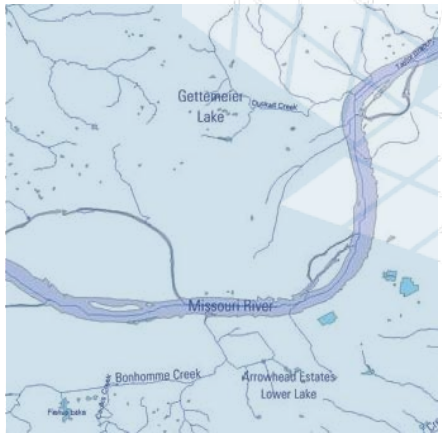
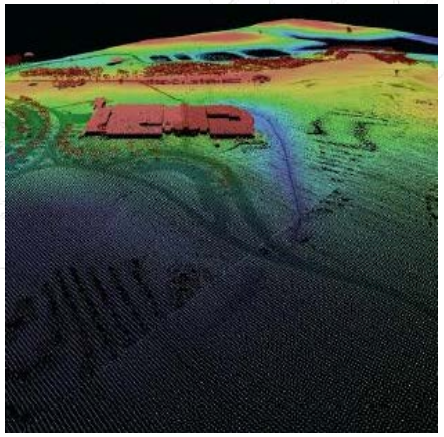
Hydrography Requirements and Benefits Study





Dan Walters
National Geospatial Program
Northeast Arc User Group
November 9, 2015

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NRCS Natural Resources Conservation Service

"How I view the purpose of the NGP"

Dr. Michael Tischler, Director, National Geospatial Program

Provides data to the public that is:

- ***Authoritative*** - data we can stand behind as the mandated federal agency
- ***Accurate*** - QA/QC, specs, and due-diligence to ensure the data is accurately representing the desired natural phenomena
- ***Accessible*** – Customers/clients are able to reach and properly leverage NGP data products
- ***Available*** - NGP produces the data our customers expect for their needs

NGP data and services :

- Advance the scientific understanding of our natural world
- Inform critical decisions within private sector, Federal government agencies, State and Local government, and Tribes

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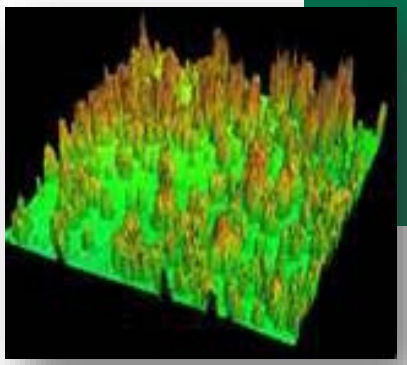
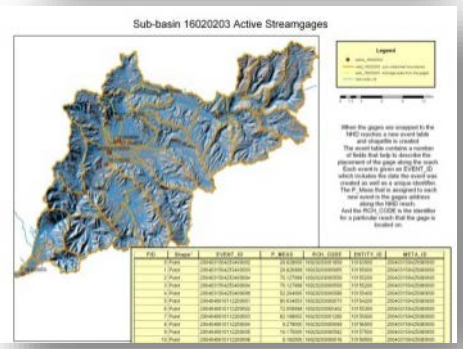
Area of National Leadership	Program Emphasis
A-16 Lead for Terrestrial Elevation	3D Elevation Program (3DEP)
A-16 Co-Lead for Inland Waters (Hydrography)	National Hydrography Dataset (NHD) Watershed Boundaries Dataset (WBD)
National Coverage of Topographic Maps	U.S. Topo and Alaska Mapping



