



BUDGET The United States
Department of the Interior

JUSTIFICATIONS

and Performance Information
Fiscal Year 2018

U.S. GEOLOGICAL SURVEY

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U.S. GEOLOGICAL SURVEY

FY 2018 BUDGET JUSTIFICATION

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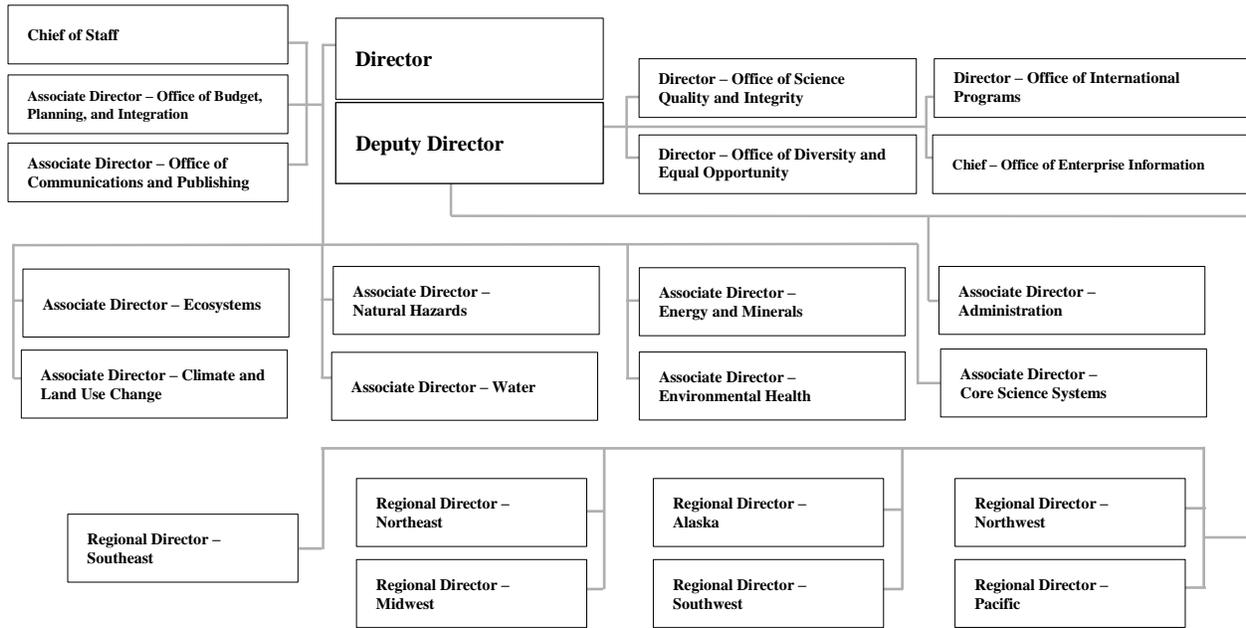
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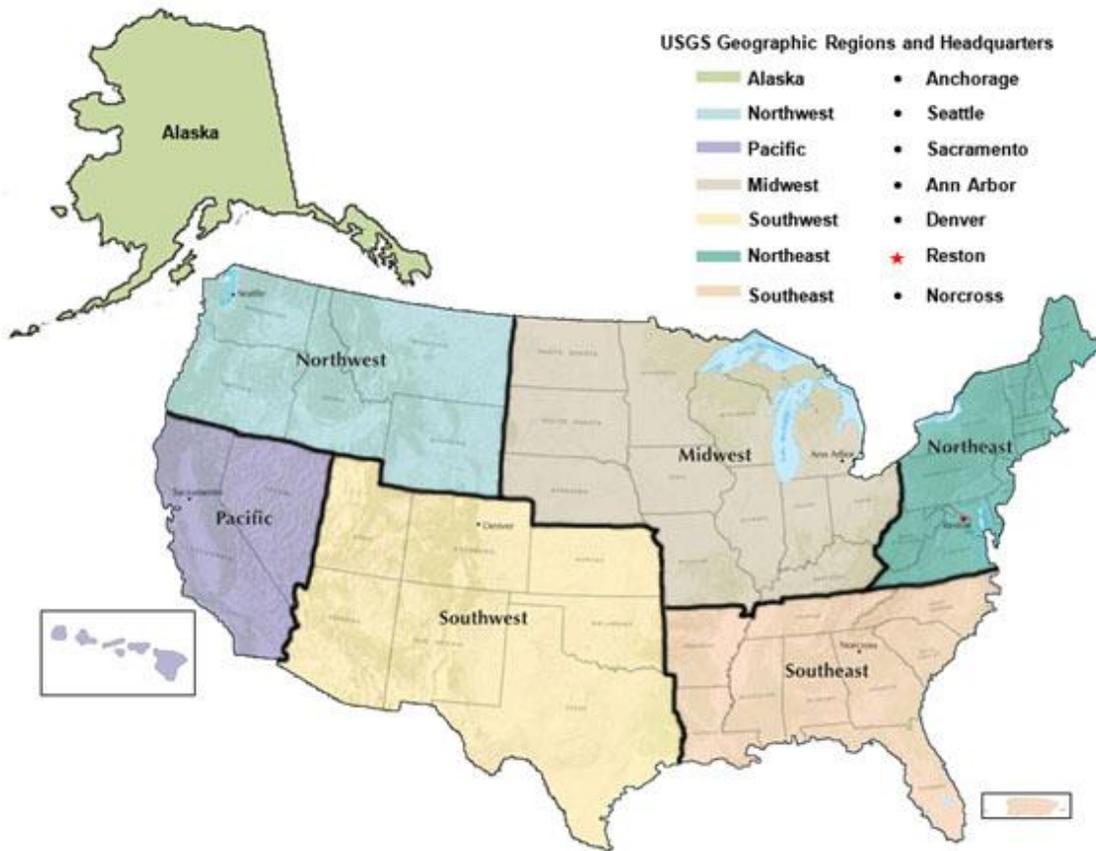
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U.S. Geological Survey



USGS Regional Structure



Executive Summary



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Total 2018 Budget Request <i>(Dollars in Thousands)</i>			
Budget Authority	2016 Actual	2017 CR Annualized	2018 Request
Current	1,062,000	1,059,981	922,168
Permanent	1,031	696	565
Operation & Maintenance of Quarters	49	52	52
Contributed Funds	982	644	513
Total Current and Permanent	1,063,031	1,060,677	922,733

FTE	2016 Actual	2017 CR Annualized	2018 Request
Direct	4,923	4,923	4,114
Reimbursable	2,799	2,799	2,519
Working Capital Fund	152	152	152
Allocation Account	72	72	72
Contributed Funds	5	5	5
USGS Total	7,951	7,951	6,862

Overview

The U.S. Geological Survey (USGS), the scientific arm of the Department of the Interior, was established in 1879 (43 U.S.C. 31) for “the classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain.”

President Theodore Roosevelt declared in a 1907 State of the Union address that conservation (of forests, wildlife, minerals—including energy minerals, and water) was “the fundamental problem which underlies almost every other problem of our national life” and established the doctrine that science is the proper tool to discharge conservation policy. This principle underpins USGS science to this day, as the USGS has developed a reputation as a source of sound, unbiased science for natural resource development and conservation.

Today, the USGS leads the Nation in providing unbiased Earth science research and integrated assessments of natural resources and hazards; supporting the stewardship of public lands and waters; as well as promoting science to protect public safety, health, property, and U.S. economic prosperity.

Executive Summary

The Nation faces unprecedented challenges: increasing demand for limited energy and mineral resources, losing critical and unique ecosystems, changing land resources, increasing vulnerability to natural hazards, growing uncertainty of water security and availability, and emerging diseases threatening wildlife and human health. The USGS provides the science to support exploration and development of energy and mineral resources; sustain healthy fish and wildlife populations; monitor changes to land resources; improve resilience to natural hazards and enhance community safety and well-being; improve water resource decision making; and provide accurate, high-resolution geospatial data.

The 2018 President's budget request includes \$922.2 million for the USGS, a decrease of \$137.8 million over the 2017 annualized Continuing Resolution. The USGS budget emphasizes developing and delivering tools and scientific information needed by the public and by land and resource managers to make the most effective decisions. The investments in this 2018 budget request advance several priorities, such as developing the ground system for Landsat 9; assessing the availability of energy and critical mineral resources; tackling water challenges; supporting disaster alerting and rapid response; conducting research on land resources; producing high-resolution geospatial data; tracking risks to the health of humans, other organisms, and ecosystems; and addressing new and emerging invasive species and disease.

Scientific coordination and collaboration within Interior and across the government is central to the USGS mission. By leveraging across Federal, State, local, and tribal governments, the private sector, and non-governmental organizations, the USGS is able to provide science and information that is thorough, accurate, and tailor-made to address some of the most pressing challenges of the 21st century. The diversity of USGS scientific expertise enables the bureau to carry out large-scale, multi-disciplinary investigations and provide impartial scientific information to resource managers and planners, emergency response officials, and the public.

While the 2018 budget request includes reductions to many programs, it continues to reflect a commitment to the core mission of the USGS, focuses on conducting important research, and provides impartial scientific data to key stakeholders and decision makers that helps promote the health, safety, and prosperity of the Nation. With this budget request, the USGS is streamlining its operational scope in support of national priorities: energy and mineral resources; science to protect public safety, health, property, natural hazard preparedness and mitigation responses; and land and water stewardship.

