline data are also available.

Any conclusions drawn from the analysis of this information are not the responsibility of NOAA, the Office of Coastal Management (OCM) or its partners.

Original contact information:

Contact Org: Woolpert

Phone: (937) 461-5660

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:
2014-01-22 to 2014-01-26, 2014-02-22 to 2014-02-25

1.5. Actual or planned geographic coverage of the data:
W: -79.350005, E: -78.551698, N: 34.308899, S: 33.552285

1.6. Type(s) of data:
(e.g., digital numeric data, imagery, photographs, video, audio, database, tabular data, etc.)

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:
- 2014-02-23 00:00:00 - Using one Leica ALS70 (lidar) system on board a Cessna 404 Titan fixed-wing aircraft, lidar data, at a nominal pulse spacing (NPS) of 0.7 meters, was collected for this task order (approximately 1092 square miles). AGL = 6500 feet - Aircraft Speed = 150 Knots, Field of View (Full) = 40 degrees, Pulse Rate = 272.0 kHz, Scan Rate = 42.3 Hz, with an average side lap of 28.7%. Multiple returns were recorded for each laser pulse along with an intensity value for each return. Five (5) missions were flown between February 22, 2014 and February 25, 2014. One (1) Global Navigation Satellite System (GNSS) Base Station was used in support of the

lidar data acquisition. Specific information regarding latitude, longitude, and ellipsoid height to the L1 phase center is included in the lidar processing report. Multiple returns were recorded for each laser pulse along with an intensity value for each return. The lidar data acquisition parameters for this mission are detailed in the lidar processing report for this task order. For all acquired lidar data as part of entire Horry County Elevation Data and Imagery task order, the geoid used to reduce satellite derived elevations to orthometric heights was GEOID12A. Data for the task order is referenced to the StatePlane Zone of South Carolina, North American Datum of 1983 (2011) International Feet, and NAVD88, in International Feet. Once the data acquisition and GPS processing phases are complete, the lidar data was processed immediately to verify the coverage had no voids. The GPS and IMU data was post processed using differential and Kalman filter algorithms to derive a best estimate of trajectory. The quality of the solution was verified to be consistent with the accuracy requirements of the project. The SBET was used to reduce the lidar slant range measurements to a raw reflective surface for each flight line. The coverage was classified to extract a bare earth digital elevation model (DEM) and separate last returns. The ALS70 calibration and system performance is verified on a periodic basis using Woolpert's calibration range. The calibration range consists of a large building and runway. The edges of the building and control points along the runway have been located using conventional survey methods. Inertial measurement unit (IMU) misalignment angles and horizontal accuracy are calculated by comparing the position of the building edges between opposing flight lines. The scanner scale factor and vertical accuracy is calculated through comparison of lidar data against control points along the runway. Field calibration is performed on all flight lines to refine the IMU misalignment angles. IMU misalignment angles are calculated from the relative displacement of features within the overlap region of adjacent (and opposing) flight lines. The raw lidar data is reduced using the refined misalignment angles.
- 2014-02-23 00:00:00 - Using one Leica ALS50 (lidar) system on board a Cessna 208B fixed-wing aircraft, lidar data, at a nominal pulse spacing (NPS) of 0.3 meters, was collected for the coastal portion of the Horry County AOI. AGL = 1968 feet - Aircraft Speed = 110 Knots, Field of View (Full) = 40 degrees, Pulse Rate = 130.0 kHz, Scan Rate = 42.9 Hz, with an average side lap of 50%. Multiple returns were recorded for each laser pulse along with an intensity value for each return. The collection occurred on two dates: January 22, 2014 and January 26, 2014. The absolute accuracy of the coastal data set was tested by Quantum Geospatial prior to delivery to Woolpert for inclusion to the overall Horry County dataset yielding a result of 2.9 cm RMSEz. The coastal data set was assessed for data coverage, GPS and IMU quality, collection density, and calibration quality by Woolpert prior to merging with the Woolpert collected data for the remainder of the county. Final project accuracy statistical analysis was performed on the merged county and coastal dataset. For all acquired lidar data as part of entire Horry County Elevation Data and Imagery task order, the geoid used to reduce satellite derived elevations to orthometric heights was GEOID12A. Data for the task order is referenced to the