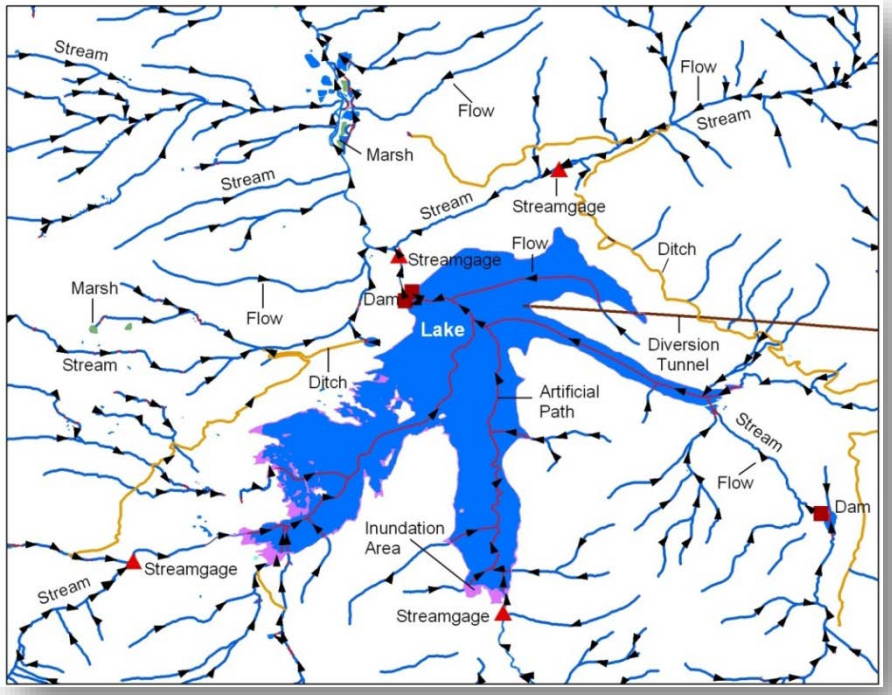


NGP Strategic Plan – Meet user needs

- NGP satisfies the needs of users for geospatial information.
  - Water Resources
  - Geologic Hazards and Mapping
  - Natural Resources Conservation
- NGP provides geospatial products and services that users incorporate into their decision making and operational activities.
- Ensure that NGP Products and Services meet users' needs, and guide the Program's investment in data, products, and services based on an understanding of how they are employed.
- Support USGS/CSS strategy to characterize, synthesize, and describe the critical zone

National Hydrography and Watershed Boundaries Datasets (NHD and WBD)

- Surface water layers of The National Map
  - The NHD represents the drainage network with features such as rivers, streams, canals, lakes, ponds, coastline, dams, and stream gages
  - The WBD represents drainage basins at eight scales
- A powerful database that contains a flow network that allows for modeling and tracing water downstream or upstream
- Use an addressing system based on reach codes and linear referencing to link information such as water discharge rates, water quality, and fish population



National Hydrography Dataset

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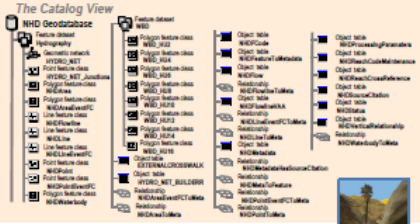
National Hydrography Dataset (NHD) Model (v2.1)