Budget Highlights

Budget Change Summary <i>(\$ in Thousands)</i>	
2017 CR Annualized	\$1,059,981
Program Change	-\$159,590
Fixed Costs	+\$21,777
2018 Budget Request	\$922,168

2018 Budget Request <i>(Dollars in Thousands)</i>					
Budget Authority			2018		
Surveys, Investigations, and Research	2016 Enacted	2017 CR	Fixed Costs	2018 Program Changes	2018 Request
Ecosystems	\$160,232	\$159,927	\$1,748	-\$29,547	\$132,128
Land Resources	\$139,975	\$139,709	\$602	-\$25,987	\$112,847
Energy and Minerals, and Environmental Health	\$94,511	\$94,331	\$1,221	-\$5,519	\$91,510
Natural Hazards	\$139,013	\$138,748	\$1,479	-\$22,116	\$118,111
Water Resources	\$210,687	\$210,287	\$2,661	-\$39,906	\$173,042
Core Science Systems	\$111,550	\$111,339	\$1,021	-\$19,391	\$92,969
Science Support	\$105,611	\$105,410	\$1,082	-\$17,124	\$89,368
Facilities	\$100,421	\$100,230	\$11,963	\$0	\$112,193
USGS Total	\$1,062,000	\$1,059,981	\$21,777	-\$159,590	\$922,168

The 2018 USGS budget request supports Interior's mission for energy and mineral development; promoting science to protect public safety, health, property; supporting land and water stewardship; supporting tribal nations; and supporting infrastructure development.

The 2018 USGS budget request maintains critical monitoring networks that provides for the safety of the American public and the resilience of the Nation's infrastructure; these include the core earthquake and volcano monitoring networks, and the national streamgage program. In addition, this 2018 budget request provides a foundation for USGS prioritized research efforts that support management decisions within Interior bureaus and other Federal agencies that depend on that information.

The 2018 budget request includes an estimated workforce reduction of 16 percent, from 4,923 to 4,114 Full Time Equivalents (FTE; this number does not include reimbursable FTEs). In addition to appropriated funding, the USGS receives funding through reimbursable agreements with other Federal agencies. However, funding reductions across the Federal government will likely reduce the reimbursable funding that the USGS receives. The USGS current reimbursable

workforce is estimated to reduce by an additional 10 percent, from 2,799 to 2,519 FTE. The USGS will evaluate any reductions to our reimbursable programs as the impacts to its partners become known.

Our Nation's Natural Resources

The USGS produces topographic and geological maps, geophysical and geochemical surveys, together with scientific research on **water, energy, and mineral resources** to produce resource assessments vital to understanding the natural wealth of the Nation. These analyses inform decision makers about the Nation's resource assets as well as those outside our borders that may impact our economy and security. The USGS's assessments increasingly include economic analysis. Private industry and government alike utilize USGS data to make informed decisions about energy and mineral resource management. A variety of USGS programs provide science to support energy and mineral resource management, including oil, gas, coal, geothermal, uranium, and gas hydrate energy resource activities. The USGS also provides critical information about mineral resource potential, production, and consumption, which is important to the economic stability and the national security of the United States. The USGS maintains the core functions related to energy and mineral resource assessments, including the underlying geological, geophysical and geochemical research and mapping capability that underpins accurate assessment results, while also yielding valuable information on the impacts of energy development.

The USGS maintains other bureau programs and activities including: biological and water resource studies related to energy production. In support of the Bureau of Ocean Energy Management (BOEM) and Bureau of Safety and Environmental Enforcement (BSEE), the bureau also maintains surveys and studies of marine-hazards to assess risk to offshore energy infrastructure and operations, as well as biological studies requests by BOEM. In 2018, the USGS would continue to conduct science to distinguish real versus perceived impacts of byproducts of energy development; create targeted and detailed geologic surveys and mapping of Western basins containing large natural gas fields; and conduct surface and subsurface three-dimensional geologic mapping for energy, mineral, and oil and gas assessments. The USGS would continue to provide critical information supporting the development of energy and mineral resources while minimizing health risks due to potential contaminant and pathogen exposures on fish and wildlife species of high interest for conservation or that are Interior Trust obligations.

The USGS would also continue to conduct monitoring, assessments, and research in order to understand and predict changes in the quality and quantity of water resources in response to land-use and management scenarios. The USGS advances understanding and integrated modeling of processes that determine water availability. The USGS would synthesize and report information at regional and national scales, with an emphasis on compiling and reporting the information in a way that is useful to States and others responsible for water management and natural resource issues. The USGS would continue to support these assessments of surface water and ground water resources for America's water stewardship by providing high-resolution elevation and hydrography datasets and detailed geologic maps.

Land and Water Stewardship

The USGS provides science on the complex human, economic, and ecological dimensions of land and water stewardship to help decision makers balance economic development with the Nation's conservation ethos regarding resources such as fish and wildlife, clean and abundant water, and thriving communities. In 2018, the USGS would continue to produce multi-resource assessments to provide information for decision makers who seek to balance multiple uses and understand trade-offs, particularly on public lands.

USGS science serves to protect and conserve our Nation's fish and wildlife heritage. The USGS bridges the gap between science and management for at-risk species and species of management concern. In 2018, the USGS would continue to work with a vast array of partners to provide science support to management agencies designed to sustain the hunting, fishing, and wildlife-related **sporting and recreation needs** of the public. The USGS data and science supports the hunting and recreational fishing sectors that contribute \$144 billion in expenditures and 480,000 American jobs (*2017 National Recreation Economy Report, Outdoor Industry Association*). The USGS would continue to identify conservation measures designed to preclude the need for listing species as endangered or threatened; recover listed species; prevent or control invasive species and wildlife disease outbreaks; and apply decision science so that management and policy actions will be transparent and durable. This work would be supported by accurate and up-to-date digital geospatial data and maps, biogeographic (animals, plants, and microbes) data, and map-on-demand services to the American people via The National Map and the Protected Areas Database of the United States (PAD-US).

In 2018, the USGS would continue to collaborate with its Interior partners to inform managers and the public about conditions of natural resources. Streamflow information on the USGS Web page at waterdata.usgs.gov provides invaluable information for emergency managers, water resource decision makers, paddlers, and anglers. Additionally, a new mobile-friendly Web site was created that would allow users to quickly locate USGS streamgages that measure rainfall, streamflow, stream height or lake levels so that users can get up-to-date information on water conditions near where they are located for safety and situational awareness, water management decisions, and recreation.

The USGS would also continue to conduct monitoring, assessments, and research in order to understand and predict changes in the quality and quantity of **water resources** in response to land-use and management scenarios. The USGS advances understanding and integrated modeling of processes that determine water availability. The USGS would synthesize and report information at regional and national scales, with an emphasis on compiling and reporting the information in a way that is useful to States and others responsible for water management and natural resource issues. The USGS would continue to support these assessments of surface water and ground water sources for America's water stewardship by providing high-resolution elevation and hydrography datasets and detailed geologic maps.

The USGS also delivers data, tools, techniques, and analyses that advance our understanding of landscapes, the forces that shape them, and the interactions of plants, animals, and the people that live among them. Land managers use USGS science to understand and detect changes that affect resources and processes that are essential to our Nation's economic growth and societal well-being. The resulting data and research products provide a scientific foundation for decisions about the management of natural

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and built landscapes and how they might be adapted to secure the Nation's interests. In addition, the USGS applies capabilities in marine geology, geochemistry and oceanography to provide information and research products critical to the management of the Nation's ocean, coastal, and Great Lakes environments.

In 2018, the USGS would also provide science to support understanding of potential **health threats to workers and visitors on public lands** from environmental contaminants and pathogens. Examples include helping understand occurrences, origins, and health implications of contaminants (such as harmful algal toxins, metals, and other compounds) and pathogens in waters, rocks, soils, and dusts on public lands. Key to this work would be increased collaborations between the USGS and health and safety officials from other Interior offices and bureaus.

Tribal Nations

In 2018, the USGS would continue to work with Tribes to provide unbiased scientific information to meet **DOI Tribal Trust Responsibilities**. The USGS also would provide information used by tribal managers to address such topics as water rights, water supply, flood-warning predictions, contamination, and disease mitigation to protect the health of Native populations, and sustainability of critical habitats and health ecosystems. For example: monitoring within an extensive network of USGS streamflow gages and groundwater monitoring stations; training; data management; Geographic Information Systems (GIS); quality control; fish and wildlife assessment and monitoring; development of models and decision-making tools; and scientific research on how natural, climatic, land use, water use, and other human factors can affect the water cycle, water quantity, and quality.

USGS science would continue to help inform efforts to protect the health of **Native populations**, and the fish and wildlife they rely on, from environmental contaminants and pathogens. The USGS would also provide science to support understanding of potential **health threats to workers and visitors on public lands** from environmental contaminants and pathogens—key to this work would be increased collaborations between the USGS and health and safety officials from other Interior Offices and Bureaus.

The USGS recognizes the importance of Native knowledge and living in harmony with nature as complements to the USGS mission to better understand the Earth. Combining traditional ecological knowledge with empirical studies allows the USGS and **Native American** governments, organizations, and people to increase their mutual understanding and respect for this land. The USGS provides information to Tribes as part of the bureau's basic mission of providing unbiased scientific information to the Nation and the Federal Trust Responsibility to Tribes.

Protect Public Safety, Health, and Property

The USGS protects public safety, public health, and property by effectively delivering natural hazards and environmental health science. In 2018, the USGS would continue to fulfill responsibilities for floods, earthquakes, tsunamis, volcanic eruptions, landslides, coastal erosion, and wildfires. The USGS would also provide non-regulatory, objective science to protect public health from natural- and human-sourced disease agents in the environment. Every year, the United States faces natural and man-made disasters

that threaten the Nation through loss of life and property, as well as threats to America's national security and economic vitality. In such events, the Nation's emergency managers and public officials look to USGS science to inform them of the risks hazards pose to human-built and natural systems and how to reduce losses, and improve response. Faced with rising expectations for rapid, robust information in response to these events, the USGS has the science and mapping capabilities to meet these needs both before and after disasters strike.

