Interagency Working Group On
Ocean And Coastal Mapping

The National Coastal Mapping Strategy (NCMS)

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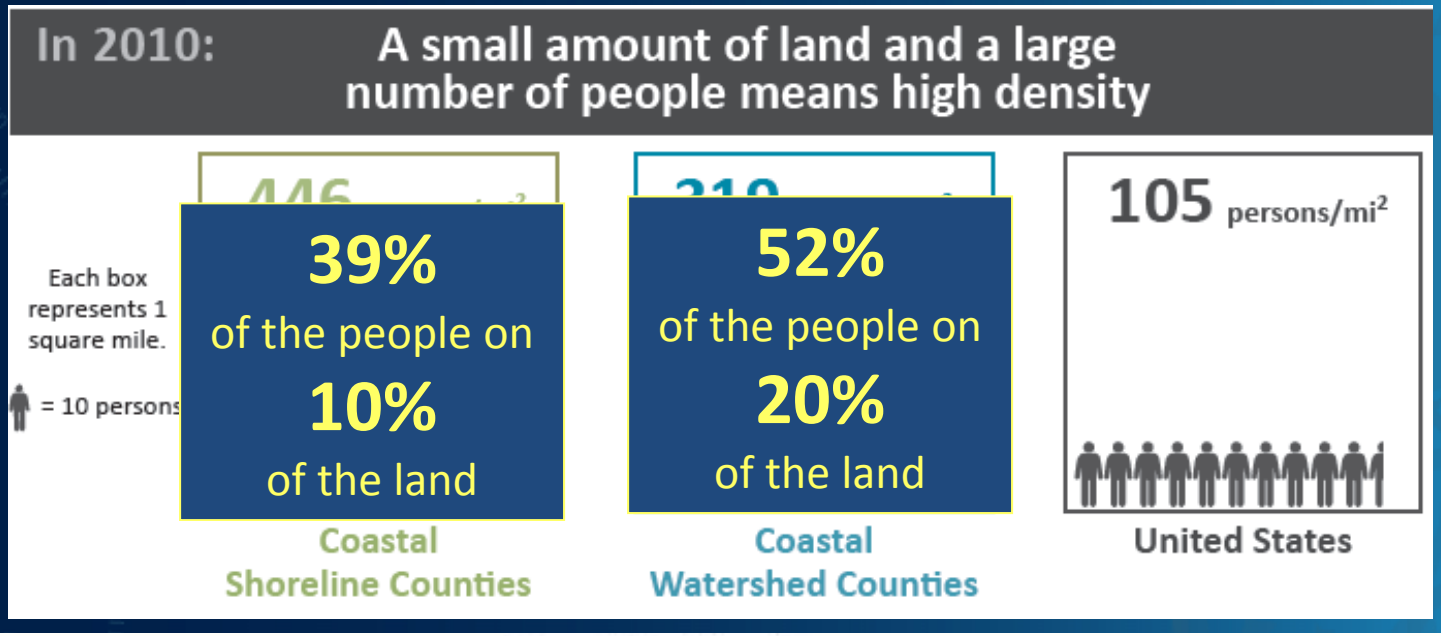
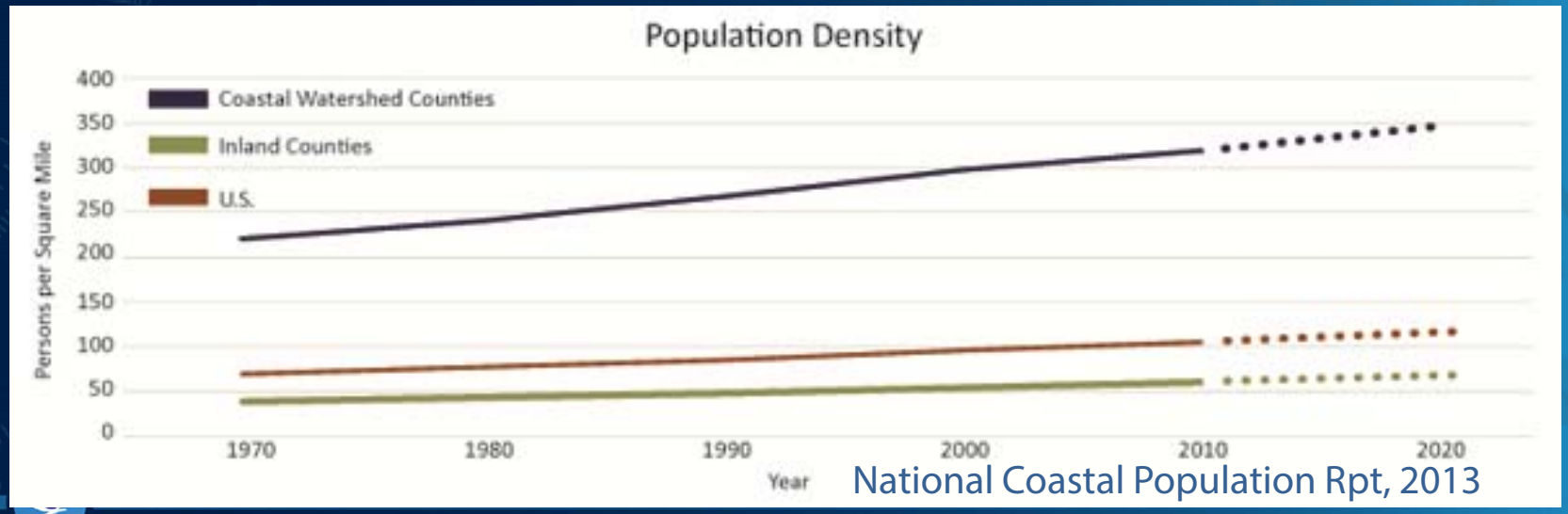
15th Annual JALBTCX Airborne Coastal Mapping and Charting Workshop