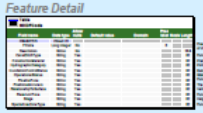
March 23, 2012

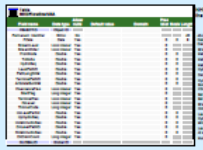
The Catalog View



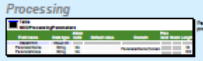
Attribute Tables

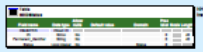
Feature Detail



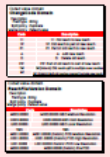


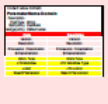
Processing

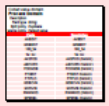




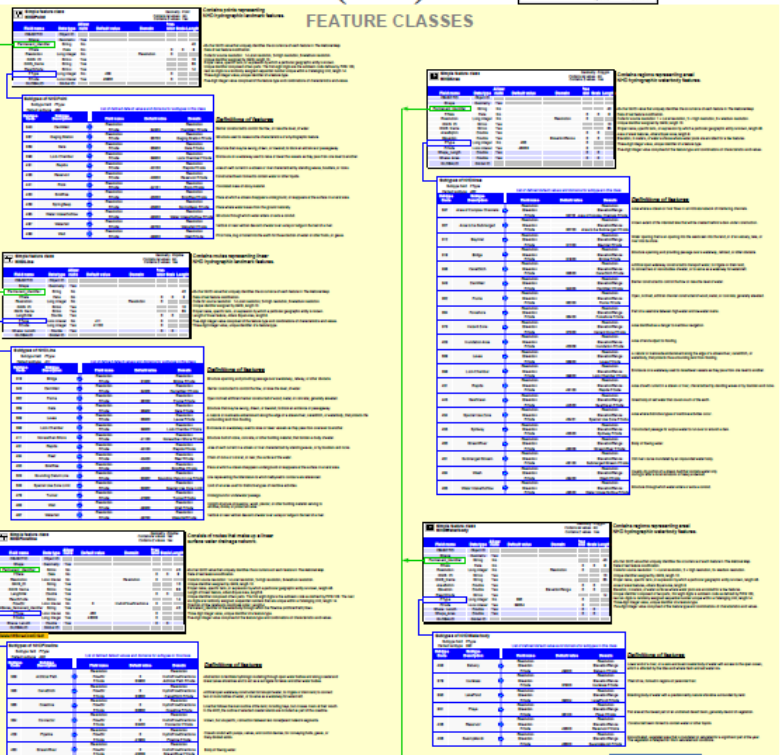
Processing Domains



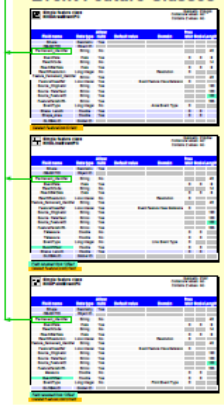




FEATURE CLASSES



Event Feature Classes

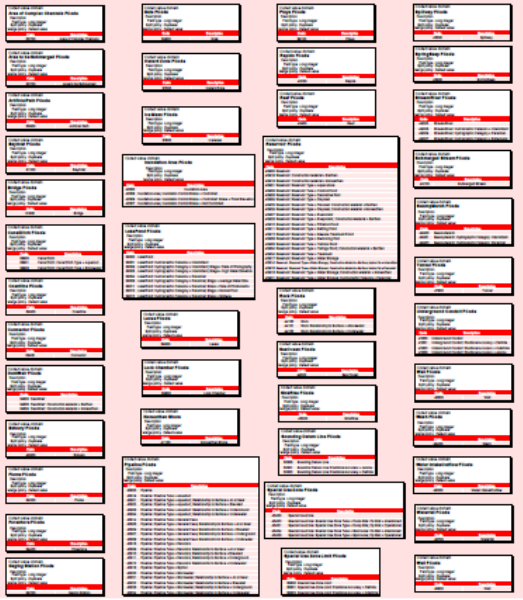


Feature Metadata

In the NHD geodatabase, feature-level metadata information is included in three tables: NHDFeatureToMetadata, NHDMetadata, and NHDResourceStation. The NHDFeatureToMetadata table links the features to their instances of metadata. The NHDMetadata table contains the general metadata characteristics for each collection of features. The NHDResourceStation table details the source associated with each metadata instance.