USGS natural hazards science informs a broad range of disaster planning, situational awareness and response activities at local to global levels. Responsibilities in natural hazards include issuing warnings and advisories for earthquakes, volcanic eruptions, landslides, and coastal erosion; informing warnings issued by other agencies for floods, tsunamis, and wildfires; providing timely information to emergency managers and response officials, the media, and the public to inform and educate communities during and between crises. Supporting activities in natural hazards science include: improving the data systems that are critical to situational awareness; implementing 24x7 operations for critical monitoring efforts; developing the next generation of tools for rapid evaluation of hazards; improving internal hazards communication; evaluating our warning and response activities, involving the relevant communities; and fostering the next generation of hazard scientists and technicians.

In 2018, USGS environmental health programs would continue to inform local, State, and national public health protection efforts for threats posed by exposures of humans to emerging or complex mixtures of environmental contaminants and pathogens, including those encountered during occupational and recreational activities, and those contained in air, soil, food, and drinking water. For example, the USGS would continue to provide science related to the mitigation of harmful algal blooms and the impacts of harmful algal toxins in bodies of water across the Nation, and to understand the implications of contaminants and pathogens produced by disasters on the health of humans and other organisms. Furthermore, USGS science would contribute valuable insights to land and water managers responsible for decisions related to sources, treatment methods, and conveyance of wastewaters and drinking waters in public and private sites, including in our national parks. USGS ecological and environmental health science would also continue to inform public health protection efforts for zoonotic and vector-borne diseases, and diseases related to invasive species. For this public health work, the USGS would continue collaborations with Federal health agencies such as the National Institutes of Health and the Centers for Disease Control and Prevention.

USGS Infrastructure

The USGS owns 270 buildings, totaling about 1.3 million square feet. In addition to these buildings, the USGS also owns another 283 structures and 8 large research vessels. The breadth of USGS constructed assets is extraordinary, including satellite ground stations, volcano observatories, a nuclear reactor, 8,200 streamgages, 18,600 groundwater wells, 2,000 water quality stations, and thousands of seismic monitoring network locations across the United States, its territories, and beyond. Many of these assets are in remote locations, such as uninhabited islands and mountainous terrain, increasing the challenge of maintaining operation of critical networks and data collection. Approximately 60 percent of USGS-owned buildings are over 40-years old and many USGS-owned assets will require significant investment

to modernize the infrastructure in order for the USGS to continue to produce world-class science. The USGS is in the process of developing modernization plans for its aging facilities portfolio.

Management and Efficiencies

The USGS is proposing to restructure the Climate and Land Use Mission Area into the Land Resources Mission Area. This allows the USGS to focus on its core functions and capabilities, including classifying and examining land and associated resources/products of national interest; detecting and understanding changes in lands and associated resources/products; and delivering scientific information in forms/formats that are relevant to and capable of being used by land and natural resource planners, managers, and decision makers. Refer to the Technical Adjustments, Section B, for more details.

The USGS's 3D Elevation Program (3DEP) is a unique collaboration between all levels of government and the private sector to leverage the services and expertise of private sector mapping firms to acquire high-resolution elevation data. When federal and non-federal partners work together to map it once and use the data many times, they can achieve efficiencies and lower costs. When 3D elevation data are available to everyone, new innovations will occur in protecting infrastructure and natural resources, and improving forest resource management, public safety, agriculture, and other industries for years to come. The 3DEP's collaboration efforts, supported by geospatial liaisons from across the United States are critical for coordinating with Federal, State, local, and tribal governments and private industry users to obtain matching funds (approximately four partner dollars for each USGS dollar invested). This strategy effectively leverages Federal dollars through partnerships to support land and water stewardship, security, and enable job creation. The economic benefit of high-resolution elevation data is tremendous to our partners across all sectors. Estimates by the National Enhanced Elevation Assessment (Dewberry, 2012), indicate a fully funded 3DEP would result in an economic benefit of \$690 million annually.

Similarly, the USGS's leads a unique collaboration between State Geological Surveys and universities to achieve efficiencies in producing three-dimensional geologic mapping and models that help to create private sector jobs, fuel American economic opportunities, and support a 21st-century economy based on energy, minerals, and oil and gas resource assessments. The USGS has over 20 years of successful cooperation among Federal (FEDMAP), State (STATEMAP), and university (EDMAP) partners to deliver digital geologic maps to the public. Each of these three components has a unique role per the National Cooperative Geologic Mapping Act of 1992, yet all work cooperatively to select and map high-priority areas for new geologic maps. Annually, the USGS works cooperatively with approximately 45 different State Geological Surveys and 20 to 25 different universities throughout the country. State geological surveys and university participants receive funding through a competitive proposal process that requires 1:1 matching funds, ensuring the value of each proposal is weighed against its cost in Federal and State appropriated funds.

Fixed Costs

The fixed costs increase for the USGS in 2018 is \$21.8 million, and includes \$9.8 million to pay for personnel-related costs and nearly \$12 million to cover increased rents costs. More information on the

USGS contribution to the Department's Working Capital Fund is located in Sundry Exhibits, Section Q. The fixed costs calculations are located in the USGS Exhibits, Section O. Cost saving projects have resulted in a smaller facilities footprint and have reduced the USGS's rent costs; however, GSA rental rates are projected to escalate in the San Francisco Bay Area. More information on rented facilities, owned facilities and their operation and maintenance, and cost saving projects is located in Facilities, Section M.

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**Technical
Adjustments
And Internal
Transfers**



The USGS has two technical adjustments in the 2018 President’s budget request:

- Restructuring the Climate and Land Use Mission Area (CLU) into the Land Resources Mission Area (LRMA). The 2018 President’s budget request contains a number of internal transfers related to the CLU to LR restructure.
- Renaming of the Coastal and Marine Geology Program (CMGP) to the Coastal-Marine Hazards and Resources Program (CMHRP) to convey the work of the program.

Climate and Land Use Change Mission Area/Land Resources Mission Area Budget Restructure

The 2018 President’s budget proposes to restructure the Climate and Land Use Change Mission Area. This restructure is necessary to allow us to more effectively operate under the proposed 2018 funding levels within the President’s request. The change conveys the work that the programs within Land Resources will be focusing on in 2018.

The table below provides a map of the changes from the old to the new structure and the descriptions that follow provide an overview of the proposed subactivities:

<u>Climate and Land Use Mission Area</u>	<u>Land Resources Mission Area</u>
<i>Climate Variability Subactivity</i>	<i>N/A</i>
National Climate Change and Wildlife Science Center/ DOI Climate Science Centers Program Element	<i>National and Regional Climate Adaptation Science Centers Subactivity</i>
Climate Research and Development Program Element	N/A (Funding transferred to Land Change Science and projects retained in the 2018 request will be funded in that subactivity)
Carbon Sequestration Program Element	N/A (Funding transferred to Land Change Science where Biologic Carbon Sequestration will be eliminated. The remaining program functions for Geologic Carbon Sequestration will be transferred to the Energy Resources Program)
<i>Land Use Change Subactivity</i>	<i>N/A</i>
Land Remote Sensing Program Element	<i>National Land Imaging Subactivity</i>
Land Change Science Program Element	<i>Land Change Science Subactivity</i>

Land Resources (Formerly Climate and Land Use Change)

The 2018 President's budget realigns the existing CLU mission area, focusing a narrower set of scientific activities to meet priority stakeholder needs. This recalibration of the science of these program necessitates a restructure of functions, capabilities, and activities. In CLU's place, the Land Resources Mission Area will focus on classifying and examining land and associated resources/products of national interest; detecting and understanding changes in lands and associated resources/products; and delivering scientific information in forms/formats that are relevant to and capable of being used by land and natural resource planners, managers, and decision makers.

The following are summaries of each of the renamed/scoped programs and their relationship to one another:

The **National Land Imaging Program (NLI)** subactivity delivers the remote sensing observation capacity, data, and research required to understand how landscapes and associated natural resources are changing at grand scales. It collects, archives, and distributes a broad array of data from near-Earth and satellite-based remote sensing platforms. The NLIP provides long-term records of changes in landscapes, real-time change-detection capabilities, and associated interpretive tools that decision makers need for land and resource management decisions.

The **Land Change Science Program (LCSP)** subactivity conducts research required to understand the forces that shape landscapes and their potential uses, to distinguish between land surface change resulting from natural forces and those that are associated with land use decisions, and to provide the scientific bases for land use decisions that affect the safety of communities, economic prosperity, and natural resources of the Nation. It delivers research products, information, and computer programs that help decision makers understand, interpret, and apply the knowledge and data gained from on-the-ground and remote sensing observation systems to land use planning, natural resource management, and adaptation planning decisions.

The **National and Regional Climate Adaptation Science Centers** subactivity is the organizing entity within USGS for the **National Climate Adaptation Science Center (NCASC)** and DOI's regional **Climate Adaptation Science Centers (CASCs)**. These centers deliver the on-the-ground observations and research required to understand how changes in climate, land uses, and associated changes in land cover are affecting the Nation's natural resources and associated populations of fish and wildlife species essential to the Nation's natural heritage. It provides information essential to the development of tools and applications that help resource managers understand which observed changes are meaningful, what the observations suggest about the condition and sustainability of natural resources, and what can be done to support conservation priorities of the Nation.