10-12 June 2014

Americans Need Resilient Coasts

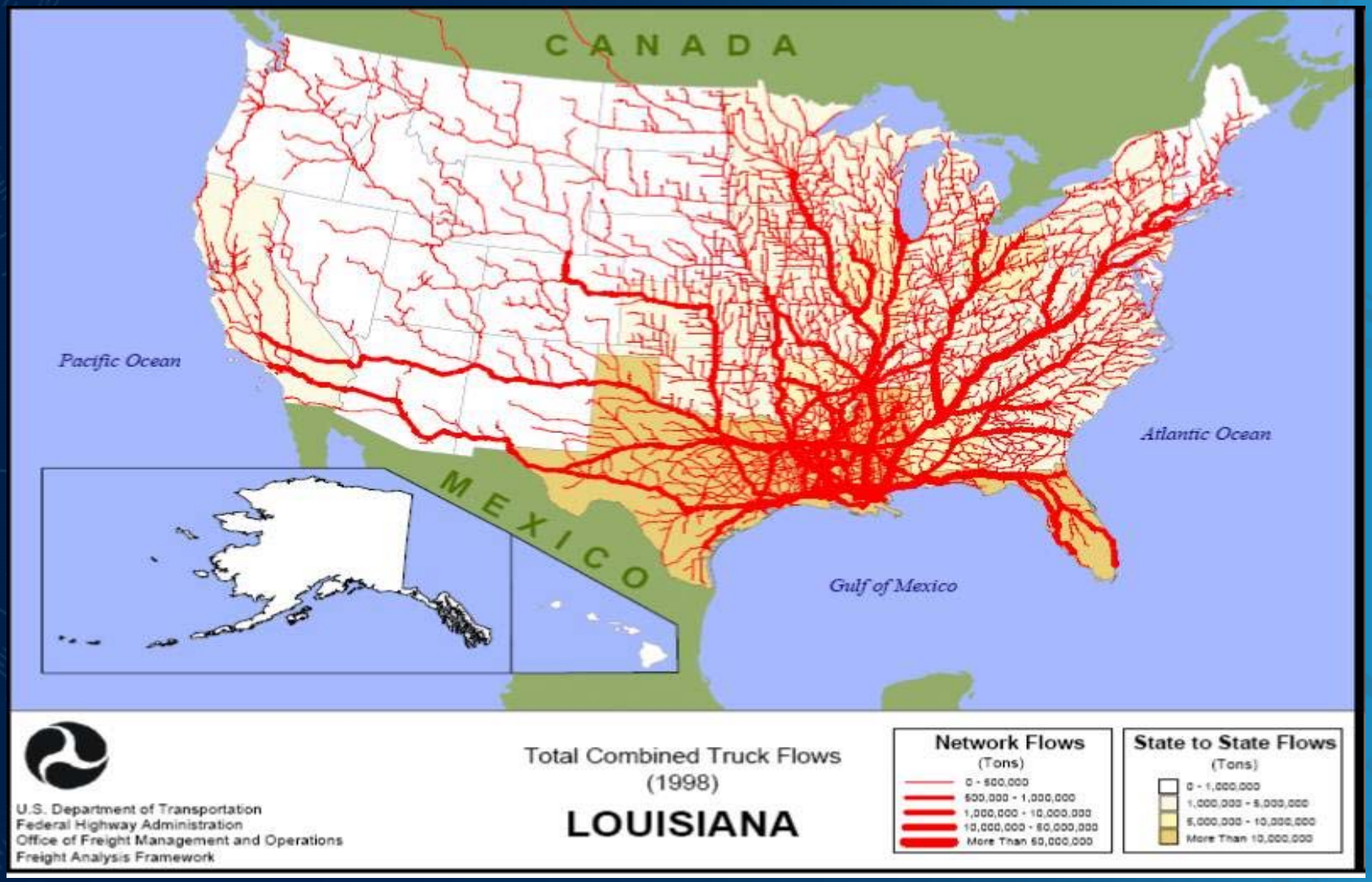
Coastal Communities:
Steadily Growing





National Coastal Population Rpt, 2013

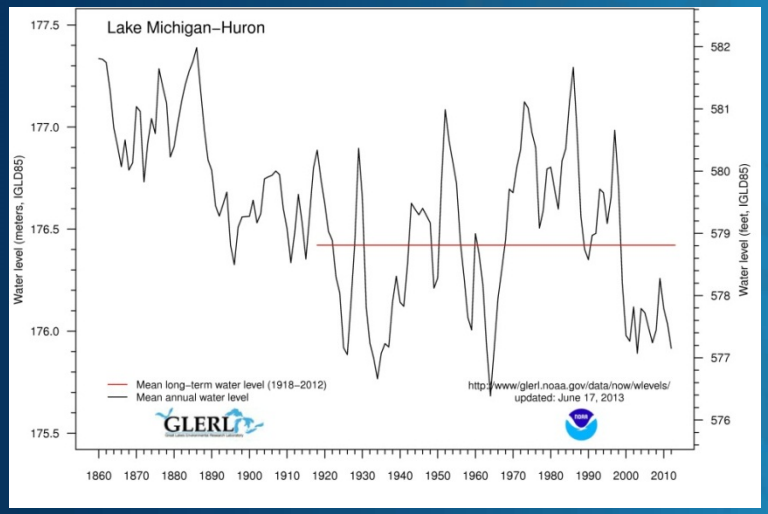
A Coastal Nation



Coastal Economies:
Vital to U.S. and International Markets

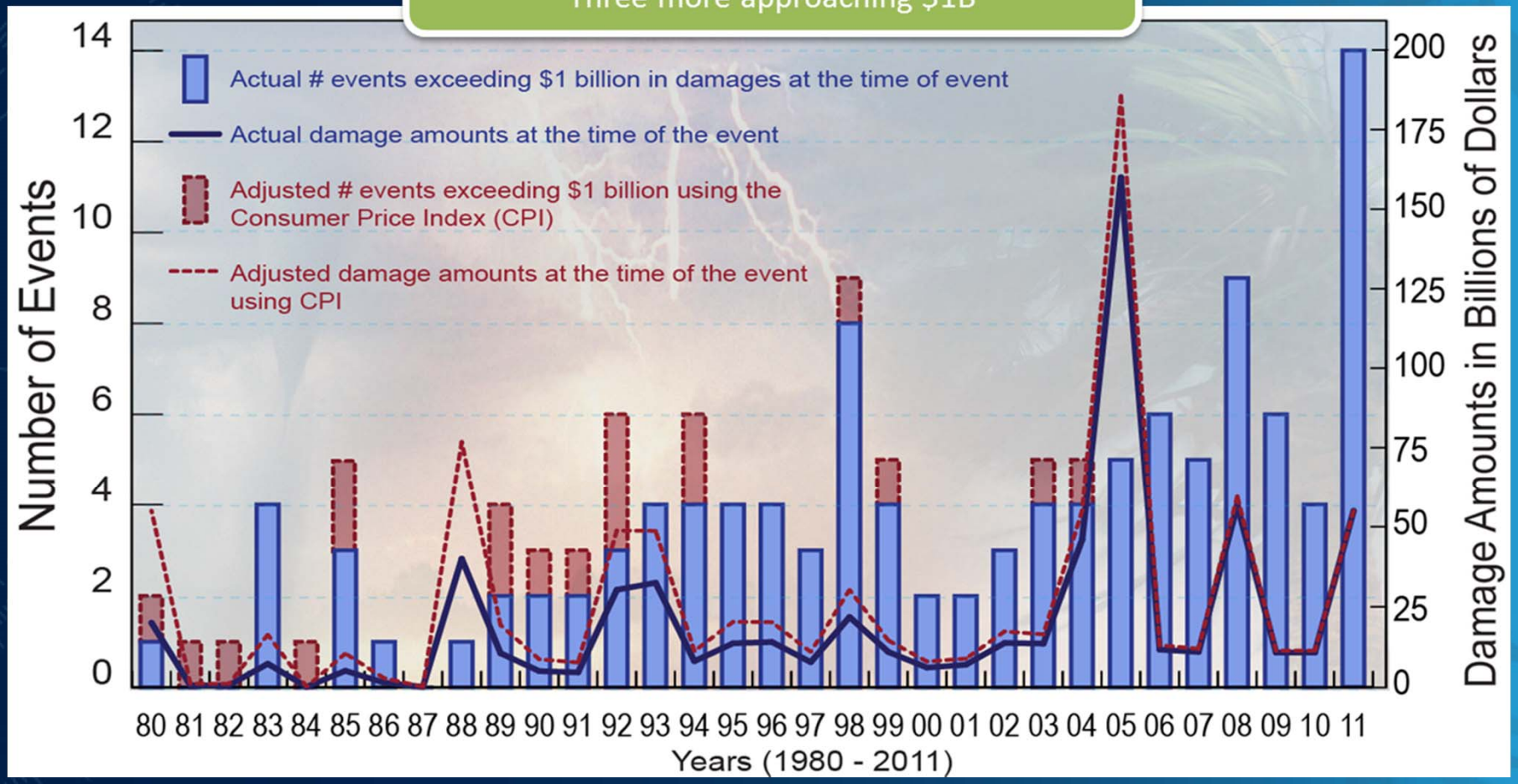
- 98% of products in U.S reach us through ports.
- 45% of U.S. GDP is generated in coastal shoreline counties.
  - $6.6 trillion
  - 51 million jobs & $2.8 trillion in wages
- Coastal tourism and recreation is significant portion of U.S. economy.
  - Beach recreation alone ~$30 billion annually.

What Does the Future Hold?



Billion Dollar Disasters: Fact of Life

A Record 14 Disasters in the U.S. in 2011
Three more approaching $1B

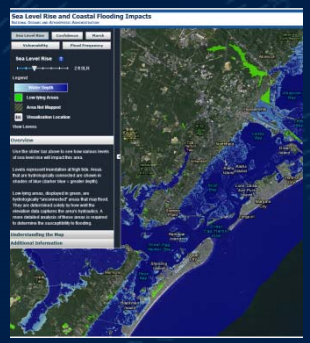


Source: NOAA

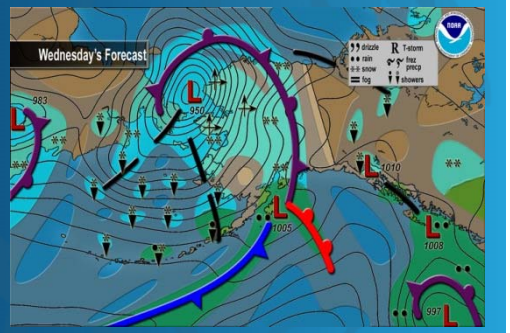
Coastal Mapping Data

Planning for Long-Term Resilience

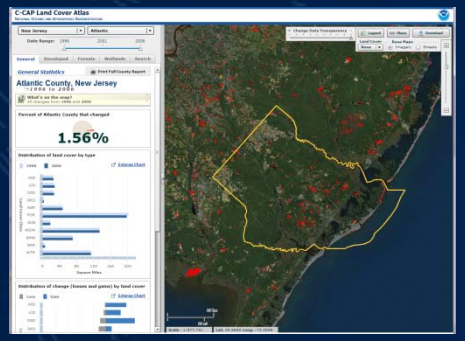
Promoting Resilience to Coastal Hazards and Climate Change

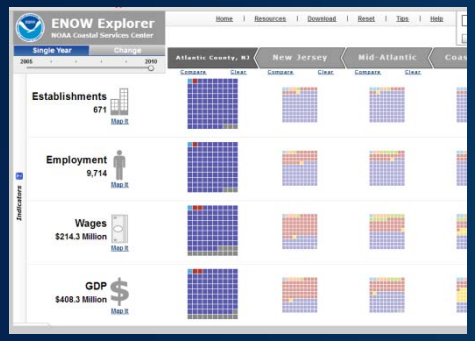


Building a Weather-Ready Nation



Supporting Community Livability





Ensuring Safe, Efficient, and Environmentally Sound Navigation

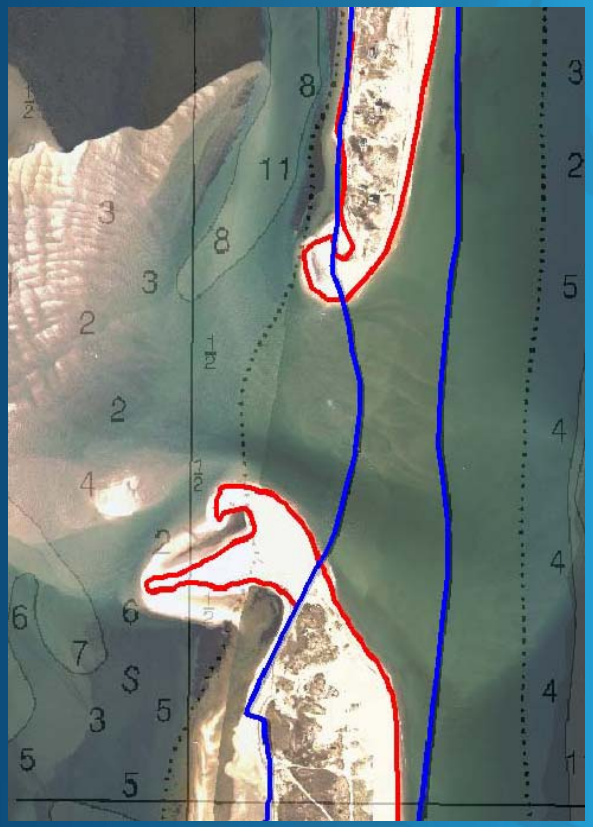
Opportunities

Maximizing Benefits of OCM Data

Oceans, coasts = economy, safety…

- Navigation, transportation, security
- Climate change and hazard resiliency
- Ecosystem-based management
- Energy siting and resource extraction

…Overlapping data requirements



Why a National Coastal Mapping Strategy

- Ocean and Coastal Mapping Integration Act of 2009 (33 U.S.C. 3504; Sec. 12205 of P.L. 111-11): need a "coordinated and comprehensive federal ocean and coastal mapping plan," which includes a focus on "cost-effective, cooperative mapping efforts."
  - Interagency Working Group on Ocean and Coastal Mapping Action: "develop an annually updated National Ocean and Coastal Mapping Plan…"

Ocean and Coastal Mapping Integration Act

(PUBLIC LAW 111-11, 3.3.2009)

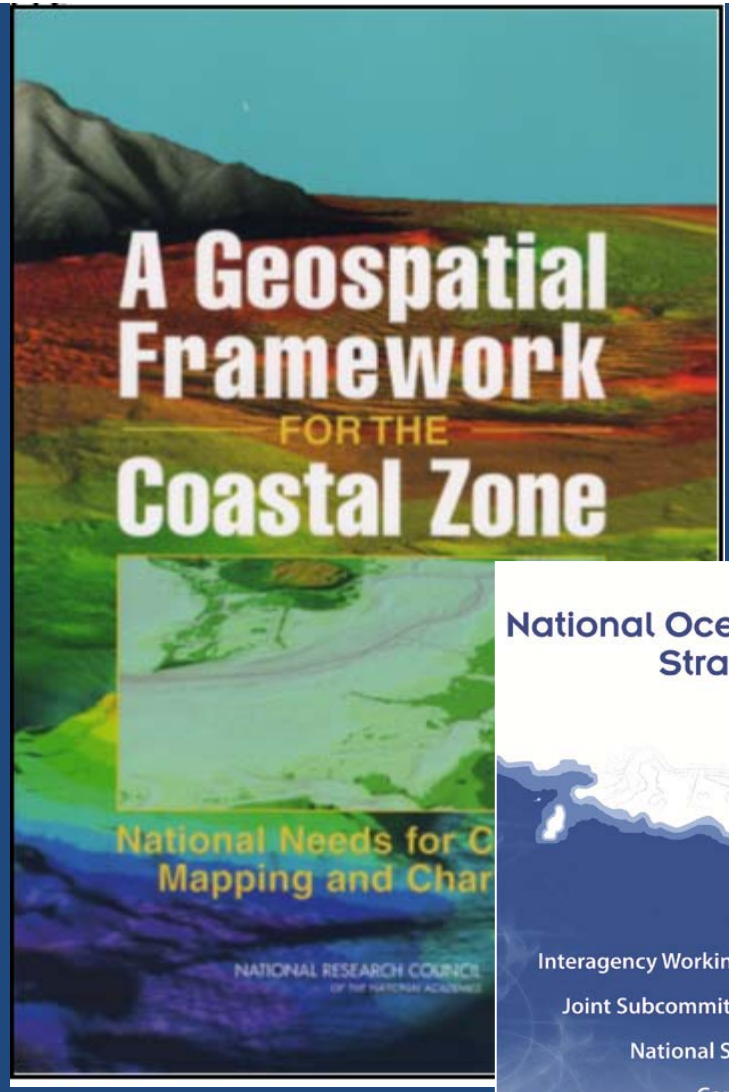
SEC. 12202. ESTABLISHMENT OF PROGRAM.
a)IN GENERAL.—The President... shall establish a program to develop a coordinated and comprehensive Federal ocean and coastal mapping plan for the Great Lakes and coastal state waters, the territorial sea, the exclusive economic zone, and the continental shelf of the United States that enhances ecosystem approaches in decision-making for conservation and management of marine resources and habitats, establishes research and mapping priorities, supports the siting of research and other platforms, and advances ocean and coastal science.
b)MEMBERSHIP.—The Committee shall be comprised of… the National Oceanic and Atmospheric Administration, the Department of the Interior, the National Science Foundation, the Department of Defense, the Environmental Protection Agency, the Department of Homeland Security, the National Aeronautics and Space Administration, and other appropriate Federal agencies involved in ocean and coastal mapping.