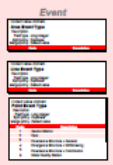
To Meta

FCode (Feature) Domains



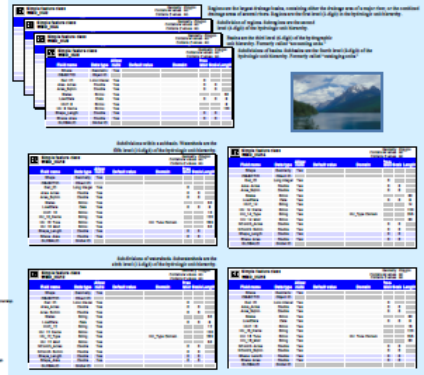
Non-FCode Domains

Event

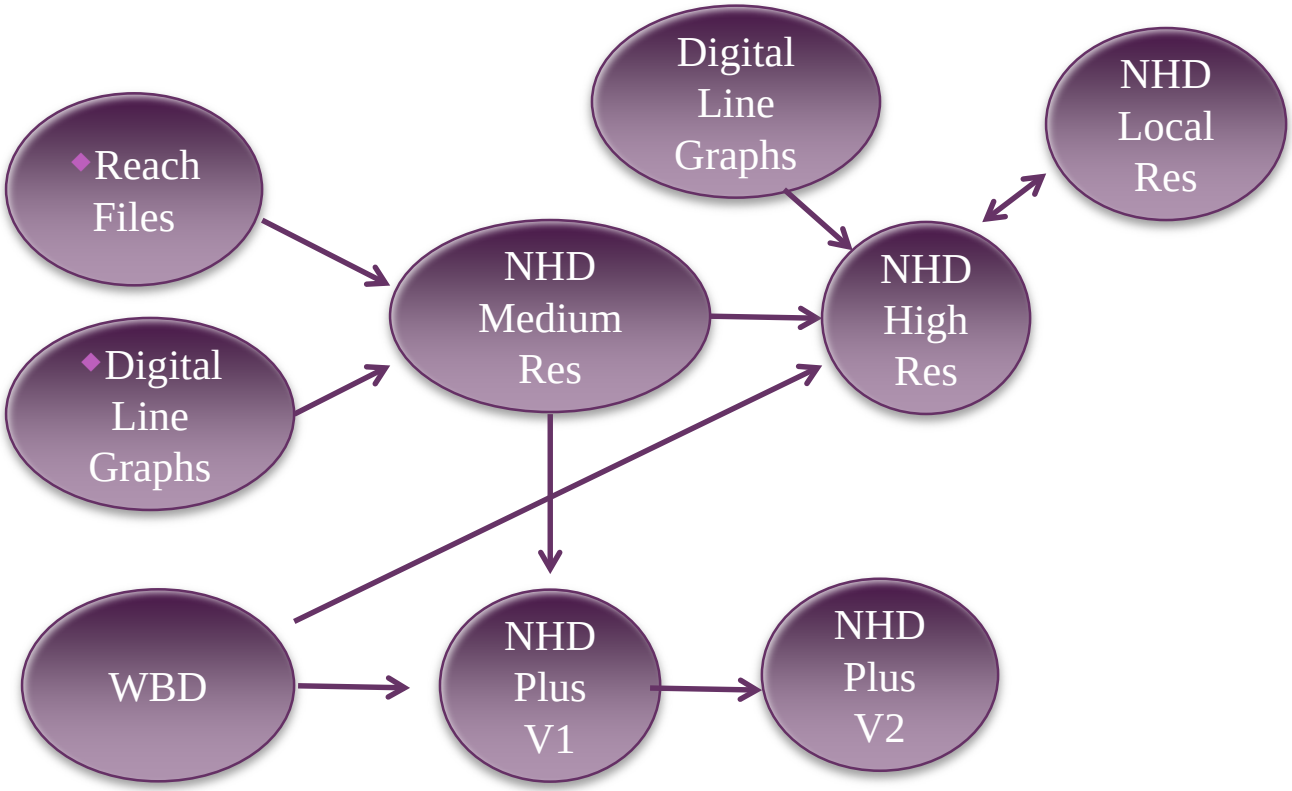


WBD

Water Boundary Dataset (WBD) Feature Classes



The NHD family

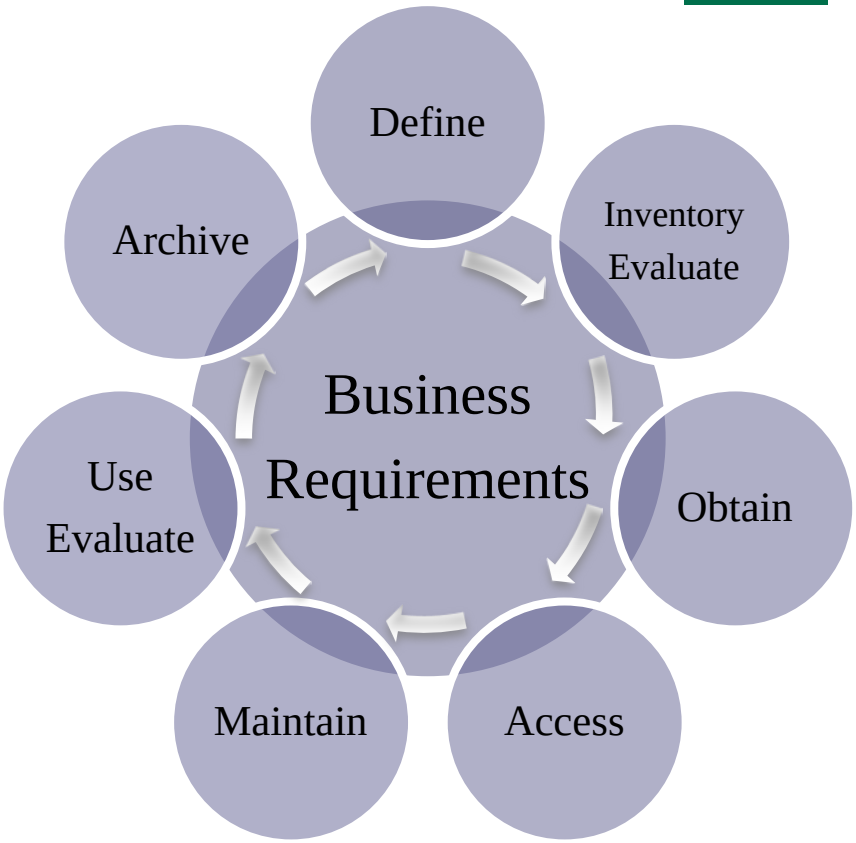


- Each has particular purpose and user community.

HRBS Purpose

Inform the next generation of hydrography data

- Update functionality of the NHD data model to leverage technology and meet emerging user needs
- Replicate the successful business model of the 3D Elevation Program which is rooted in the National Enhanced Elevation Assessment
- Next phase in the A-16 lifecycle management process



Geospatial Data Lifecycle

NEEA Benefits for Top Business Uses