Collectively, the subactivities within the **Land Resources Mission Area (LRMA)** deliver ground-based data and analyses, remotely sensed data and analyses, investigative research, and tools and applications necessary for science-based decisions related to stewardship of lands, natural resources, and their uses in support of economic prosperity consistent with shared conservation ethic.

The table shown below is a crosswalk of the old and new budget structure within CLU, using 2018 funding levels.

		PROPOSED			Energy Resources
		Land Resources			
		National Land Imaging Program	Land Change Science Program	National Climate Adaptation Science Center & Regional Climate Adaptation Science Centers	
Fiscal Year 2018 <i>dollars in thousands</i>					
CURRENT	Climate & Land Use Change	National Climate Change & Wildlife Science Centers / DOI CSCs		\$17,435	
		Climate Research and Development		\$10,311	
		Carbon Sequestration ¹			+\$1,477
		Land Remote Sensing	\$76,127		
		Land Change Science		\$8,974	
2018 Request Levels in New Structure		\$76,127	\$19,285	\$17,435	+\$1,477

The 2018 President’s budget is presented in the proposed new structure. The tables below are provided for comparison purposes.

The Land Resources Mission Area chapter presents the program, the summary of proposed changes, the activity and program overview, and the performance changes in the new structure.

¹ The funding in the Land Change Science Program that remains from Carbon Sequestration program will transfer (through a technical adjustment) to the Energy and Minerals Program as part of the 2018 President’s request. The Carbon Sequestration line will be \$0 after the transfer and is not shown in the new structure in this exhibit.

Technical Adjustments

New Budget Activities \$000	2016 Actual	2017 CR	2018 Budget Request	Change from 2017 CR	% Change from 2017 CR
Land Resources					
National Land Imaging Program	72,194	72,057	76,127	4,070	6%
Land Change Science Program	41,346	41,267	19,285	-21,982	-53%
National and Regional Climate Adaptation Science Centers	26,435	26,385	17,435	-8,950	-34%
Total	139,975	139,709	112,847	-26,862	-19%

Former Budget Activities \$000	2016 Actual	2017 CR	2018 Budget Request	Change from 2017 CR	% Change from 2017 CR
Climate and Land Use Change					
National Climate Change and Wildlife Science Center/DOI Climate Science Centers (CSC's)	26,435	26,385	17,435	-8,950	-34%
Climate Research and Development	21,495	21,454	0	-21,454	-100%
Carbon Sequestration	9,359	9,341	0	-9,341	-100%
Land Remote Sensing	72,194	72,057	76,127	4,070	6%
Land Change Science	10,492	10,492	19,285	8,813	84%
Total Land Resources	139,975	139,709	112,847	-26,862	-19%

Natural Hazards

Within the Natural Hazards Mission Areas, the USGS proposes to change the name of the Coastal and Marine Geology Program (CMGP) to the Coastal/Marine Hazards and Resources Program (CMHRP). There are no funding changes based on this name change. This change reflects the connection between the critically important hazards-related activities such as offshore earthquake and tsunami hazards as well as coastal changes hazards due to extreme storms. This also highlights the priority work conducted in the Program addressing to offshore resources, including work related to identifying the extended shelf of the United States and evaluating methane hydrates as a potential energy source.

Fiscal Year 2018 <i>dollars in thousands</i>		PROPOSED
		Coastal/Marine Hazards and Resources
CURRENT	Coastal and Marine Geology Program	\$35,774

Other Internal Transfers

USGS Internal Transfers			
Subactivity	Internal Transfer	2017 Program Change Amount	FTE Changes
Internal Transfer: Increase		32,272	163
Land Change Science	Transfer from Climate Research and Development	21,454	119
Land Change Science	Transfer from Carbon Sequestration	9,341	37
Energy Program	Transfer from Land Use Change	1,477	7
Internal Transfer: Decrease		-32,272	-163
Climate Research and Development	Transfer to Land Change Science	-21,454	-119
Carbon Sequestration	Transfer to Land Change Science	-9,341	-37
Land Change Science	Transfer to Energy Program	-1,477	-7
Internal Transfer Total		0	0

Internal Transfer from the former Climate and Research and Development Program to Land Change Science Program (\$21,454,000/119 FTE): Paleontological, biogeochemical, and geographic expertise previously funded by the Climate Research and Development Program will be utilized by the Land Change Science Program (LCSP) to conduct investigations, deliver datasets, and support the development of geospatial tools intended to support delivery of research and data required to: understand the forces that shape landscapes and their potential uses; distinguish between changes resulting from natural forces and those that are associated with land use decisions; and to provide the scientific bases for decisions related to land use decisions that affect the safety of communities, economic prosperity, and natural resources of the Nation. Examples of projects to be transferred to the LCSP include development of land use and land cover change projection tools designed to help resource managers anticipate, plan for, and adapt to changes in climate and associated resource management challenges; development of geological data sets that can be used to understand how landscapes and associated natural resources have been affected by past variations in climate, water availability, and natural disturbances over time to improve understandings of our Nation’s present vulnerabilities to similar variations and the threats they pose to economic prosperity and natural heritage; and investigations of arctic landscapes and the challenges that changes in temperatures and water availability might present for the development, use, and conservation of natural resources. Of the amounts transferred, \$11.1 million and 54 FTE of Climate R&D will be proposed for termination.

Internal Transfer from the former Carbon Sequestration Program to Land Change Science Program (\$9,341,000/37 FTE): The USGS Carbon Sequestration Program focuses on two aspects of carbon sequestration: biologic carbon sequestration and geologic carbon sequestration. The biologic carbon sequestration project focuses on the science behind removing carbon from the atmosphere and storing it in vegetation (particularly forests and wetlands), soil and sediments, and aquatic environments. The geologic carbon sequestration project researches the effects and capacity of pumping CO₂ deep underground: Will it induce seismic activity; what are the potential benefits in terms of enhanced oil recovery; how much CO₂ can be stored underground and where is it most feasible; and will the CO₂

storage affect drinking water? Authorized by the Energy Independence and Security Act (EISA) of 2007 (P.L. 110-140), which calls for the USGS to develop a methodology for, and then complete a national assessment of, the geologic storage capacity for CO₂. It also directed Interior to conduct a national assessment to quantify the amount of carbon stored in ecosystems, the capacity of ecosystems to sequester additional carbon, and the rate of greenhouse gases fluxes in and out of the ecosystems (biologic carbon sequestration). Of the amounts transferred, \$7.9 million of the carbon sequestration research will be proposed for reduction.

Internal Transfer from the Land Resources Mission Area, Land Change Science Program to the Energy and Mineral Resources Mission Area, Energy Resources Program (\$1,477,000/7 FTE): Carbon Sequestration – Geologic Research and Assessments project work will continue after transfer to the Energy and Mineral Resources Mission Area. The project will work on a national assessment of the technically recoverable hydrocarbon resources resulting from CO₂ injection and storage through CO₂-enhanced oil recovery. The goals of this work are to: (1) complete and publish an assessment methodology; (2) conduct a national assessment of recoverable oil and associated CO₂ storage that is expected in future CO₂-enhanced oil recovery operations; and (3) publish the assessment results. In addition this funding will allow for a limited amount research on improving the geologic and technical foundation of CO₂ storage in various geologic basins.

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USGS Science Collaboration



Science Collaboration



USGS researchers handle an invasive Burmese python in the Everglades National Park.

The USGS works collaboratively with other Interior bureaus and Federal agencies to identify and address issues of importance to the Nation.

Introduction

Created by an Organic Act of Congress in 1879, the United States Geological Survey (USGS) has evolved over the last 138 years into a bureau with a mission to deliver integrated scientific understanding and forecasts of natural systems to improve the Nation's economic well-being; reduce societal risks to hazards; support resilient infrastructure and natural resource security; and inform strategies for adapting to changing landscapes. The USGS provides reliable scientific information for the common good of its Federal, State, tribal, and local partners and the American people.

Scientific coordination and collaboration is central to the USGS's science mission. USGS is the sole science agency for the Department of the Interior. Thousands of Federal, State, local, and tribal governments, the private sector, and non-governmental organization partners seek out the USGS for its natural science expertise; its vast Earth and biological data holdings; and unbiased scientific analyses and publications. As a non-regulatory entity, the USGS provides objective, credible scientific research and analysis that Federal agencies and Interior bureaus with regulatory responsibilities use to make informed decisions based on sound science. The USGS contributes valuable expertise to these collaborations, filling in the knowledge gaps that the USGS is uniquely capable of addressing.

By leveraging efficiencies across various Federal, State, local, tribal, and industry sectors, the USGS provides thorough and accurate science—tailor-made to address some of America's most pressing challenges of the 21st century. The USGS enters into scientific partnerships, making the best use of limited resources to further national priorities including:

- The Nation's natural resources, including energy, minerals, and water.
- Stewardship, including recreation and sporting, and tribal nations.
- Science to protect public safety, health, and property, including natural hazards and environmental health.
- Infrastructure, including development and construction.
- Management and efficiencies.