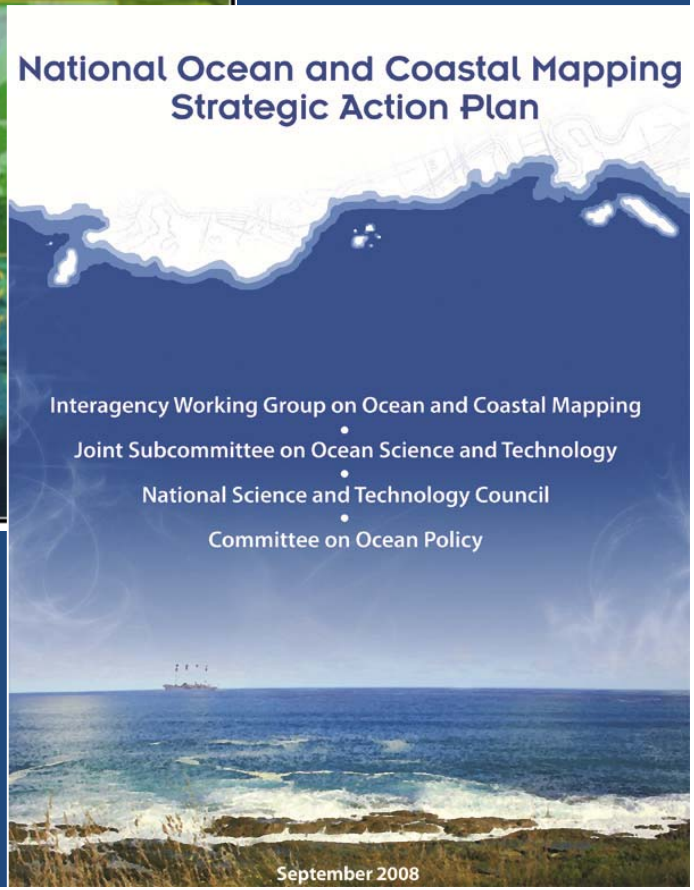
WHO:

- NOAA
- USGS
- USACE
- NAVOCEANO
- BOEM
- NSF
- NGA
- USCG
- EPA
- FEMA
- NASA
- *and other appropriate Federal agencies involved in ocean and coastal mapping.*

IWG-OCM

- Sits under the Subcommittee on Ocean Science and Technology (SOST) of the National Science and Technology Council Committee on Environment and Natural Resources (CENR)
- Co-chaired by NOAA, USGS, and USACE
- Charged with facilitating "the coordination of ocean and coastal mapping activities and avoid[ing] duplicating mapping activities…"





More Why

National Ocean Policy Implementation Plan –

- ***Advance our mapping and charting capabilities and products to support a range of economic activities.***
- ***Develop and share decision-support tools to identify coastal land protection and restoration priorities.***
  - IWG-OCM Actions: "Develop an interagency plan for topographic (primarily LiDAR or equivalent accuracy) and shallow bathymetric mapping to ensure comprehensive and accurate elevation information for coastlines.
  - Develop an annually updated National Ocean and Coastal Mapping Plan… that defines priority mapping needs and gaps, and implement the plan through interagency collaboration in planning, budgeting, and execution.

Interagency Working Group On
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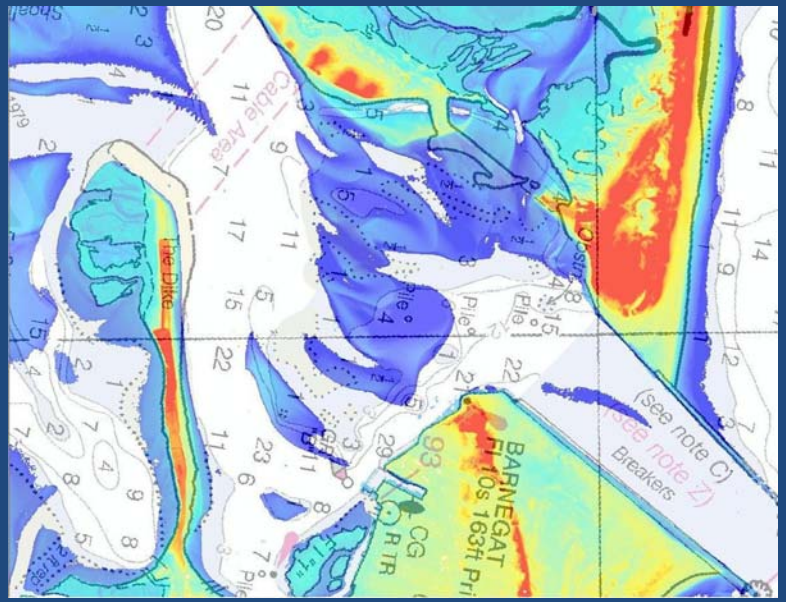
National Coastal Mapping Strategy

Interagency Plan for Coordinated Mapping of Shoreline and the Littoral Zone

- **GOAL:**
  - To survey/map the Nation's coasts/nearshore areas on a 5-8 year cycle for multipurpose use
  - Repeat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National Coastal Mapping Strategy

Interagency Plan for Coordinated Mapping of Shoreline and the Littoral Zone

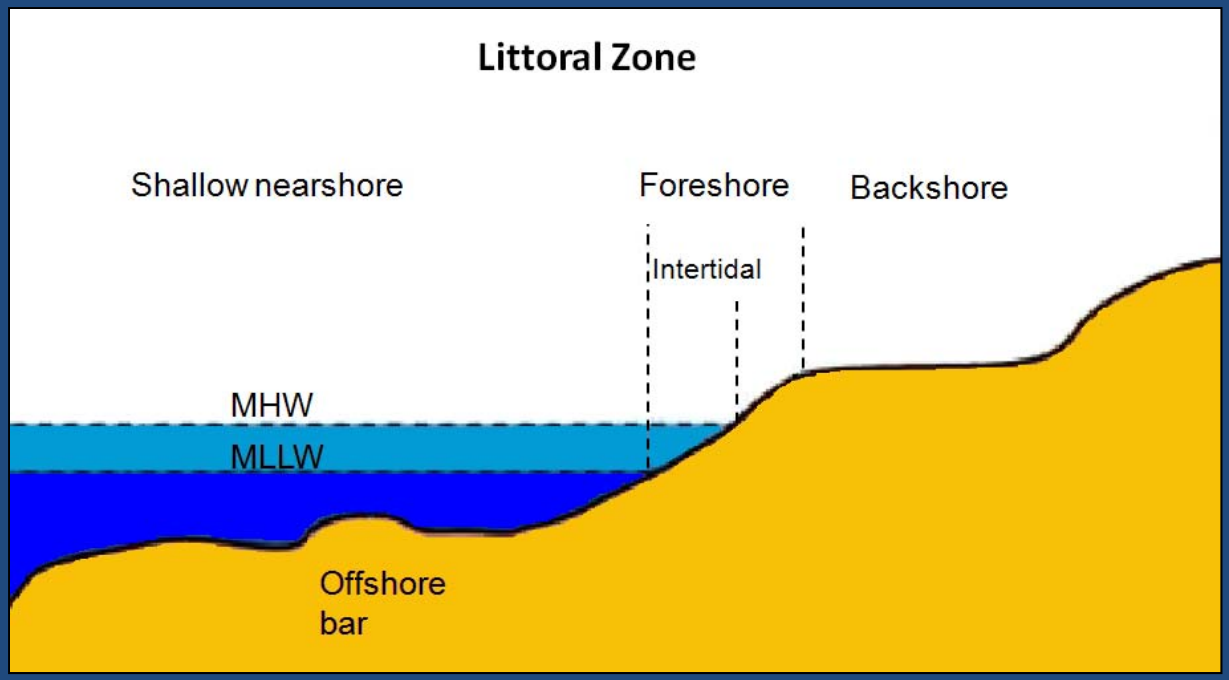
- **Initial Mapping Strategy in development**
  - Builds on existing partnerships
  - High priority data need

<u>Four Main Components:</u>

- Long term planning and Annual Summit for coordination
- Common standards;
- Whole life cycle approach to data;
- R&D on new tool and techniques for data collection and use.

Strategy

- Focus initially on:
  - Shoreline
  - Littoral zone
  - Coastal lidar



Q: Why this initial focus?

- A: **JALBTCX** is already making good progress on coordinating federal mapping activities focused on the littoral zone and lidar
  - Annual JALBTCX Tech Workshops
  - Quarterly interagency coordination meetings and annual face-to-face meeting
  - Existing specifications initiatives
- Challenging environment for data acquisition
- High priority data need
- Consistent with NOP-IP

2009 JALBTCX "Common Specifications" initiatives

Joint Airborne Lidar Bathymetry Technical Center of Expertise

Interagency (USACE, NAVO, NOAA, and USGS) consortium

JALBTCX
Joint Airborne Lidar Bathymetry Technical Center of Expertise

The specifications on the following pages are by-products of the "LIDAR Survey Specifications Summit Meeting", hosted by JALBTCX in Jan. 2009.

Prior to the conference, the four sponsoring agencies (NAVOCEANO, USACE, NOAA and USGS) each listed their specifications within their own agency [e.g. blue rectangle below]. Thoughout the conference, these standards were compared and some instances, one standard was considered to be the best practice and declared to be a consensus item [e.g. green rectangle below], while other parameters that still remain up to debate (or at least are agency specific) are outlined in red.

In most cases, the consensus specifications are subdivided depending on the application of the data (i.e. is the survey purpose for nautical charting or environmental assessment.

Topographic lidar	NAVOCEANO	USACE	NOAA	USGS	Consensus Items (application dependent) Charting	Coastal Mapping, etc.
Product Information						
horizontal datum	WGS84	NAD83	NAD83	WSG84(G1150)		
vertical datum	chart datum (MLLW)	NAVD88	MHW / MLLW	WSG84(G1150)		
horizontal accuracy	altitude dependant, < 0.38 m	2 m 2σ	1 m, or as specified in project instructions	1 m	2.0m at 2σ	
vertical accuracy	altitude dependant, < 0.37	25 cm 2σ	15 cm RMSE, or as specified in project instructions	15 cm	0.3m at 2σ	

Individual Agency Specifications

National Coastal Mapping Strategy

Component 1: Annual Coastal Mapping Summit

Coordination of coastal mapping plans
and activities

- Convened annually to address the geospatial lifecycle of mapping data, from planning and collection through data archive and access.
- Goal: to coordinate both long-term data needs across the participating agencies and coordinate near-term project plans.
- Mapping plans and requirements will be made available to agencies in advance of the Summit using a simple, web-based geospatial tool such as SeaSketch.
- Areas of overlap will be identified at the Summit and evaluated for coordination opportunities. Post-Summit discussions will occur remotely to outline coordination specifics.