Rank		Annual Benefits	
		Conservative	Potential
1	Flood Risk Management	$295M	$502M
2	Infrastructure and Construction Management	$206M	$942M
3	Natural Resources Conservation	$159M	$335M
4	Agriculture and Precision Farming	$122M	$2,011M
5	Water Supply and Quality	$85M	$156M
6	Wildfire Management, Planning and Response	$76M	$159M
7	Geologic Resource Assessment and Hazard Mitigation	$52M	$1,067M
8	Forest Resources Management	$44M	$62M
9	River and Stream Resource Management	$38M	$87M
10	Aviation Navigation and Safety	$35M	$56M
:			
20	Land Navigation and Safety	$0.2M	$7,125M
	Total for all Business Uses (1 – 27)	**$1.2B**	**$13B**

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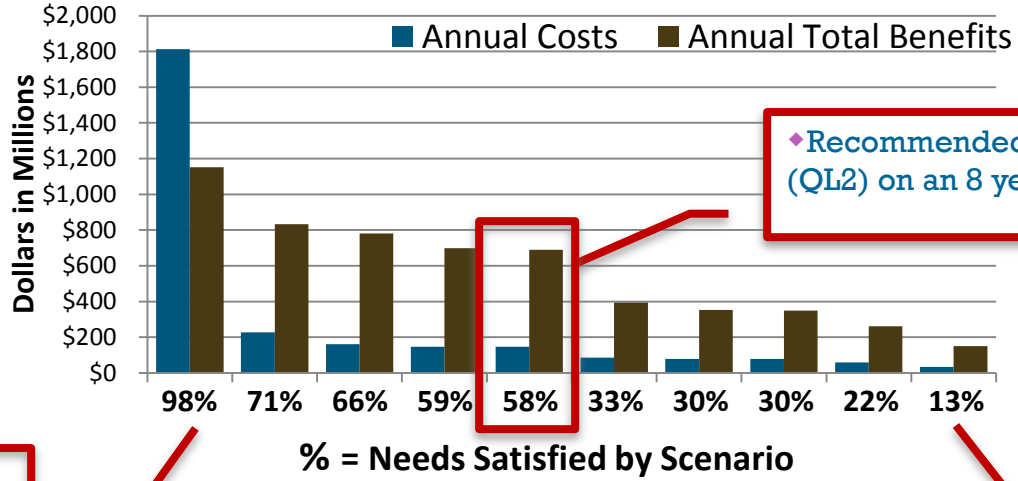
National Program Recommendation