Science Collaboration

As America seeks to solve these challenges, the USGS provides sound decision-ready science in a timely manner to inform multi-entity collaborations on issues affecting energy and mineral resource assessments, infrastructure development, public health and safety, community resilience, and sustainable economies. Examples include:

- Conducting monitoring and assessments associated with natural hazards as well as assessing and researching coastal impacts and resources.
- Assessing the availability and recoverability of oil, gas, and other energy resources.
- Assessing the sources and life cycles of critical minerals that are increasing in importance with the emergence of new technologies.
- Providing the tools for communities to plan for increased pressures on available water supplies, including drought.
- Developing the basis for an improved ability to project the availability of water for future economic, energy production, and environmental uses.
- Creating the foundation for addressing multiple emerging Federal, State, tribal, and local governments, and private industry requirements for infrastructure, energy, and water demands through the 3D Elevation Program (3DEP).
- Building a high-quality geologic mapping framework to understand the distribution and quantity of mineral resources and inform resource management.
- Providing tools for early detection and control of invasive species and wildlife disease.
- Providing science to help protect the health of visitors and workers on Federal lands, and science to protect the health of Native populations and the fish and wildlife they rely on for nutrition, from environmental contaminants and pathogens.
- Engaging the next generation to build a 21st century workforce.

Examples of USGS Science Coordination and Collaborations

The USGS collaborates with its partners to provide valuable science for decision making. The following section offers a snapshot of a cross-section of the USGS's science coordination activities with other Interior bureaus, and Federal, State, tribal, and local partners.

The Nation's Natural Resources

Critical Minerals: The USGS collaborates with a number of external organizations to leverage the expertise and contributions of partners toward the goal of a more thorough understanding of the Nation's mineral potential, production, and consumption. The USGS has been closely involved with the development of a critical mineral early warning screening tool in collaboration with Federal agency partners (including the Department of Energy, the Department of Defense, and the Department of Commerce, among others) and industry stakeholders. This tool is essential for decision makers to understand the supply and availability of critical minerals upon which the Nation depends for products ranging from smartphones to advanced national defense systems. The United

States is 100 percent dependent upon foreign countries for its supply of 20 critical mineral commodities, and more than 50 percent dependent upon imports for an additional 30 critical minerals. Therefore, the collaboration between the USGS and its Federal and industry partners to develop the critical minerals early warning system has been important to United States' national security and economic prosperity.

Unconventional Energy Resource Assessments: The USGS works with Federal agencies, including the U.S. Department of Energy and other agencies, on a scientific research collaboration project designed to better understand our Nation's unconventional oil and gas (UOG) resources and their impacts. Through the Federal Multiagency Collaboration on Unconventional Oil and Gas, the USGS provides research to understand the availability and recoverability of unconventional oil and gas resources across the Nation, and works with its Federal partners to leverage the scientific expertise of each agency toward the goal of a holistic understanding of UOG development so that decision makers will have thorough and accurate scientific data upon which to base their domestic energy policy decisions.

Energy Development: The USGS collaborates with the State of Wyoming, the Bureau of Land Management (BLM), the U.S. Forest Service, the Bureau of Reclamation, the U.S. Fish and Wildlife Service, the National Park Service, non-governmental organizations, industry, and communities to assess and facilitate responsible natural gas development by providing science and technical assistance to partners; and with the Bureau of Ocean Energy Management on the science needed for making decisions in the outer continental shelf that balance fisheries management and energy development.

Archival Resources for Industry: The USGS's Core Research Center, located in the Denver Federal Center, houses rock cores and samples from 63,000 wells representing over 242 million linear feet of subsurface rock strata from 36 States. The USGS's geologic samples provide an invaluable archive to both the private and public sector for oil, gas, and mineral exploration; infrastructure development; and water resource management. In 2016, 57 percent of the users represented industry researchers who revisit reservoirs that were once considered tight or depleted and to reevaluate the potential for further oil and gas production with new technology, by re-analyzing the USGS's archived rock cores. Mining professionals also analyze existing, ore-rich rock cores to determine the value of pursuing extraction.

Offshore Energy: The USGS collaborates with the Bureau of Ocean Energy Management on science needed for making decisions in the outer continental shelf for fisheries management and energy development; and with U.S. Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service to assess the risk associated with alternatives for sighting offshore wind development.

Water Resources: The USGS provides science information and assessments of surface and ground water availability and quality for the Nation to Tribes, the National Park Service, U.S. the Fish and Wildlife Service, NOAA, and many other stakeholders.

Land and Water Stewardship

Water Conservation: Water is a fundamental natural resource; it circumscribes economic opportunities and is integral to the quality of our lives and the health of our environment. The USGS collaborates with States, Tribes, and local communities to address competing demands for water by helping improve conservation and increase water availability, restore watersheds, and resolve long standing water conflicts.

Sustain and Manage America's Resources for Tomorrow: The hydrologic cycle (i.e., the continuous movement of water above, on, and below the surface of the Earth) is a continuous process that often is not confined to any single political jurisdiction. Effective water stewardship and the governance of water use—and its reusability—therefore requires horizontal collaboration and cooperation across departments and sectors within a vertical hierarchy of local, State, and national interests. The USGS brings research strengths in resource assessments and surface water monitoring for America's end users – such as State, local, and tribal resource managers enabling effective water management among all sectors and stakeholders that depend on water.

The USGS's develops new water accounting tools and assesses water availability at the regional and national scales. Through the National Water Census, the USGS is integrating diverse research on water availability and use and enhancing the understanding of connection between water quality and water availability. Research is designed to build decision support capacity for water management agencies and other natural resource managers. In addition, Geographic Focus Area Studies between the USGS and the Bureau of Reclamation, provides the framework Interior needs to successfully join the related water resource programs of its bureaus and offices in pursuit of a single unifying purpose: to secure a sustainable water future for the nation.

Coastal Erosion: The Coastal-Marine Hazards and Resources Program has worked with the U.S. Army Corps of Engineers (USACE; Corps) to leverage USGS expertise about beach processes and responsibilities for forecasting beach change assisting USACE's role in coordinating beach nourishment projects. The USGS and USACE are working with the American Shore and Beach Preservation Association to discuss plans for development of a new Coastal Resiliency Network and to support collaborative research on coastal risk and vulnerability. The goal is to use the wealth of data that already exists in the Corps, the USGS, and other Federal agencies to quantify coastal resiliency and predict changes through time. Additionally, the USGS and USACE are collaborating on identifying ways to streamline and improve procedures for transforming raw lidar data into useful data products.

Harmful Algal Blooms and Harmful Algal Toxins: The USGS currently leads a diverse range of multi-disciplinary studies to address harmful algal bloom and harmful algal toxin issues in water bodies throughout the Nation, including the following: developing field and laboratory methods to identify and quantify harmful algal blooms and associated toxins; understanding causal factors, environmental fate and transport, ecological processes, and effects of environmental exposure; and developing early warning systems for potentially harmful blooms. Study approaches use a combination of traditional methods and emerging technologies, including advanced analytical techniques, stable isotopes, molecular techniques, sensor technology, and satellite imagery. Studies

range in scale from laboratory experiments on individual water bodies, to studies that are regional or national in scope, and are completed in collaboration with local, State, Federal, tribal, non-governmental organizations, and industry partners.

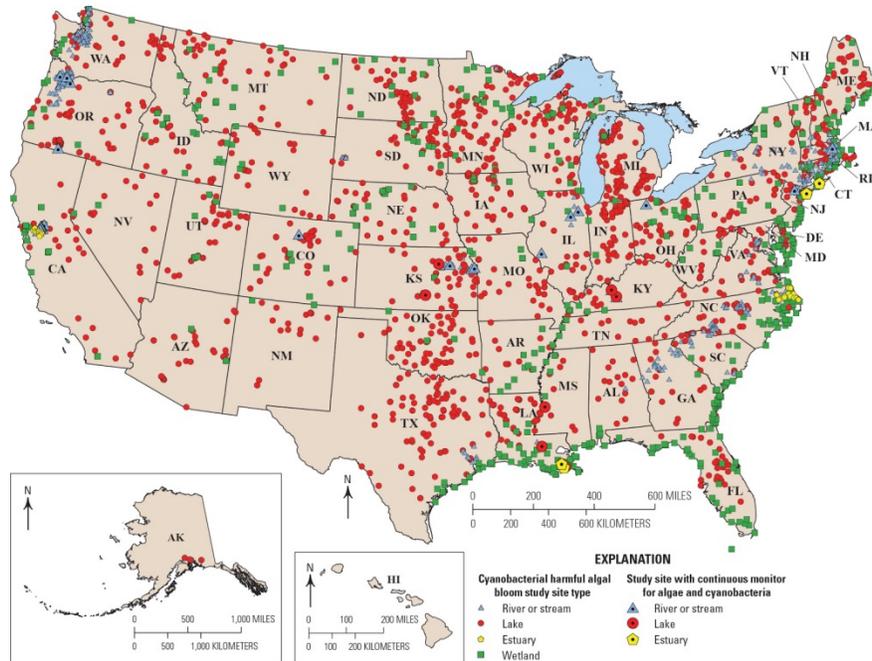


Figure 1: The USGS has conducted cyanobacterial harmful algal bloom studies at thousands of sites throughout the Nation since the mid-1990s. Studies range in scope, from local to national, and have been completed in collaboration with local, State, Federal, tribal, academic, non-governmental organization, and industry partners. Source: USGS.

Recent examples of USGS harmful algal bloom/harmful algal toxin science include:

- Developing a variety of approaches to quantify harmful algae and associated toxins including field protocols, field guides, taxonomy, sample preparation techniques, advanced analytical techniques, and molecular tools.
- Operating a network of about 80 sensors that measure algae in near real-time in high-valued water bodies used for recreation and drinking water throughout the Nation.
- Conducting National- and regional-scale assessments to show the widespread occurrence of multiple algal toxins in a diverse range of settings across the Nation.
- Characterizing the environmental persistence, fate, and transport of harmful algae and associated compounds (e.g., harmful algal toxins). USGS studies have documented impacts hundreds of miles downstream from lakes reporting harmful blooms.
- Performing integrated ecosystem studies that use tools such as stable isotopes, genetics, and sensors, in addition to traditional approaches, to better understand environmental drivers of harmful algal bloom formation in lakes, rivers, and estuaries throughout the Nation.