National Coastal Mapping Strategy

Component 2: Common Standards

- 2009 Common Specifications effort was a great start, but we have the following challenges:
  - While the Matrix did an excellent job of capturing the specifications of the different interagency partners in one place, there was relatively little consolidation of specs
  - Technology and agency needs have evolved and specs have changed since 2009
- NCMS Component 2 goal:
  - Build on the 2009 JALBTCX efforts and take next steps towards addressing these challenges

National Coastal Mapping Strategy

Component 2

- How to get there?
  - Consolidation across agencies on a single specification for coastal mapping remains the ultimate goal
  - But, it's also extremely challenging, as there are significant budgetary implications (e.g., adopting the most stringent spec requires other agencies to expend more $ for the same amount of mapping, and probably without any increase to budget)

1) Limit initial focus to *lidar* coastal mapping
2) Start with critical first task: define consistent coastal lidar quality levels, which form a key component of any spec

National Coastal Mapping Strategy

Component 2

- What lidar Quality Levels are:
  - A means of consistently comparing specifications across agencies and coordinating acquisition to meet cross-agency needs
  - A primary component of a specification
  - Specified in terms of vertical uncertainty ("accuracy"), point density, and equivalent nominal point spacing
- What lidar Quality Levels are *not*:
  - A complete specification, in and of themselves
    - Reason: full agency specs for coastal lidar typically include a number of additional components, such as QA/QC requirements, formats for deliverables, ancillary data requirements, etc.

National Coastal Mapping Strategy

Component 2

Bathy Lidar Quality Level	Source	Vertical RMSE, (m)	Nominal Pulse Spacing (m)	Point Density (pt/m^2)	Corresponding 3DEP/topo-lidar QL
$QL1_B$	Bathy or Topo-Bathy Lidar	0.095 + 0.00275D	0.7	2.04	QL2 (note: D=0 for land)
$QL2_B$	Bathy or Topo-Bathy Lidar	0.095 + 0.00275D	2.0	0.25	No exact match
$QL3_B$	Bathy or Topo-Bathy Lidar	0.185 + 0.00275D	2.0	0.25	RMSE equivalent to QL3
$QL4_B$	Bathy or Topo-Bathy Lidar	0.185 + 0.00275D	5.0	0.04	RMSE equivalent to QL3; Point density equivalent to QL4 and QL5
$QL5_B$	Bathy or Topo-Bathy Lidar	0.463 + 0.00275D	5.0	0.04	Point density equivalent to QL4 and QL5

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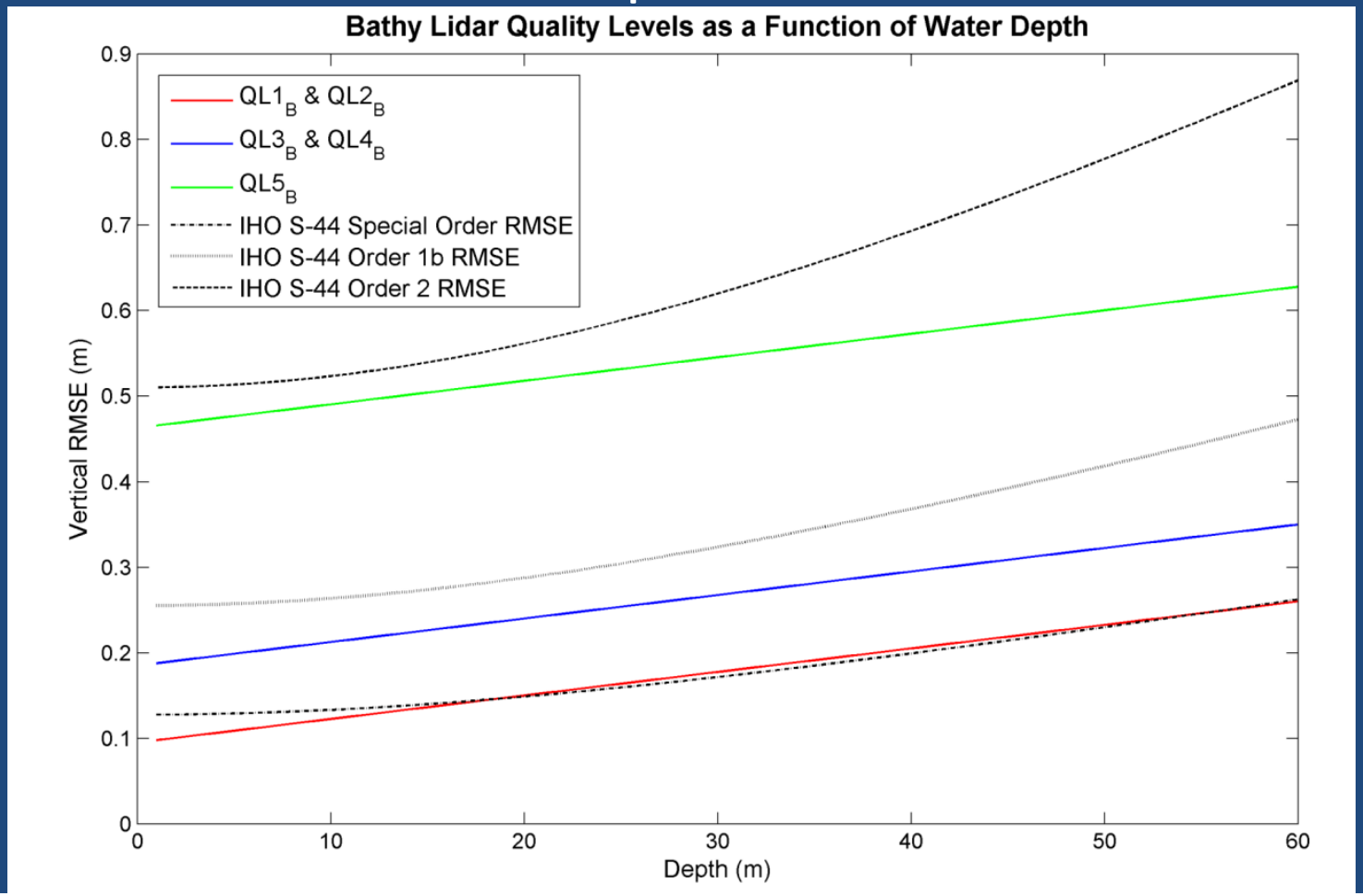
National Coastal Mapping Strategy

Component 2



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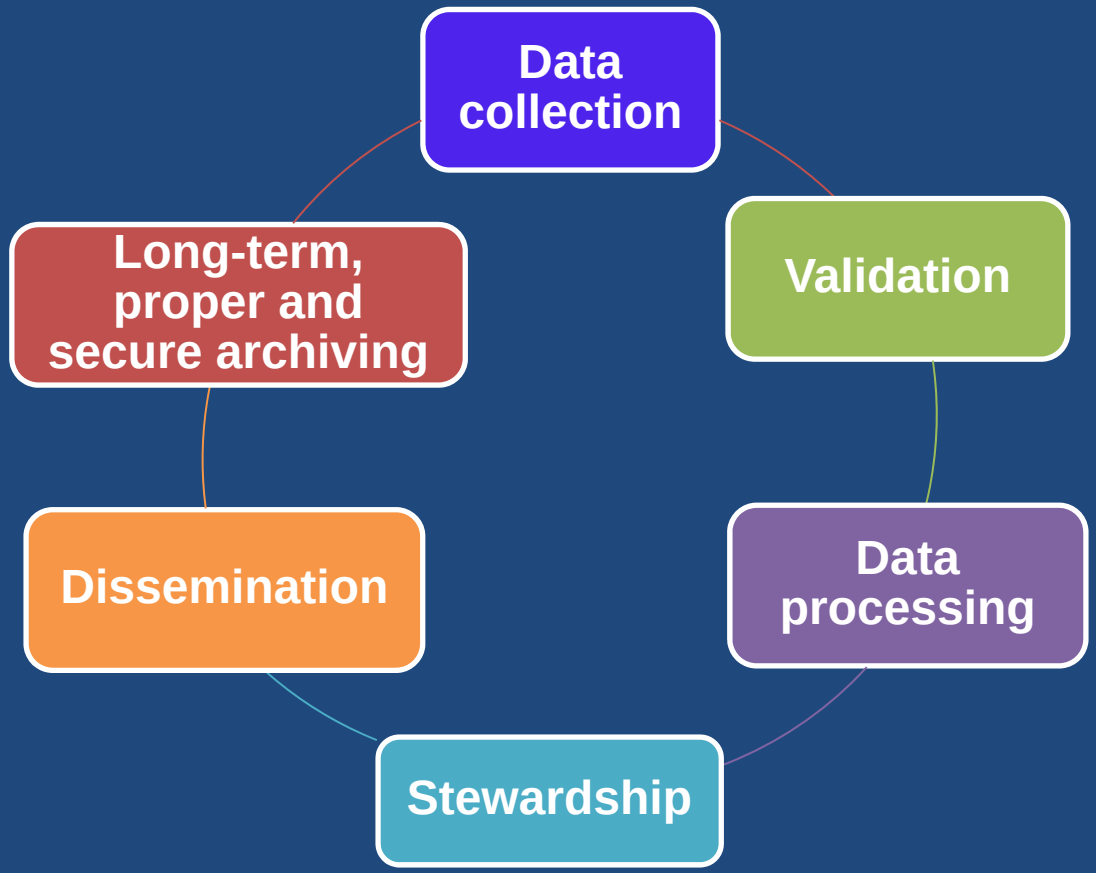
Ocean And Coastal Mapping