Multiple Scenarios Considered

- Avg. Annual Costs: $146M
- Avg. Annual Benefits: $690M
- Avg. Annual Net Benefits: $544M
- Benefit Cost Ratio - 4.7:1
- Total Benefits Satisfied: 58%



- Recommended program (QL2) on an 8 year cycle
- Highest quality level (QL1) on an annual cycle
- QL3 on a 25 year cycle (closest to existing program)

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HRBS Approach

- Document major uses of geospatial water information by Federal, State, and local government; water utilities and other private sector industries; tribal; not for profit; and the academic research community.
- Document benefits that will be realized from a Hydrographic Analysis Framework that met user requirements – not just a dataset, but a system.
- Identify the data types, quality, organization, and delivery mechanisms required to achieve those benefits.
- Develop a menu of proposed program approaches with associated costs and benefits.

HRBS Information Collection Plan

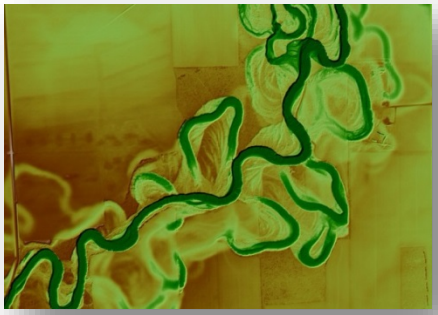
- Federal (Contractor)
- Agency kickoff
  - Hosted by USGS/Contractor
- Online survey
  - Served by Contractor
- Raw compilation
  - Summary sheet
- Agency interview
  - Managed by Contractor
- Clean compilation
- Results

- Non-Federal (Liaisons)
- State kickoff
  - Hosted by Liaison and POC
- Online survey
  - Served by Contractor
- Raw compilation
  - Summary sheet
- Agency interview
  - Managed by Liaison and POC
- Clean compilation
- Results

HRBS Process

Points of contact

- Within each Federal agency and State, department executives were contacted by the USGS Associate Directors of Water and Core Science Systems
- Each executive was asked to identify a primary Point of Contact (POC) to coordinate response within the agency.
- POCs identified individuals within States and Federal agencies to respond to online questionnaire
- POCs coordinated workshops to develop “composite” responses at State and Agency level.
- POCs will validate agency summaries



HRBS Questions

Understand user requirements and benefits of a national hydrography data set (system)

- What does your agency need hydrography data to do? What are your Mission Critical Activities related to hydrography data?
- What are the system requirements necessary to support that activity?
  - Content (feature content, currency, accuracy)
  - Attribution – name, volume, velocity
  - Tools – linear referencing, tracing, event management, editing
  - Integration with other datasets – wetlands, elevation, soils, transportation
- What is the value to your work if these requirements were met?

HRBS Process

Online Questionnaire

- Identifying information – name, agency, email
- Mission Critical Activity (MCA) and Business Use (BU)
- Requirements
  - Data characteristics
  - Functional requirements
  - Related/commonly used datasets
- Benefits (operational, customer service, societal)
  - Current
  - Future
- Delivery/access preferences

Preliminary questionnaire results

23 Federal Agencies, 50 states

- 532 individual responses
- 595 Mission Critical Activities reported
- 222 identified as Federal (23 Agencies identified)
- 202 identified as State (all 50 states represented)
- 53 identified as Regional or local government
- 10 identified as Tribal government
- 26 identified as Not for Profit (including academia)
- 19 identified as Commercial

HRBS **Preliminary** Results

Mission Critical Activities by State (357 total)

State	Number of MCAs
Alabama	9
Alaska	9
Arizona	3
Arkansas	8
California	11
Colorado	5
Connecticut	8
Delaware	3
Florida	8
Georgia	7
Hawaii	3
Idaho	4
Illinois	6
Indiana	6
Iowa	5
Kansas	7
Kentucky	2
Louisiana	8
Maine	9
Maryland	3
Massachusetts	5
Michigan	6
Minnesota	11
Mississippi	8
Missouri	9