Science Collaboration

- Quantifying impacts of harmful blooms on aquatic organisms, including threatened and endangered species.
- Collaborating with the National Aeronautics and Space Administration, NOAA, and the U.S. Environmental Protection Agency to develop an early warning indicator, called the Cyanobacteria Assessment Network (CyAN), of freshwater and estuarine algal blooms using satellite information to aid expedient public health advisories.

Land Imaging: The National Land Imaging (NLI) Program advances the science and methods for collecting, analyzing, and understanding user needs in order to motivate agility in its product and service portfolio. The program collaborates with many Federal partners including Interior bureaus, the National Aeronautics and Space Administration, NOAA, the U.S. Department of Agriculture (USDA), and the National Geospatial Intelligence Agency on remote sensing science. Landsat is a valuable tool for many Federal partners providing them with information that enhances their ability to meet their mission. For example, the USDA uses Landsat imagery to estimate crop production and monitor water use for agricultural production. Landsat imagery is also used to develop the USDA's Cropland Data Layer, a crop-specific land cover classification product, and USDA's Satellite Imagery Archive. NLI works with users to better understand their needs for land imaging observations, products, and services; through the Interior Remote Sensing Working Group and other venues, NLI works with various Interior bureaus to seek input on its new products and land imaging initiatives in order to better meet user needs. Interior bureaus use Landsat satellite data and products for work including: drought, invasive species, fire mitigation, water use and availability information, and energy and mineral development.

Geologic Mapping with States: The USGS, along with State and university partners, share the common responsibility identified in the National Geologic Mapping Act, of 1992, to collaborate and expedite the production of a geologic map database for the Nation applicable to land-use management, assessment, and utilization and conservation of natural resources, groundwater management, and public safety. Annually, the USGS works cooperatively with approximately 45 different State geological surveys and 20-25 different universities throughout the country to select and map high-priority areas for new geologic maps.

Mapping Public Lands: The Protected Areas Database of the United States (PAD-US) is the Nation's inventory of public parks (including National Parks) and other protected open space. With more than three billion acres in 150,000 locations, the spatial data within the PAD-US represents public lands managed by national, State, regional, and local governments, as well as non-profit conservation organizations. PAD-US informs critical decisions in habitat management, recreation, public health, and wildfire planning and response by groups such as the National Park Service, U.S. Forest Service, U.S. Fish & Wildlife Service, and National Wildfire Coordinating Group. The accuracy and accessibility of PAD-US make it one of the vital engines behind scientific analysis of issues involving land management and conservation practice for government, academic, commercial, and non-profit science.

Wildlife Management: USGS science is needed by agencies to determine appropriate harvest levels by hunters, manage disease outbreaks in both wildlife and domestic animals, ensure public safety, and manage wildlife on National Refuges, National Parks, and BLM Units.

Wildlife-Related Recreation: The unique role of the Cooperative Research Unit's Program (CRU) is exemplified by the agency partnerships and integration of its work into management decision making. Each Unit is owned collectively by its cooperators, made up of Interior agencies, the State natural resource agency, and the university. Collaborative work conducted by the CRUs provides science support to management agencies designed to sustain the hunting, fishing, and wildlife-related recreation needs of the public that account for \$144 billion dollars in expenditures and 480,000 American jobs (*2017 National Recreation Economy Report, Outdoor Industry Association*).

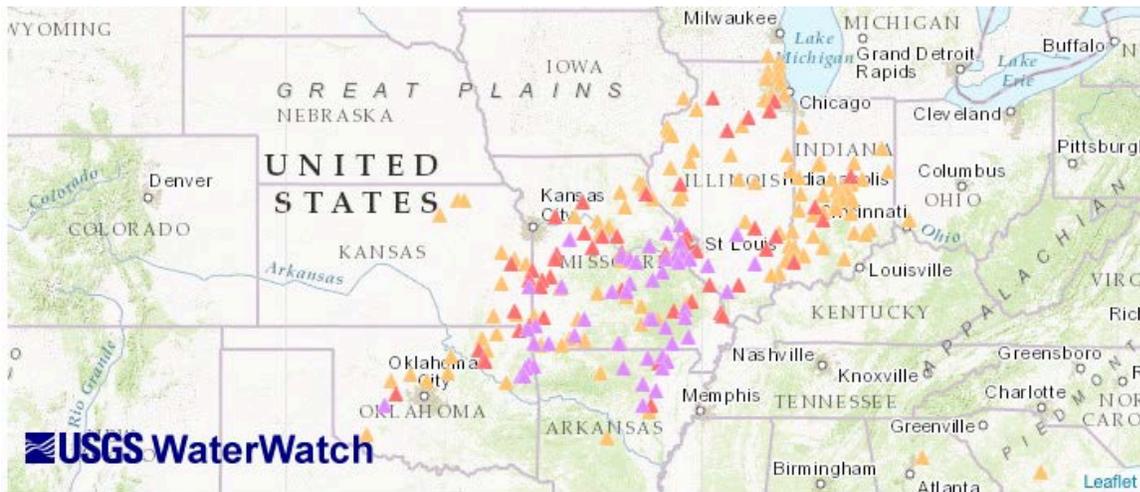
Tribal Fisheries, Water Uses, and the Environment: The USGS evaluates habitat projects designed to enhance anadromous fish populations (i.e., fish born in fresh water, spending adult life in the sea, and returning to fresh water to spawn; salmon, smelt, shad, striped bass, and sturgeon are common examples) by tribal partners, including the Nisqually Indian Tribe, Swinomish Indian Tribe, and the Yakama Nation to most effectively target limited financial resources. The USGS collaborates with work related to water availability issues on tribal lands in order to address such topics as water rights, water use, hydrologic conditions, and water-quality issues. In addition, USGS cooperative activities related to energy and water enhance local cooperative studies related to regional drought and enhance data collection related to tribal water issues. In addition, environmental factors are recognized drivers of Native health. USGS Environmental Health science, in collaboration with Federal, State, local, and tribal partners, helps inform efforts to protect the health of Native populations, and the fish and wildlife they rely on as sources of nutrition, from environmental contaminants and pathogens.

Public Safety and Security

Earthquake Hazards: Through National Earthquake Hazards Reduction Program, (NEHRP), the USGS partners with the Federal Emergency Management Agency (FEMA), the National Science Foundation, and the National Institute of Standards and Technology (NIST) to reduce earthquake losses in the United States. For example, the USGS partners with FEMA and NIST in the development and updating of building codes, based on USGS earthquake hazard science. The USGS *ShakeMap* product, which provides rapid situational awareness of earthquake ground motions, is sent directly to numerous businesses, utilities, lifeline operators, response officials, and State and local government agencies, and is imported directly into FEMA's *HAZUS* software for detailed estimation of earthquake impacts.

Mapping for Disaster Response: The USGS offers world-class science capabilities to support the Department of Defense (DOD). Since 2003, the USGS has partnered with the U.S. Northern Command (USNORTHCOM) to facilitate science support in the event of a major natural disaster. One key product that now supports USNORTHCOM and other DOD partners during a natural disaster is the USGS topographic map or US Topo, which the USGS provides to DOD through a partnership with the Defense Logistics Agency. This new capability enables immediate requests and delivery of this USGS resource to the impacted area.

Providing Critical Information during Flooding: Through the Groundwater and Streamflow Information Program, the USGS operates more than 8,200 streamgages that provides data for flood forecasting, flood-control operations, and disaster mitigation and recovery. The river stage and streamflow discharge data that the USGS collects and disseminates are crucial to the reliability of National Weather Service (NWS) river and flood forecasts by enabling the adjustment and validation of flood models. USGS data also support the operation of water control structures by the U.S. Army Corps of Engineers (USACE) and numerous other water managers by providing real-time validation of water releases. USGS personnel routinely perform maintenance of streamgage equipment and make manual measurements of streamflow discharge during flooding events. These activities are even more critical during times of flood, especially when flows are above the peak flow of record. The USGS provided this critical data recently during the significant flooding that occurred from Arkansas to Indiana beginning in April-May 2017.



Explanation

- ▲ USGS streamgages above major flood stage as defined by the National Weather Service
- ▲ USGS streamgages above moderate flood stage as defined by the National Weather Service
- ▲ USGS streamgages above flood stage as defined by the National Weather Service

Figure 2 --USGS streamgages reporting flow above NWS minor, moderate, and major flood stage from April 27 to May 2, 2017.

Infrastructure

Invasive Species Impacts to the Built Environment: USGS scientists partner with Interior and other Federal, State, tribal, territorial agencies, non-governmental entities, and private industry to help solve problems posed by invasive species. Invasive species cause broad-scale negative ecological, agricultural, cultural, human health and quality of life impacts. Similarly, damaging impacts of invasive species on the Nation’s economy, infrastructure, energy, water resources, and military readiness are significant. Every year, invasive species cost the United States billions of dollars in economic losses and other damages. The USGS joins the above-mentioned entities to combat invasive species from a Federal perspective by investigating (1) new and emerging priorities of national concern; (2) early detection and rapid response; (3) innovative control technologies; and (4) cost-effective techniques for prevention, eradication, control and restoration. The USGS’s invasive

species efforts provide resource managers within, and outside, Interior tools and guidance to control invasive species negatively impacting the Nation's trust resources.

Science for Safe Drinking Water and other Public Health Infrastructure on Public Lands: The USGS's Environmental Health science helps inform upgrades to wastewater and drinking water treatment infrastructure, road building, and other facilities improvements on public lands. The USGS Environmental Health Mission Area works with Federal partners such as the National Park Service, as well as State and local agencies to provide critical science on issues related to infrastructure and health on public lands.