National Coastal Mapping Strategy

Component 3: Common data management procedures



"Whole Life Cycle" Data Approach

National Coastal Mapping Strategy

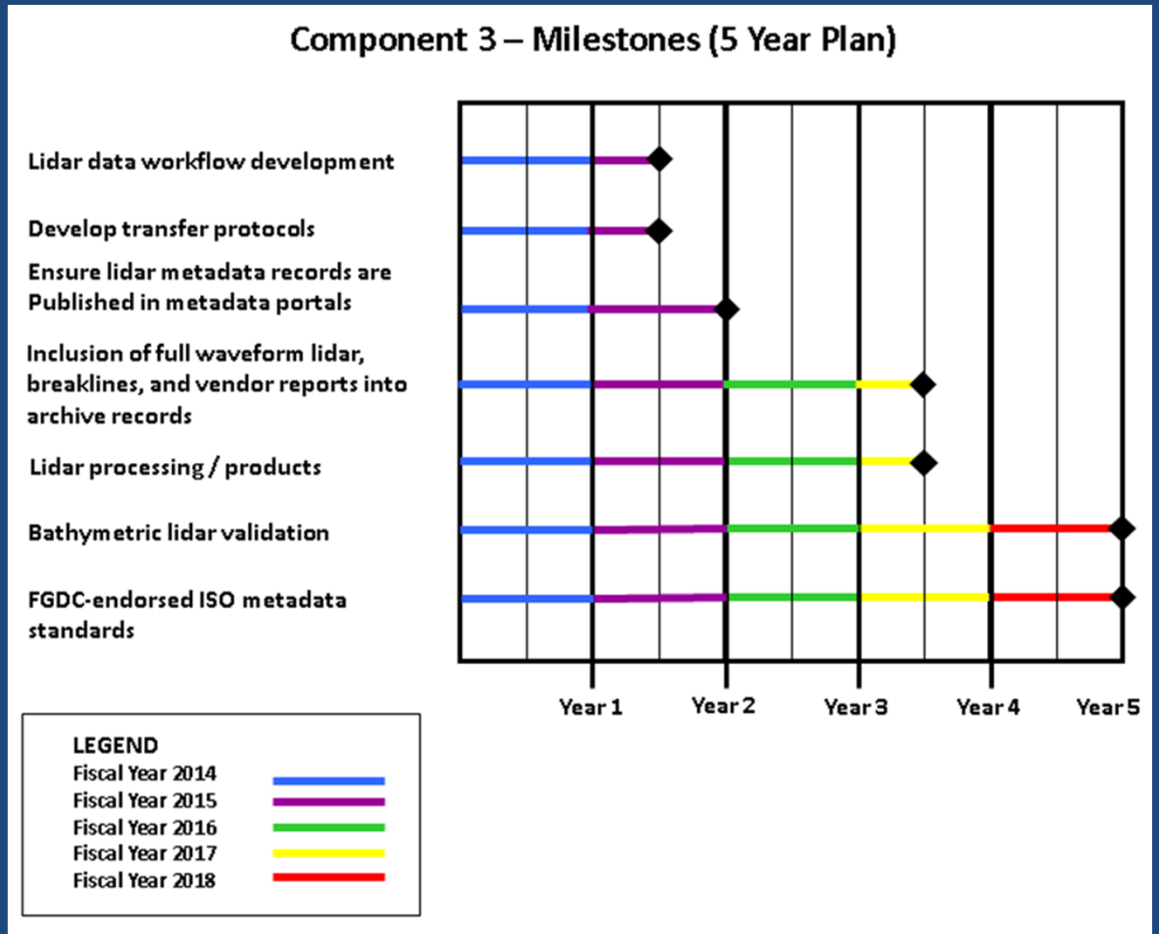
Component 3: Common data management procedures

- Long Term Goals:
  - Work with the lidar community and metadata portals to develop and implement best practices for describing topographic and bathymetric lidar data within **FGDC-endorsed ISO metadata** standards
  - Develop methods to **validate bathymetric lidar measurements using independent datasets**
  - Develop procedures for **standardizing the creation of meaningful products**, such as, converting data to more useful file formats, and ensuring that the lidar data is classified using ASPRS specifications
  - Develop and implement **procedures for the comparing of lidar data repositories** to ensure that all littoral lidar data are properly archived, and to reduce data duplication between archives
  - **Include full waveform lidar data**, any vendor supplied breaklines, and associated vendor quality and accuracy reports into the archive record, and potentially include in public delivery

Interagency Working Group On
Ocean And Coastal Mapping

National Coastal Mapping Strategy

Component 3: Common data management procedures



National Coastal Mapping Strategy

Component 4: Consensus on targeted research and development

- Topographic and bathymetric lidar and other coastal mapping technologies are rapidly evolving, thus it is critical for Federal coastal mapping agencies to maintain active research and development (R&D programs).

- Given current budget constraints, it is equally critical for agencies to coordinate their R&D efforts, in order to leverage one another's capabilities and stretch limited research dollars.

- While R&D priorities typically vary from agency to agency, there are broad research topic areas that are of mutual interest to Federal coastal mapping agencies, including:
  - New sensor technologies (to improve quality and timeliness of data collection)
  - Algorithms (to process raw data and create usable data and products)
  - New uses of the data (e.g., to address coastal management and science questions)

National Coastal Mapping Strategy

Component 4: Consensus on targeted research and development

There is currently no formal structure in place for coordinating coastal mapping R&D efforts and establishing new collaborative research projects. To address this need, the following actions are strongly recommended:

- **Establish an Interagency Coastal Lidar R&D Committee (CLRDC):**
  - The CLRDC would report to the IWG-OCM and would provide biannual briefings to the IWG-OCM.
  - Representatives would be appointed by each Federal coastal mapping agency and would typically consist of senior technical staff.
  - The CLRDC would convene in person annually, either after the JALBTCX Workshop or during the Annual Coastal Mapping Coordination Summit, and would hold quarterly teleconferences.

- Define a formal process for selecting sanctioning collaborative R&D initiatives process.

National Coastal Mapping Strategy

Component 4: Consensus on targeted research and development

Proposed formal process for selecting sanctioning collaborative R&D initiatives:

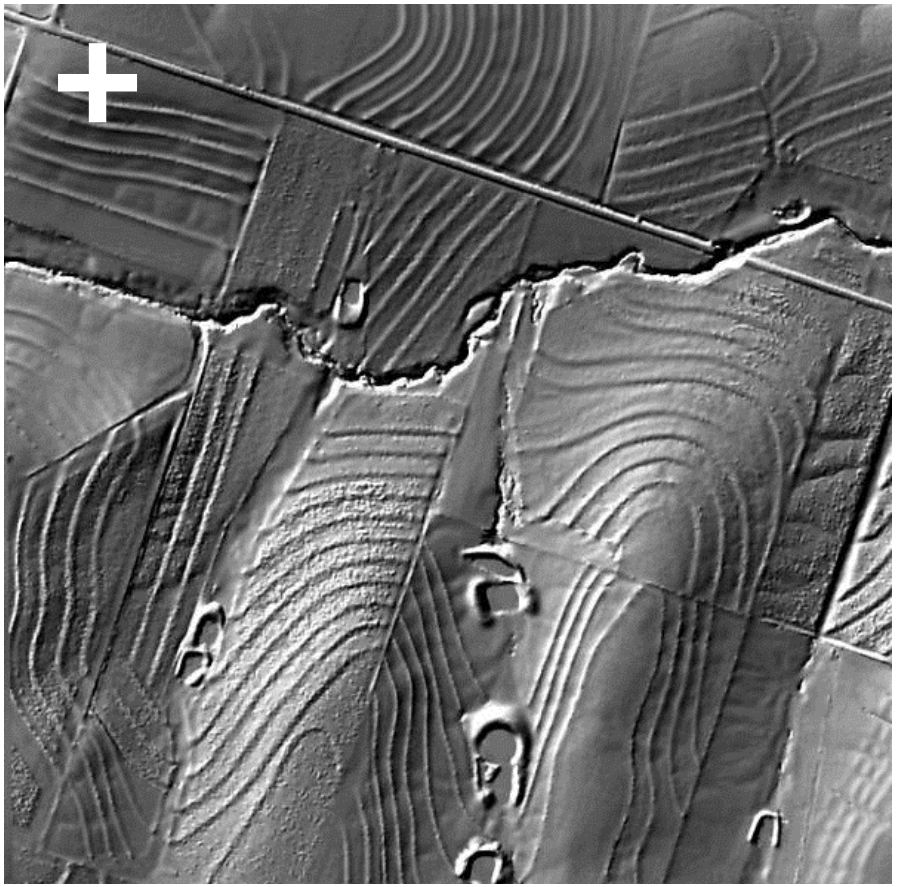
- The CLRDC would annually solicit research topics from the member agencies.
- Respondents would submit a proposal describing the topic, motivation, interagency collaborators, funding level and anticipated outcomes (e.g., technical reports or papers, new operational procedures or products, new processing algorithms, etc.).
- The CLRDC reviews proposals and selects those to be supported, based on technical merit, feasibility, cross-agency interest, and budget considerations. The CLRDC then presents the list of selected topics to the IWG-OCM.
- The IWG-OCM gives final approval for the selected topics and will seek funding from the applicable agencies to support the collaborative R&D projects identified through this process.

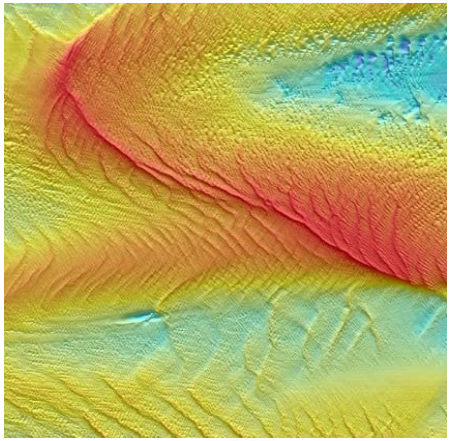
National Coastal Mapping Strategy

Component 4: Consensus on targeted research and development

The IWG-OCM has thus far identified the following prospective R&D topics for interagency cooperation:

- Use of satellite imagery to determine water clarity as a function of season, tide stage, etc. for lidar project planning.
- Marine debris mapping and submerged object detection.
- Seafloor habitat mapping from bathymetric lidar.
- Total propagated uncertainty (TPU) for shoreline and other data products derived from coastal, topo-bathy lidar.
- Satellite-derived bathymetry
- Enhanced analysis of coastal salt marshes (e.g., marsh migration, estimation of biophysical parameters, etc.) from lidar waveform data.
- Enhanced storm vulnerability analysis.
- Development of a Coastal Engineering Index (CEI).





Coordination of IWG-OCM and 3DEP Acquisition Planning for Airborne Lidar in the US Coastal Zone

Aligning 3DEP Plan and IWG-OCM National Coastal Mapping Strategy

Rationale:

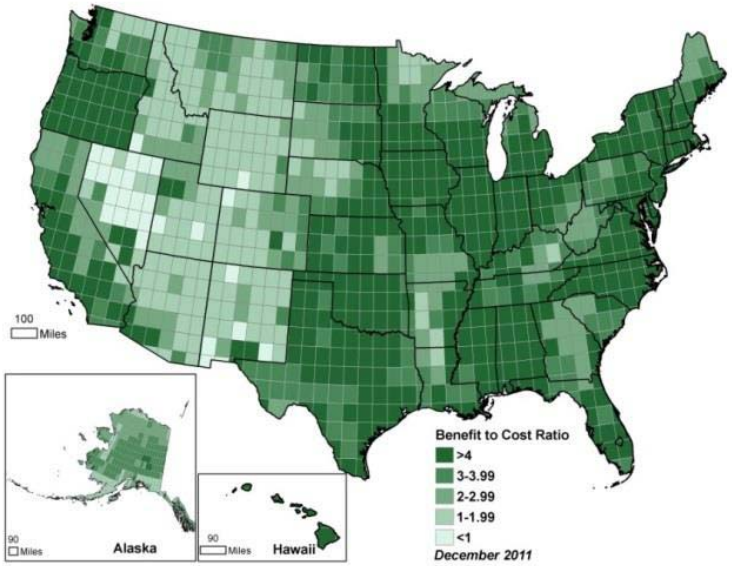
- Common members
- Complementary initiatives
- Zone of overlapping interest – topography and bathymetry along coasts for a seamless elevation picture
- Consistency and coordination key
  - Standards/specs and Quality Levels coordination
  - Planning schedules
- Federal agencies must leverage joint capabilities, eliminate duplication, maximize mapping resources