State Plane Zone of South Carolina, North American Datum of 1983 (2011) International Feet, and NAVD88, in International Feet. Once the data acquisition and GPS processing phases are complete, the lidar data was processed immediately to verify the coverage had no voids. The GPS and IMU data was post processed using differential and Kalman filter algorithms to derive a best estimate of trajectory. The quality of the solution was verified to be consistent with the accuracy requirements of the project. The SBET was used to reduce the lidar slant range measurements to a raw reflective surface for each flight line. The coverage was classified to extract a bare earth digital elevation model (DEM) and separate last returns.
- 2014-03-19 00:00:00 - Ground control and QAQC control point survey was performed by Woolpert surveyors, to support the NOAA Horry County Elevation Data and Imagery project. All surveys were performed in such a way as to achieve ground control that supports lidar data at 9.25 cm RMSE accuracy and satisfy a local network accuracy of 5 cm at a 95% confidence level. All ground control survey field activities took place from 03/18/2014 through 03/22/14. Woolpert collected control data for data processing as supplemental QAQC points. The supplemental QAQC points were collected to be used in independent accuracy testing. The survey was performed using one (1) Trimble Navigation R8 Model 3 GNSS dual frequency GPS receiver with Air Link Communications Raven CDMA cellular modem, one (1) Trimble Navigation R8 Model 2 receiver, one (1) Trimble Navigation R8 receiver, and one (1) Trimble Navigation R8 Model 3 GNSS dual frequency GPS receiver with Air Link Communications Raven CDMA cellular modem as a rover. Woolpert surveyors,utilizing Real-Time Kinematic GPS techniques, made observations on 27 ground control points and 21 quality control check points using 1-second epoch rates and observations of 60 to 180 seconds. Each station was occupied twice to insure necessary horizontal and vertical accuracies. All GPS ground control observations were processed using Trimble Navigation's Trimble Business Center. All horizontal GPS control was based on South Carolina State Plane Zone (3900), NAD83(2011) expressed in International Feet. The vertical datum used for this project was based on the North American Vertical Datum of 1988 (NAVD88), GEOID12A, also expressed in International Feet.
- 2014-02-23 00:00:00 - The individual flight lines were inspected to ensure the systematic and residual errors have been identified and removed. Then, the flight lines were compared to adjacent flight lines for any mismatches to obtain a homogeneous coverage throughout the project area. The point cloud underwent a classification process to determine bare-earth points and non-ground points utilizing "first and only" as well as "last of many" lidar returns. This process determined Default (Class 1), Ground (Class 2), Noise (Class 7), Water (Class 9), Ignored Ground (Class 10), Overlap Default (Class 17) and Overlap Ground (Class 18). The bare-earth (Class 2 - Ground) lidar points underwent a manual QA/QC step to verify the quality of the DEM as well as a peer-based QC review. This included a review of the DEM surface to remove artifacts and ensure topographic quality. Classification of water (class 9) and ignored ground (class 10) was completed via the