Management and Efficiencies

USGS Environmental Health science ultimately helps enhance efficiency and management of Department of Interior activities, by informing decision making, reducing costs, and balancing regulatory burdens with opportunities to protect health—including protecting the health of Interior workers on Federal lands. Examples include helping understand occurrences, origins, and health implications of contaminants (such as harmful algal toxins, metals, and other compounds) and pathogens in waters, rocks, soils, and dusts on public lands. The USGS Environmental Health Mission Area works with the Department of the Interior – Office of Occupational Safety and Health, the National Park Service – Office of Public Health, the National Institute of Environmental Health Sciences, the Centers for Disease Control and Prevention, among others, on these activities.

The USGS, via the 3DEP Executive Forum, facilitates executive dialog and collaboration on strategies to implement and sustain 3DEP for the benefit of its Federal stakeholders and the broader community. The Forum is comprised of representatives from 14 Federal agencies that support 3DEP goals for nationwide data coverage.

The USGS-led Alaska Mapping Executive Committee meets regularly to coordinate on critical Alaska topographic mapping activities. Executives from 15 Federal agencies and the State of Alaska are combining efforts to acquire new digital elevation, hydrography, transportation, shoreline and geospatial data for Alaska, and create a new digital topographic map series for the State.

The USGS and the U.S. Forest Service share data for mapping purposes to create more consistent and current products. This collaboration reduces costs for map production and results in more consistent products.

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Budget at a Glance

Budget at a Glance

Budget at a Glance (Dollars in Thousands)						
	2016 Actual	2017 CR Annualized	Fixed Costs	Internal Transfer	Program Changes	2018 Budget Request
Surveys, Investigations, and Research						
Ecosystems						
Status and Trends Program	20,473	20,434	206	0	-3,806	16,834
Eliminate Curation of Smithsonian Museum Collections					-1,600	
Reduce Species-Specific Wildlife Research					-2,000	
Reduce Status and Trends Program Operations					-206	
Fisheries Program	20,886	20,846	253	0	-5,253	15,846
Eliminate Unconventional Oil and Gas Research					-1,000	
Reduce Contaminants Research					-500	
Reduce Species-Specific Fisheries Research					-3,500	
Reduce Wildlife Program Operations					-253	
Wildlife Program	45,757	45,670	508	0	-10,707	35,471
Eliminate Whooping Crane Propagation Program					-1,500	
Reduce Contaminants Research					-500	
Reduce Changing Arctic Ecosystems Research and Monitoring					-1,600	
Reduce Species-Specific Wildlife Research					-6,599	
Wildlife Operations					-508	
Environments Program	38,415	38,342	392	0	-9,392	29,342
Reduce Ecosystem Services Tool Development and Case Studies					-1,000	
Reduce Greater Everglades Research and Monitoring					-5,000	
Reduce Chesapeake Bay Research and Monitoring					-3,000	
Reduce Environments Program Operations					-392	
Invasive Species Program	17,330	17,297	127	0	-127	17,297
Reduce Invasive Species Program Operations					-127	
Cooperative Research Units Program	17,371	17,338	262	0	-262	17,338
Reduce Cooperative Research Units Program Operations					-262	
Total, Ecosystems	160,232	159,927	1,748	0	-29,547	132,128
Land Resources						
National Land Imaging Program	72,194	72,057	340	0	3,730	76,127
Landsat 9 Ground System Development					22,400	
Eliminate Support for National Civil Applications Center					-4,847	
Reduce Satellite Operations					-8,996	
Eliminate AmericaView State Grant Programs					-1,215	
Reduce Science Research and Investigations					-3,272	
Reduce National Land Imaging Operations					-340	
Land Change Science Program	41,346	41,267	122	-1,477	-20,627	19,285
Transfer from Climate Research and Development					21,454	
Transfer from Carbon Sequestration					9,341	
Eliminate Biologic Carbon Sequestration					-5,237	
Transfer to Energy					-1,477	
Reduce Geologic Carbon Sequestration					-2,627	
Eliminate Landscape Science Projects					-1,498	
Eliminate Climate Research and Development Activities					-11,143	
Reduce Land Change Science Operations					-122	
National and Regional Climate Adaptation Science Centers	26,435	26,385	140	0	-9,090	17,435
Eliminate Support for National Phenology Network					-250	
Eliminate Support for GeoData Portal at Office of Water Infrastructure					-200	
Realign the National and Regional Climate Adaptation Science Centers					-8,500	
Reduce National and Regional Climate Adaptation Science Centers Operations					-140	
Total, Land Resources	139,975	139,709	602	-1,477	-25,987	112,847

Budget at a Glance

Budget at a Glance (Dollars in Thousands)						
	2016 Actual	2017 CR Annualized	Fixed Costs	Internal Transfer	Program Changes	2018 Budget Request
Surveys, Investigations, and Research						
Energy and Mineral Resources, and Environmental Health						
<i>Energy and Mineral Resources</i>	73,066	72,927	934	1,477	-934	74,404
Mineral Resources Program	48,371	48,279	644	0	-644	48,279
Reduce Mineral Resources Program Operations					-644	
Energy Resources Program	24,695	24,648	290	1,477	-290	26,125
Reduce Energy Resources Program Operations					-290	
<i>Subtotal: Mineral and Energy Resources</i>	73,066	72,927	934	1,477	-934	74,404
Environmental Health	21,445	21,404	287	0	-4,585	17,106
Contaminant Biology Program	10,197	10,178	139	0	-2,087	8,230
Reduce Contaminant Research					-1,948	[1,042]
Reduce Contaminant Biology Program Operations					-139	0
Toxic Substances Hydrology Program	11,248	11,226	148	0	-2,498	8,876
Eliminate Radioactive Waste Disposal Science in Support of Energy and Land and Water Stewardship					-700	
Eliminate Municipal Wastewater Science to Support Land and Water Stewardship and Infrastructure					-100	
Eliminate Contaminant Science in Support of Water and Land Stewardship, Energy, and Wastewater and Drinking Water Infrastructure					-1,550	
Reduce Toxic Substances Hydrology Program Operations					-148	-
<i>Subtotal: Environmental Health</i>	21,445	21,404	287	0	-4,585	17,106
Total, Energy and Mineral Resources, and Environmental Health	94,511	94,331	1,221	1,477	-5,519	91,510
Natural Hazards						
Earthquake Hazards Program	60,503	60,388	561	0	-9,561	51,388
Eliminate implementation of Earthquake Early Warning System for the West Coast					-8,200	
Reduce Support for Regional Earthquake Monitoring, Assessments and Research					-800	
Reduce Earthquake Hazards Operations					-561	
Volcano Hazards Program	26,121	26,071	343	0	-3,982	22,432
Suspend Implementation of NVEWS					-1,500	
Reduce Volcano Hazard Assessments					-1,639	
Suspend Maintenance of Monitoring Networks and Data Analysis at Yellowstone and Commonwealth of the Northern Mariana Islands					-500	
Reduce Volcano Hazards Operations					-343	
Landslide Hazards Program	3,538	3,531	53	0	-53	3,531
Reduce Landslide Hazards Operations					-53	
Global Seismographic Network	6,453	6,441	29	0	-1,484	4,986
Suspend implementation of GSN seismic station upgrades					-1,455	
Reduce Global Seismographic Network Operations					-29	
Geomagnetism Program	1,888	1,884			-1,884	0
Eliminate the Geomagnetism Program					-1,884	
Coastal/Marine Hazards and Resources Program	40,510	40,433	493	0	-5,152	35,774
Eliminate Marine Habitat/Resource Mapping and Ocean and Glacier Studies to Inform Resource Management					-1,600	
Eliminate Elevation Model Development and Regional Coastal Resource Assessments					-2,500	
Reduce Support for Regional Coastal Management, Restoration, and Risk Reduction					-559	
Reduce Coastal-Marine Hazards and Resources Program Operations					-493	0
Total, Natural Hazards	139,013	138,748	1,479	0	-22,116	118,111