State	Number of MCAs
Montana	7
Nebraska	3
Nevada	6
New Hampshire	7
New Jersey	9
New Mexico	10
New York	12
North Carolina	12
North Dakota	2
Ohio	13
Oklahoma	11
Oregon	5
Pennsylvania	13
Rhode Island	5
South Carolina	5
South Dakota	11
Tennessee	9
Texas	8
Utah	7
Vermont	4
Virginia	5
Washington	6
Washington D.C.	3
West Virginia	5
Wisconsin	10
Wyoming	6

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HRBS Preliminary Results

Mission Critical Activities by Federal Agency (54)

Agency name	Number of MCAs
Agricultural Research Service	3
Animal and Plant Health Inspection Service	5
Bureau of Land Management (BLM)	1
Bureau of Ocean Energy Management (BOEM)	1
Bureau of Reclamation	4
Environmental Protection Agency (EPA)	5
Farm Service Agency (FSA)	1
Federal Emergency Management Agency (FEMA)	1
Federal Energy Regulatory Commission (FERC)	2
International Joint Commission (IJC)	1
National Oceanic and Atmospheric Administration (NOAA)	3
National Park Service (NPS)	1
Natural Resources Conservation Service (NRCS)	3
Nuclear Regulatory Commission (NRC)	1
Office of Surface Mining Reclamation and Enforcement (OSMRE)	1
U.S. Army Corps of Engineers (USACE)	3
U.S. Census Bureau (USCB)	1
U.S. Fish and Wildlife Service (USFWS)	4
U.S. Forest Service (USFS)	2
United States Geological Survey (USGS)	9
Western Area Power Administration (WAPA)	2

HRBS Preliminary Results

Mission Critical Activities by Business Use

Business Use	Number of MCA
Water Quality	81
Water Resource Planning and Development	68
Flood Risk Management	51
River and stream flow management	43
River and Stream Ecosystem Management	33
Natural Resources Conservation	31
Urban and Regional Planning	17
Infrastructure and Construction Management	17
Agriculture and Precision Farming	10
Education K-12 and beyond	9
Coastal Zone Management	8
Wildlife and Habitat Management	7
Forest Resources Management	6
Homeland Security, Law Enforcement, and Disaster Response	6
Health and Human Services	4
Geologic Resource Assessment and Hazard Mitigation	3
Renewable Energy Resources	3
Recreation	3
Marine and Riverine Navigation Safety	3
Oil and Gas Resources	3
Sea Level Rise and Subsidence	2
Wildfire Management, Planning, and Response	2
Resource Mining	2

HRBS Preliminary Results

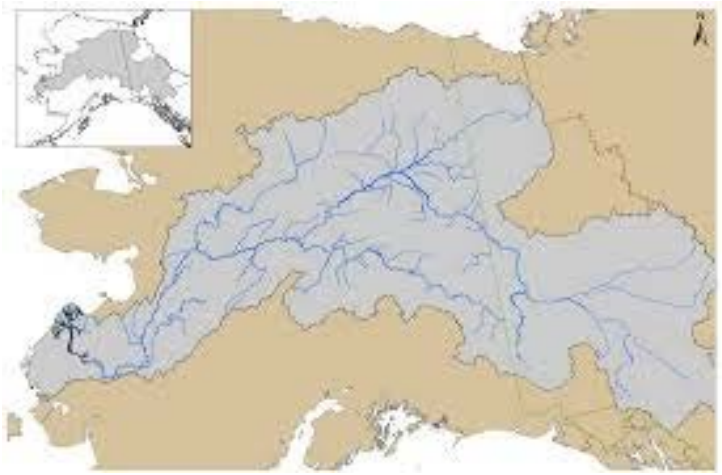
Update Frequency

Update Frequency	Number of MCAs
Annually	135
2-3 years	111
4-5 years	112
6-10 years	39
>10 years	17

HRBS Preliminary Results

Current and Future benefits by Federal Agency

Desired Positional Accuracy	Number of MCAs
+/- 3 feet, 90% (1:1,200-scale)	140
+/- 7 feet, 90% (1:2,400-scale)	103
+/- 33 feet, 90% (1:12,000-scale)	70
+/- 40 feet, 90% (1:24,000-scale)	92
+/- 170 feet, 90% (1:100,000-scale)	3
+/- 420 feet, 90% (1:250,000-scale)	2