use of the hydrologic breaklines collected for the hydro-flattening phase. The overlap classes were determined by first identifying the overlapping areas and reclassifying the LAS data by offset from a corridor. This allows the returns located on the edge of the swath to be removed from the bare earth coverage in an effort to produce a more uniform data density. The returns determined to be overlap are then further classified to produce overlap default (class 17) and overlap ground (class 18). The surveyed ground control points are used to make vertical adjustments to the data set and to perform the accuracy checks and statistical analysis of the lidar dataset. Supervisory QC monitoring of work in progress and completed editing ensured consistency of classification character and adherence to project requirements across the entire project area. The resulting deliverables for this task order consist of classified LAS file in LAS 1.2 format, 4 feet pixel size DEM files in ERDAS IMG format, and Hydrologic Breakline, Flightline Vector, and Control Point data in ESRI Geodatabase format.
- 2014-02-23 00:00:00 - The individual flight lines were inspected to ensure the systematic and residual errors have been identified and removed. Then, the flight lines were compared to adjacent flight lines for any mismatches to obtain a homogeneous coverage throughout the project area. The point cloud underwent a classification process to determine bare-earth points and non-ground points utilizing "first and only" as well as "last of many" lidar returns. This process determined Default (Class 1), Ground (Class 2), Noise (Class 7), Water (Class 9), Ignored Ground (Class 10), Overlap Default (Class 17) and Overlap Ground (Class 18). The bare-earth (Class 2 - Ground) lidar points underwent a manual QA/QC step to verify the quality of the DEM as well as a peer-based QC review. This included a review of the DEM surface to remove artifacts and ensure topographic quality. Classification of water (class 9) and ignored ground (class 10) was completed via the use of the hydrologic breaklines collected for the hydro-flattening phase. The overlap classes were determined by first identifying the overlapping areas and reclassifying the LAS data by offset from a corridor. This allows the returns located on the edge of the swath to be removed from the bare earth coverage in an effort to produce a more uniform data density. The returns determined to be overlap are then further classified to produce overlap default (class 17) and overlap ground (class 18). The surveyed ground control points are used to make vertical adjustments to the data set and to perform the accuracy checks and statistical analysis of the lidar dataset. Supervisory QC monitoring of work in progress and completed editing ensured consistency of classification character and adherence to project requirements across the entire project area. The hydrologic breaklines were produced according to USGSv1.0 specifications. The compilation procedure included use of lidar intensity, bare earth surface model, point cloud data, open source imagery in an effort to manually compile hydrologic features in a 2-d environment. Following the compilation phase, a separate process was used to adjust the breakline data to best match the water level at the time of the lidar collection. Any ponds and/or lakes were adjusted to be at or just below the bank and to be at a constant elevation. Any streams were adjusted to be at or just below

the bank and to be monotonic. Manual QAQC and peer-based QC review was performed on all delineated data to ensure horizontal placement quality and on all adjusted data to ensure vertical placement quality. The final hydrologic breakline product was delivered in ESRI Geodatabase format and was also used in the processing of the DEM deliverable. The resulting deliverables for this task order consist of classified LAS file in LAS 1.2 format, 4 feet pixel size DEM files in ERDAS IMG format, and Hydrologic Breakline, Flightline Vector, and Control Point data in ESRI Geodatabase format.
- 2014-02-23 00:00:00 - Tile Size: 5,000ft x 5,000ft. The tile file name was derived from the southwest corner of each tile. Project data extent was provided by NOAA and subsequently buffered by 1 kilometer and provided in shape file format. Project deliverables were clipped to the 1 kilometer data extent.
- 2014-02-26 00:00:00 - The flightline vectors were generated by importing the Raw LAS strips into Geocue software. Bounding polygons are created around each individual swath. The polygons were exported to shapefile and a centerline was generated for each. Attribution was added to each flightline in the form of line number, date of acquisition, and start/stop times.
- 2015-02-04 00:00:00 - The NOAA Office for Coastal Management (OCM) received 1488 files in .img format from Woolpert. The files contained hydroflattened DEM data. The data were in State Plane South Carolina FIPS 3900 NAD 1983 (2011) Intl Ft coordinates and North American Vertical Datum of 1988 (GEOID12A) Intl Ft heights. OCM performed the following processing: 1. IMG files were converted to tif format using gdal_translate. 2. The raster files were copied to database and https for Digital Coast storage and provisioning purposes

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:
- 1.6. Type(s) of data
- 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/57194

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=8820/details/8820
https://noaa-nos-coastal-lidar-pds.s3.us-east-1.amazonaws.com/dem/SC_Horry_DEM_2014_8820/

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=4814 The data set is dynamically generated based on user-specified parameters.;

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.