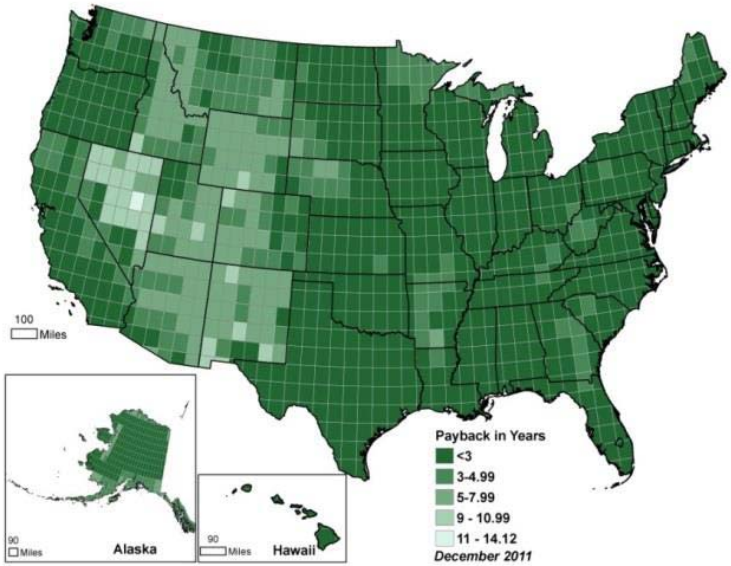
Current Level of Agreement Between 3DEP and IWG-OCM in Prioritization of Acquisition Planning

Prioritization Criteria

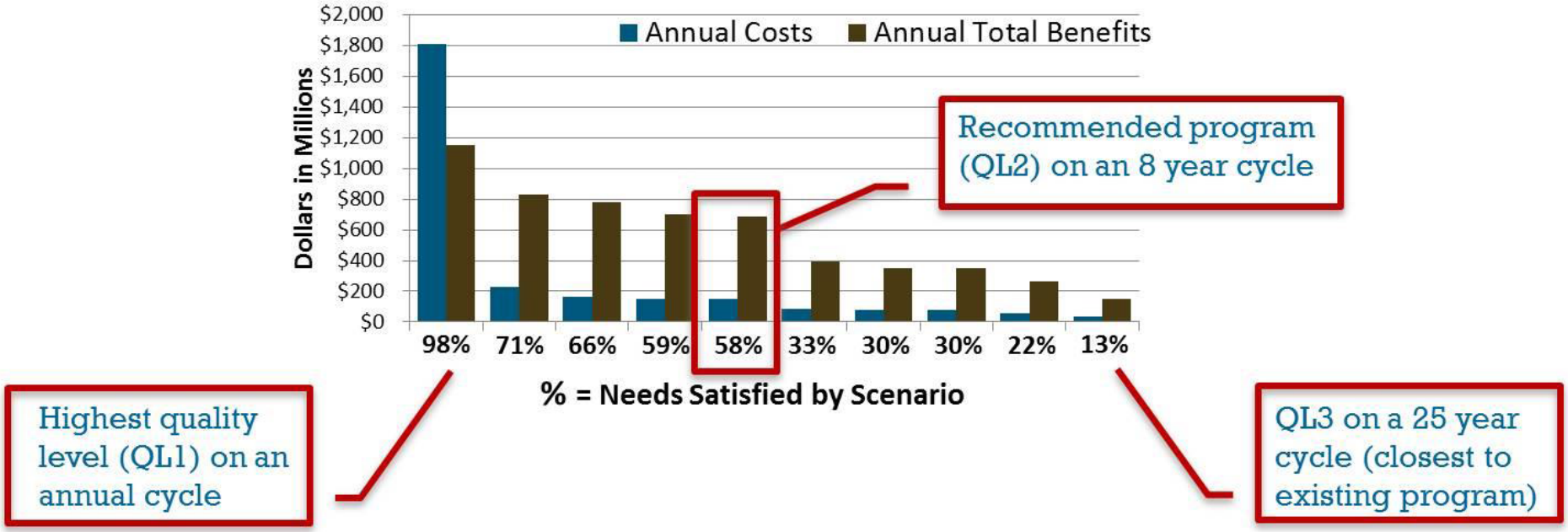
3DEP:		IWG-OCM:
Areas with the highest net benefits as identified through the NEEA requirements study	→	Also a factor for IWG-OCM members, incl USGS/CMGP/CoNED, USACE, NOAA, FEMA
Areas included in a federal, state or regional partner acquisition plan	→	Also a factor for IWG-OCM members, incl USGS/CMGP/CoNED, USACE, NOAA
Areas of no existing coverage	→	Relevant – proposed for inclusion in the NCMS
Areas with existing coverage that do not meet Quality Level 3 specification	→	Relevant – proposed for inclusion in the NCMS
Areas with coverage greater than 8-years old	→	Relevant – proposed for inclusion in the NCMS
Areas with significant topographic change	→	Presently a significant factor for several IWG-OCM members (NOAA, USGS/CMGP, USACE)
Areas subject to serious and significant hazards (earthquakes, landslides, volcanic activity, coastal flooding, sea level rise)	→	Coastal hazards relevant for many IWG-OCM members – proposed for inclusion in the NCMS. (inundation, SLR, earthquakes, erosion etc.)

Based on the NEEA Study: Coastal Regions: 1) High benefit / cost, 2) Short payback time





Action for IWG-OCM CoChairs: Move to Adopt an 8 Year Cycle for National Coastal Lidar Collection

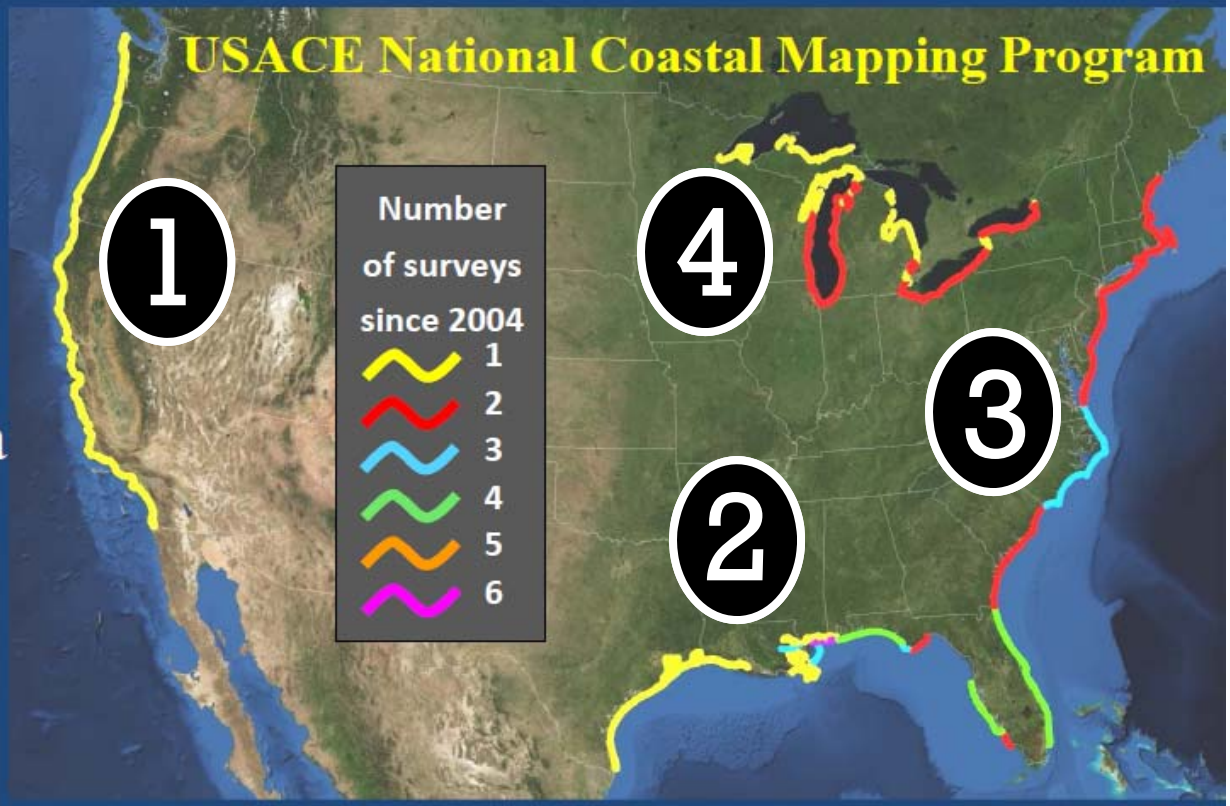


Sequencing of Planned USACE Regional Coastal Lidar Acquisition

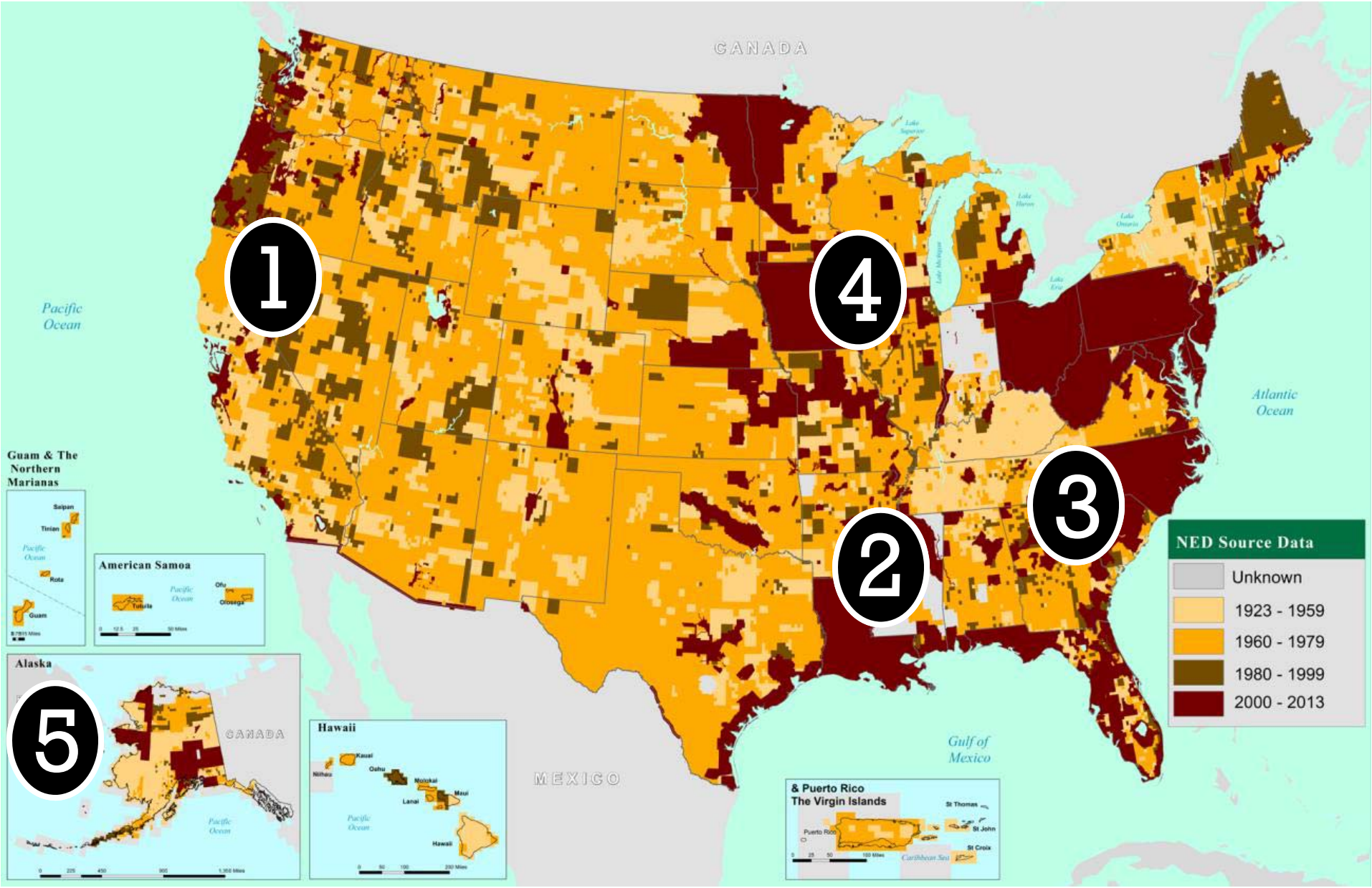
Coordination:

USACE Planned OCM Activities

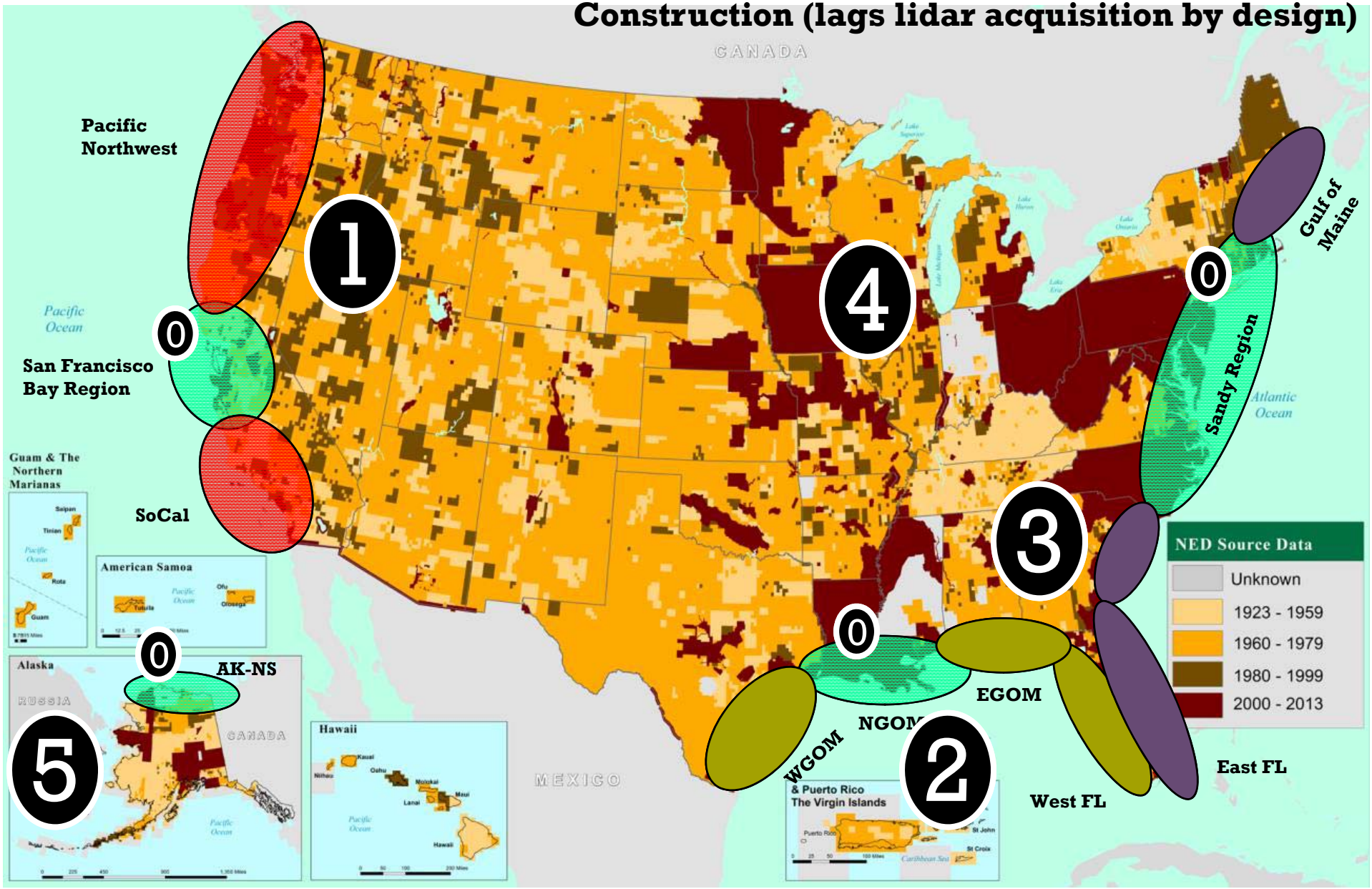
FY13 Hawaii
1 - FY14/15 West Coast
2 - FY16 Gulf Coast
3 - FY17 East Coast
4 - FY18/19 Great Lakes
+ project specific data collection activities



Sample Post Sandy Sequencing in Regional Emphasis of IWG-OCM Coastal Lidar Acquisition (inclusive of topo, topobathy, and bathy lidar)



Sample Post Sandy Sequencing of Regional Emphasis in USGS-NOAA CoNED Construction (lags lidar acquisition by design)



: Phase 0 (FY13-FY15) : Phase 1 (FY16-FY18) : Phase 2 (FY19-FY21) : Phase 3 (FY22-FY24)

Summary:

Currently aligning NCMS and 3DEP plans

- NCMS v1.0 is nearly ready for roll out
- We *can* do integrated 5 to 8-year plan, vis a vis 3DEP
  - Layer USACE, NOAA, USGS plans, then other IWG-OCM/sister agencies
  - Gather base resource funding estimates for NCMS
  - Determine whether to recommend a different (increased) funding profile to accomplish 8-yr plan
  - Confirm with IWG-OCM that topobathymetric lidar and aerial photography are the key datasets for NCMS

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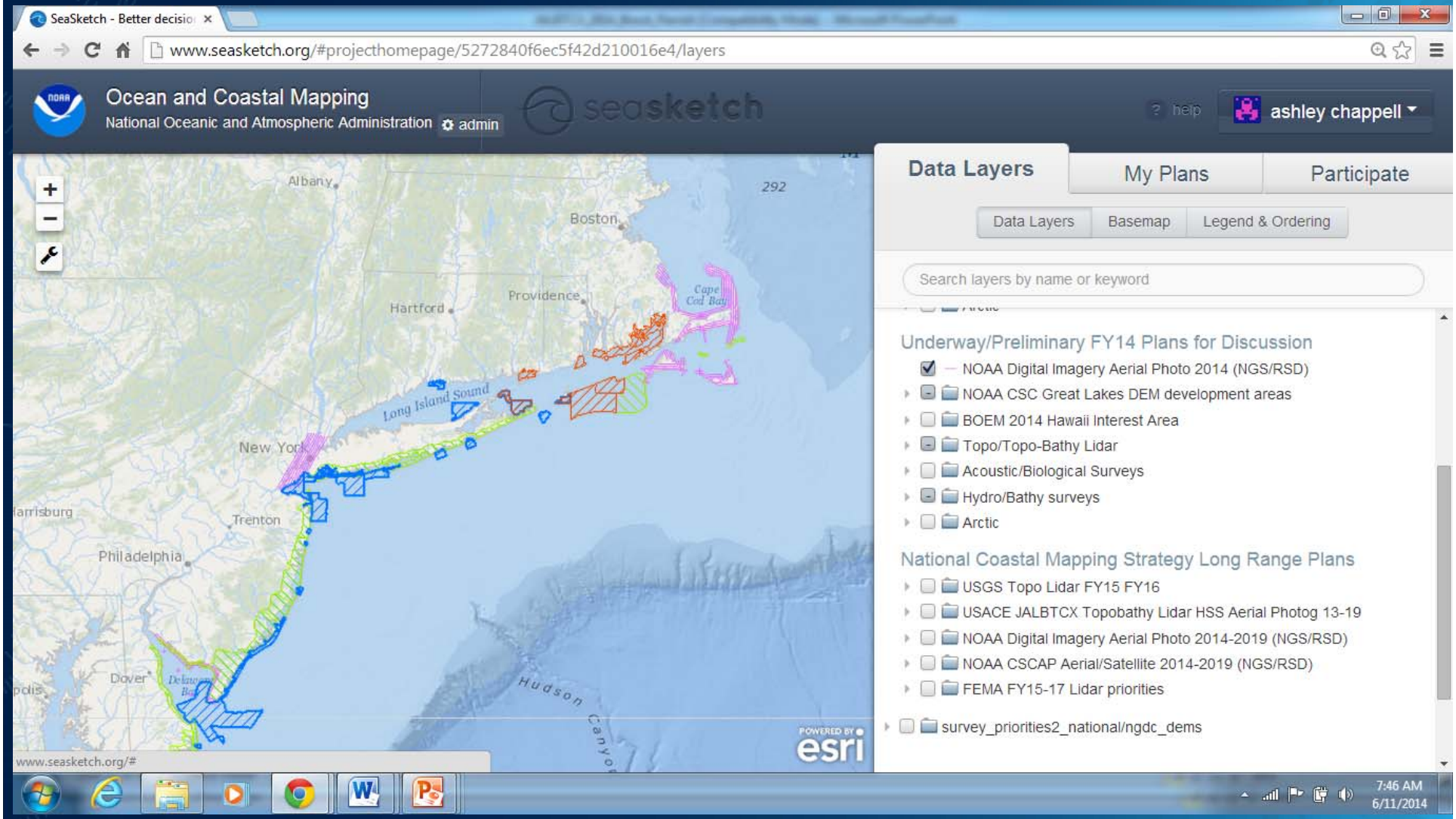
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Ocean and Coastal Mapping
National Oceanic and Atmospheric Administration
admin
seasketch
help
ashley chappell
Albany
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Hartford
Providence
Cape Cod Bay
Long Island Sound
New York
Trenton
Philadelphia
Dover
Hudson Canyon
292
Data Layers
My Plans
Participate
Data Layers
Basemap
Legend & Ordering
Search layers by name or keyword
Underway/Preliminary FY14 Plans for Discussion
NOAA Digital Imagery Aerial Photo 2014 (NGS/RSD)
NOAA CSC Great Lakes DEM development areas
BOEM 2014 Hawaii Interest Area
Topo/Topo-Bathy Lidar
Acoustic/Biological Surveys
Hydro/Bathy surveys
Arctic
National Coastal Mapping Strategy Long Range Plans
USGS Topo Lidar FY15 FY16
USACE JALBTCX Topobathy Lidar HSS Aerial Photog 13-19
NOAA Digital Imagery Aerial Photo 2014-2019 (NGS/RSD)
NOAA CSCAP Aerial/Satellite 2014-2019 (NGS/RSD)
FEMA FY15-17 Lidar priorities
survey_priorities2_national/ngdc_dems
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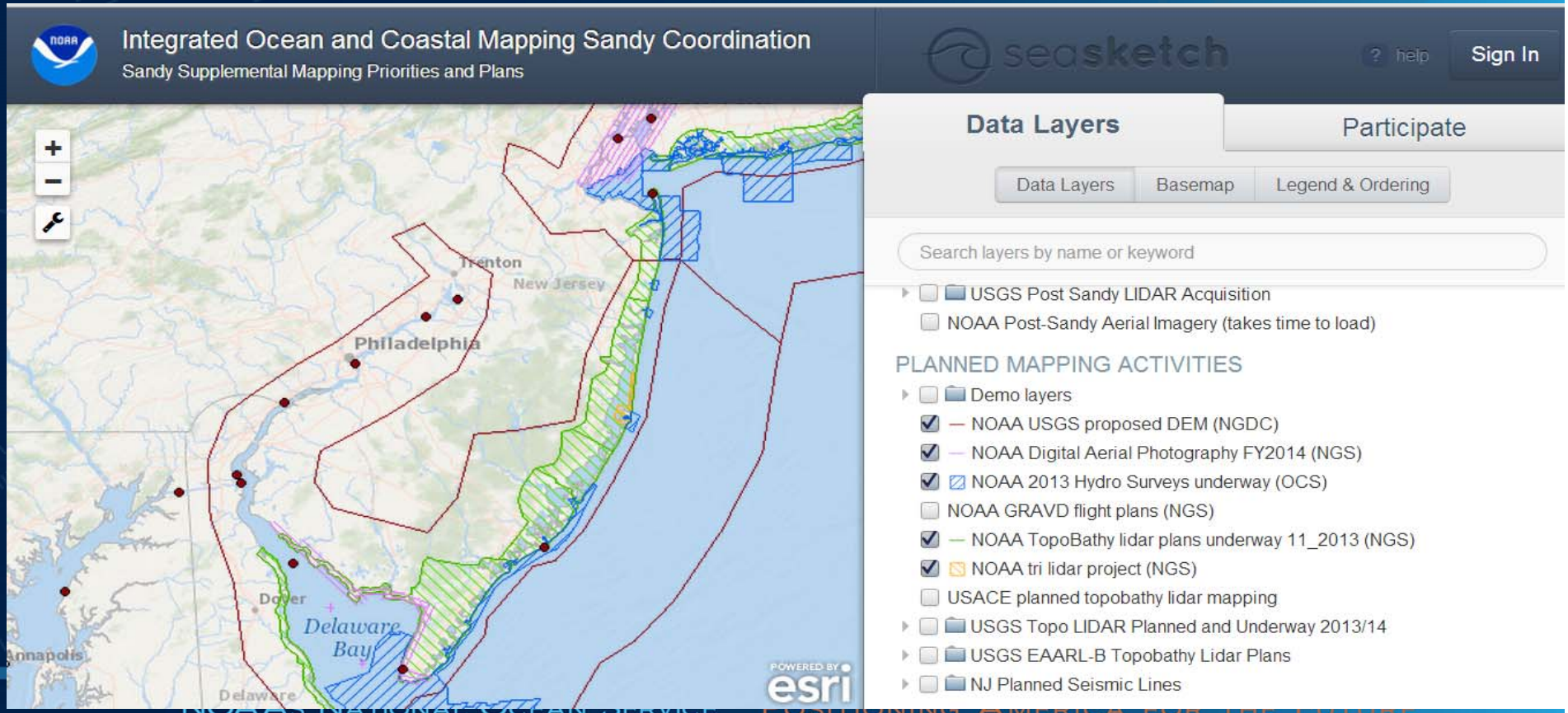
7:46 AM
6/11/2014