HRBS Preliminary Results

Integration with Elevation Data

Elevation Importance	Number of MCAs	Percentage of MCAs
Required	264	62%
Highly Desirable	98	23%
Nice to Have	31	7%
Not Required	15	4%
Null	9	2%
	417	

Elevation Level of Analysis	Number of MCAs	Percentage of MCAs
Perform Geospatial Analysis	308	72%
Associate Selected Data Type	36	8%
Visual Inspection	43	10%
None	20	5%
Null	10	2%
	417	

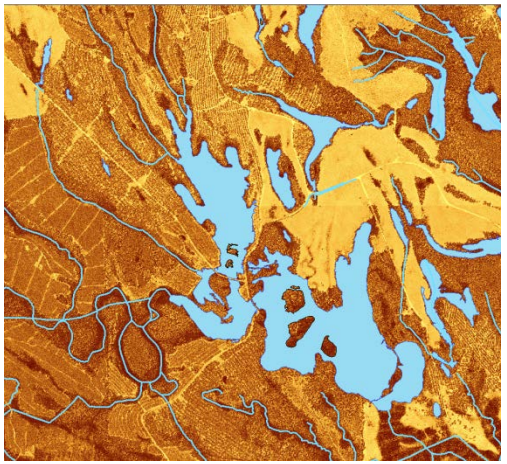
Other themes

- Land cover
- Transportation
- Soils
- Climate
- Dams
- Geology
- Census Data
- NASS
- NWI
- STORET

HRBS Preliminary Results

Most frequently selected functional requirements

Required Characteristic	Number of MCAs	Percent of MCAs
Calculate drainage area	326	77%
Find upstream or downstream feature within watershed	279	66%
Linkages to streamgage observations	277	65%
Navigate up or downstream on network	271	64%
Delineate catchment	269	63%
Wetlands	266	63%
Flow periodicity	265	62%
Floodplain boundary	249	59%
Calculate stream distance to points	240	56%
Bridges, culverts	219	52%
Accumulate upstream or downstream features	215	51%



HRBS Preliminary Results

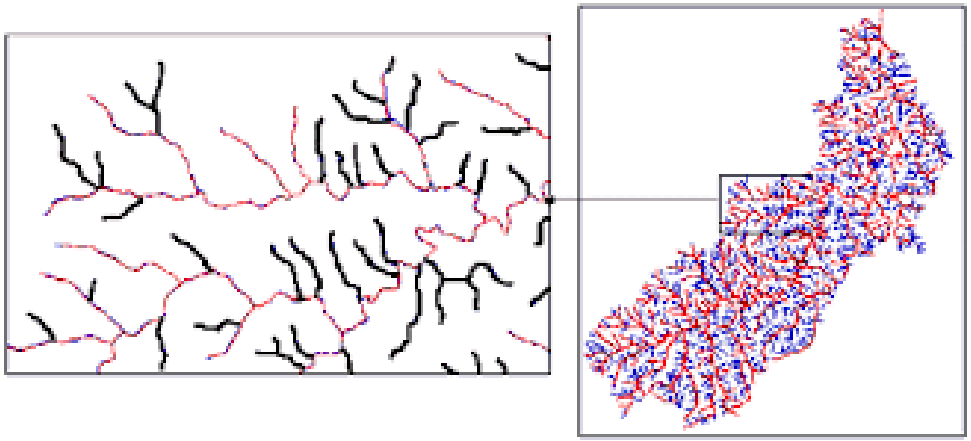
General Benefits highlights

- Hydrography data supports at least $4.7 Billion in Federal program activities and $5.5 Billion in State and local programs
- Current annual benefits exceed $1 Billion
- Potential future benefits also exceed $1 Billion

All data reside in a geodatabase

- Requirements
- Benefits
- Agency/state
- Business use
- Geography

- Benefits by requirement
- Requirements and benefits by geography
- Requirements and Benefits by agency/state



Next Steps

What do we do now?

- Complete QA of the data; fill in some gaps
- Have POCs validate responses
- Complete data report
- Develop program recommendations