2013: NOAA IOCM and Sandy

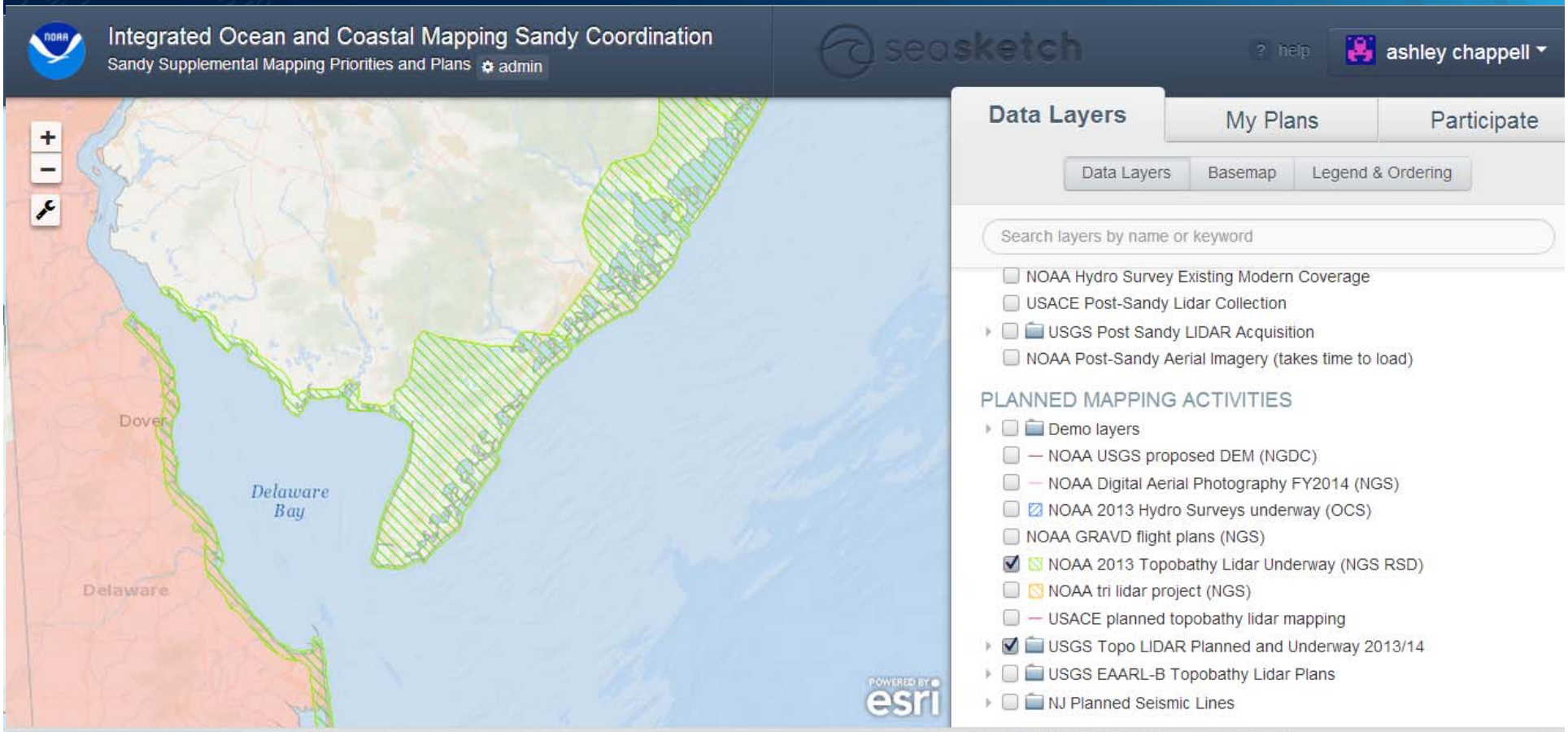
IOCM team started Supplemental planning coordination after immediate storm response settled

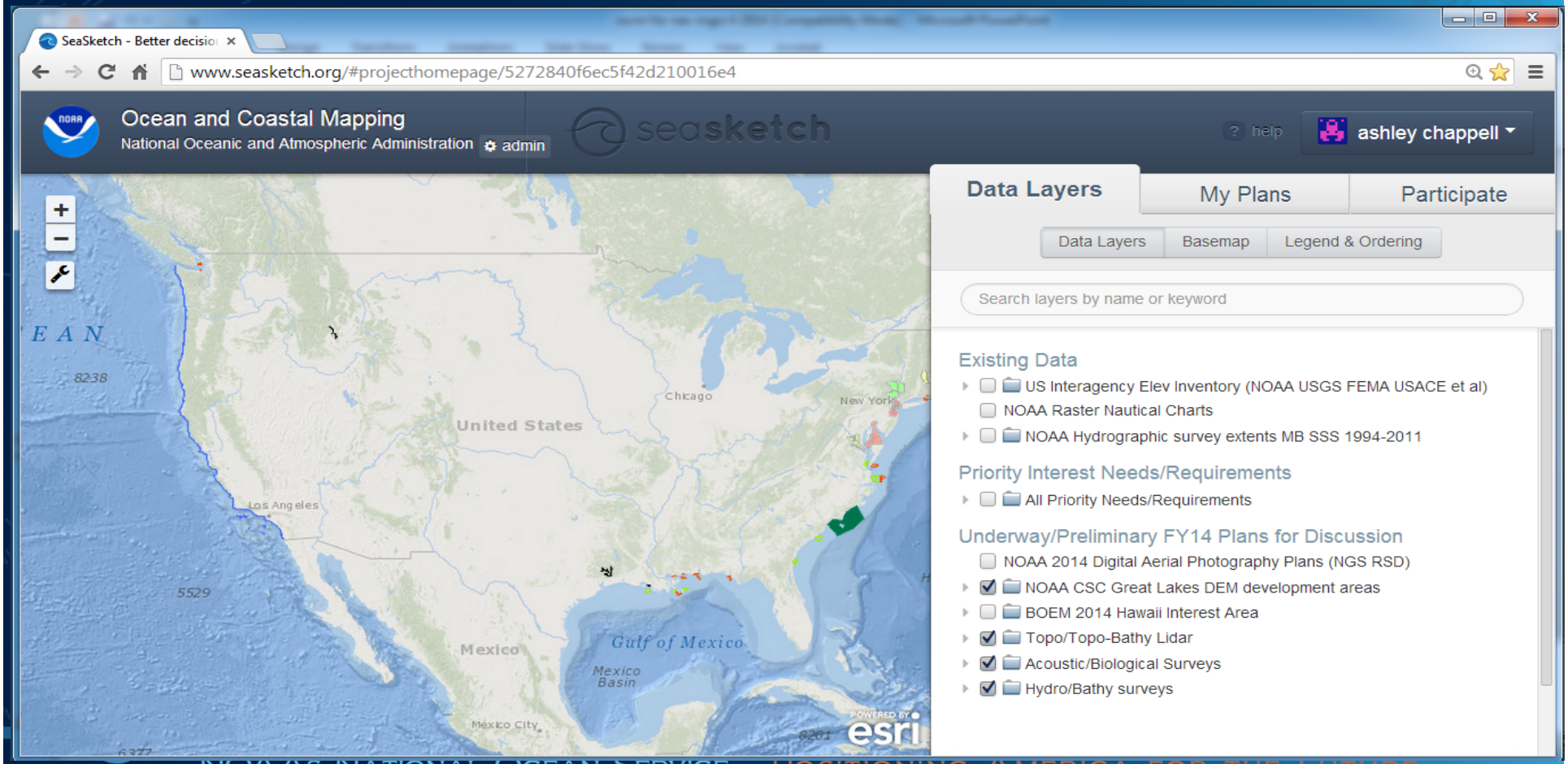
Initiated use of Seasketch to aid coordination within/outside NOAA



Mapping Coordination

- NGS Remote Sensing Division worked with partners to maximize topobathy lidar data collects
- USGS and NOAA discussed overlaps, modified plans for best outcome



Mapping Coordination

- Agencies have agreed to use Seasketch for national info sharing on acquisition plans
- Additional tools available for use