Budget at a Glance

Budget at a Glance (Dollars in Thousands)						
	2016 Actual	2017 CR Annualized	Fixed Costs	Internal Transfer	Program Changes	2018 Budget Request
Surveys, Investigations, and Research						
Water Resources						
Water Availability and Use Science Program	42,052	41,972	642	0	-12,201	30,413
Reduce National Research Program					-4,325	
Eliminate Water Use Data and Research					-1,500	
Eliminate Mississippi Alluvial Plain Aquifer Assessment Project					-1,000	
Eliminate U.S.-Mexico Transboundary Aquifer Assessment Project					-1,000	
Eliminate Water-Use Unconventional Oil and Gas					-250	
Eliminate Focus Area Studies					-1,600	
Eliminate two Regional Groundwater Evaluations					-789	
Eliminate Groundwater Model Development, Maintenance and Sustainability					-1,095	
Reduce Water Availability and Use Science Program Operations					-642	
Groundwater and Streamflow Information Program	71,535	71,399	742	0	-3,982	68,159
Reduce National Research Program					-1,540	
Reduce National Groundwater Monitoring Network					-1,700	
Reduce Support to Groundwater and Streamflow Information Operations					-742	
National Water Quality Program	90,600	90,428	1,277	0	-17,235	74,470
Reduce National Research Program					-6,011	
Eliminate National Park Service Cooperative Water Partnership					-1,743	
Eliminate National Atmospheric Deposition Program					-1,576	
Reduce National Water-Quality Assessment Project Lower Mississippi					-4,000	
Stream Quality Assessment					-2,628	
Reduce National Water-Quality Assessment Project Trends Assessments					-1,277	
Reduce National Water Quality Program Operations					-6,488	
Water Resources Research Act Program	6,500	6,488	0	0	-6,488	0
Eliminate Water Resources Research Act Program					-6,488	
Total, Water Resources	210,687	210,287	2,661	0	-39,906	173,042
Core Science Systems						
National Geospatial Program	62,854	62,735	575	0	-11,375	51,935
Reduce Federal Geographic Data Committee Functions					-2,700	
Eliminate Geospatial Research and Reduce 3DEP Technical Support					-5,100	
Reduce 3D Elevation Program (3DEP) Functions					-3,000	
Reduce National Geospatial Program Operations					-575	
National Cooperative Geologic Mapping Program	24,397	24,351	244	0	-2,314	22,281
Reduce National Cooperative Geologic Mapping Program Functions					-2,070	
Reduce National Cooperative Geologic Mapping Program Operations					-244	
Science Synthesis, Analysis and Research Program	24,299	24,253	202	0	-5,702	18,753
Reduce USGS Library Functions					-3,000	
Reduce Biogeographic Science Functions					-2,500	
Reduce Science Synthesis, Analysis and Research Program Operations					-202	
Total, Core Science Systems	111,550	111,339	1,021	0	-19,391	92,969
Science Support						
Administration and Management	81,981	81,825	944	0	-13,390	69,379
Reduce Administration and Management Services					-12,446	
Reduce Administration and Management Operations					-944	
Information Services	23,630	23,585	138	0	-3,734	19,989
Reduce Information Services Program					-3,596	
Reduce Information Services Operations					-138	
Total, Science Support	105,611	105,410	1,082	0	-17,124	89,368
Facilities						
Rental Payments and Operations & Maintenance	93,141	92,964	11,963	0	0	104,927
Deferred Maintenance and Capital Improvement	7,280	7,266	0	0	0	7,266
Total, Facilities	100,421	100,230	11,963	0	0	112,193
Total, SIR	1,062,000	1,059,981	21,777	0	-159,590	922,168

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Program Changes



Program Changes

Dollars in Thousands	2016 Enacted	2017 CR	2018 Program Changes	Fixed Costs	2018 Request
Ecosystems	\$160,232	\$159,927	-\$29,547	\$1,748	\$132,128
Status and Trends Program	\$20,473	\$20,434	-\$3,806	\$206	\$16,834
Fisheries Program	\$20,886	\$20,846	-\$5,253	\$253	\$15,846
Wildlife Program	\$45,757	\$45,670	-\$10,707	\$508	\$35,471
Environments Program	\$38,415	\$38,342	-\$9,392	\$392	\$29,342
Invasive Species Program	\$17,330	\$17,297	-\$127	\$127	\$17,297
Cooperative Research Units Program	\$17,371	\$17,338	-\$262	\$262	\$17,338
Land Resources	\$139,975	\$139,709	-\$25,987	\$602	\$112,847
National Land Imaging Program	\$72,194	\$72,057	\$3,730	\$340	\$76,127
Land Change Science Program	\$10,492	\$10,472	-\$20,627	\$122	\$19,285
National and Regional Climate Adaptation Science Centers	\$26,435	\$26,385	-\$9,090	\$140	\$17,435
Climate Research and Development Program	\$21,495	\$21,454	\$0	\$0	\$0
Carbon Sequestration Program	\$9,359	\$9,341	\$0	\$0	\$0
Energy and Mineral Resources, and Environmental Health	\$94,511	\$94,331	-\$5,519	\$1,221	\$91,510
<i>Energy and Mineral Resources</i>	\$73,066	\$72,927	-\$934	\$934	\$74,404
Mineral Resources Program	\$48,371	\$48,279	-\$644	\$644	\$48,279
Energy Resources Program	\$24,695	\$24,648	-\$290	\$290	\$26,125
<i>Environmental Health</i>	\$21,445	\$21,404	-\$4,585	\$287	\$17,106
Contaminant Biology Program	\$10,197	\$10,178	-\$2,087	\$139	\$8,230
Toxic Substances Hydrology Program	\$11,248	\$11,226	-\$2,498	\$148	\$8,876
Natural Hazards	\$139,013	\$138,748	-\$22,116	\$1,479	\$118,111
Earthquake Hazards Program	\$60,503	\$60,388	-\$9,561	\$561	\$51,388
Volcano Hazards Program	\$26,121	\$26,071	-\$3,982	\$343	\$22,432
Landslide Hazards Program	\$3,538	\$3,531	-\$53	\$53	\$3,531
Global Seismographic Network	\$6,453	\$6,441	-\$1,484	\$29	\$4,986
Geomagnetism Program	\$1,888	\$1,884	-\$1,884	\$0	\$0
Coastal/Marine Hazards and Resources Program	\$40,510	\$40,433	-\$5,152	\$493	\$35,774

Program Changes

Dollars in Thousands	2016 Enacted	2017 CR	2018 Program Changes	Fixed Costs	2018 Request
Water Resources	\$210,687	\$210,287	-\$39,906	\$2,661	\$173,042
Water Availability and Use Science Program	\$42,052	\$41,972	-\$12,201	\$642	\$30,413
Groundwater and Streamflow Information Program	\$71,535	\$71,399	-\$3,982	\$742	\$68,159
National Water Quality Program	\$90,600	\$90,428	-\$17,235	\$1,277	\$74,470
Water Resources Research Act Program	\$6,500	\$6,488	-\$6,488	\$0	\$0
Core Science Systems	\$111,550	\$111,339	-\$19,391	\$1,021	\$92,969
National Geospatial Program	\$62,854	\$62,735	-\$11,375	\$575	\$51,935
National Cooperative Geologic Mapping Program	\$24,397	\$24,351	-\$2,314	\$244	\$22,281
Science Synthesis, Analysis and Research Program	\$24,299	\$24,253	-\$5,702	\$202	\$18,753
Science Support	\$105,611	\$105,410	-\$17,124	\$1,082	\$89,368
Administration and Management	\$81,981	\$81,825	-\$13,390	\$944	\$69,379
Information Services	\$23,630	\$23,585	-\$3,734	\$138	\$19,989
Facilities	\$100,421	\$100,230	\$0	\$11,963	\$112,193
Rental Payments and Operations & Maintenance	\$93,141	\$92,964	\$0	\$11,963	\$104,927
Deferred Maintenance and Capital Improvement	\$7,280	\$7,266	\$0	\$0	\$7,266
USGS Total	\$1,062,000	\$1,059,981	-\$159,590	\$21,777	\$922,168

The 2018 President's budget includes \$922.2 million for the USGS, a program decrease of \$159.6 million over the 2017 Annualized Continuing Resolution and fixed costs of \$21.8 million. The 2018 budget request proposes various reductions in programs, but reflects a commitment to executing core USGS mission responsibilities. The USGS focus continues to be providing impartial scientific data and leading-edge research that supports policies and decisions that promote the health, safety, and prosperity of the Nation. With this proposed requested budget, the USGS is reducing or eliminating programs.

More information on the program changes proposed in 2018 can be found in the Mission Area Chapters.

Ecosystems

Status and Trends Program

(-\$3,806,000/-24 FTE)

Eliminate Curation of Smithsonian Museum Collections (-\$1,600,000/-11 FTE): This reduction eliminates active curation of mammal and bird collections housed at the Smithsonian Institution and the research associated with the collection. It would also eliminate USGS research on systematics of North American species important to Interior for management of trust responsibilities and development of modern museum methods, including three-dimensional imaging and DNA cataloging to preserve specimens and facilitate rapid electronic sharing of species information.

Reduce Species-Specific Wildlife Research (-\$2,000,000/-13 FTE): This reduces the science that supports Interior and other Federal, State, and tribal agencies' management of species under their authority, such as manatees, grizzly bears, walruses, polar bears, and migratory birds. This decreases support to States for management of game, fish, furbearer species, and waterfowl that provide recreational fishing and hunting opportunities.

Reduce Status and Trends Program Operations (-\$206,000/0 FTE): This reduces the support of field research to understand the current condition (status) and changes to that condition (trends) for species under management responsibility of Interior bureaus and other Federal, State, and tribal partners, including equipment, services, and work with partners.

Fisheries Program

(-\$5,253,000/-34 FTE)

Eliminate Unconventional Oil and Gas Research (-\$1,000,000/-7 FTE): This eliminates research on ecological effects of unconventional oil and gas development in the Marcellus (Pennsylvania) and Bakken (North Dakota) shales. This would decrease information for Federal and State resource management agencies that guides natural gas development in ways that avoid or minimize impacts to valued fish and wildlife habitat. The USGS would also discontinue development of genetic (specific genes) and genomic (all of an organism's genes) indicators of environmental stress that can be used by resource managers, public health agencies, and other responders to detect and respond to leaks and reduce risks to fish, wildlife, and humans.

Reduce Contaminants Research (-\$500,000/-4 FTE): This decreases the number of studies the USGS will conduct on the sources and impacts of contaminants that may affect commercial and sport fish, forage fish, and Federal species of management concern. This would also discontinue the development of genetic and genomic tools to study impacts of endocrine disruptors on sport fish populations such as small mouth bass.

Reduce Species-Specific Fisheries Research (-\$3,500,000/-23 FTE): This reduces the science that supports Interior and other Federal, State, and tribal agencies' management of species under their authority, such as salmon, trout, sturgeon, shad, and migratory fish. This decreases support to states for management of sports fisheries that provide recreational opportunities to anglers. This decrease would also eliminate the Fisheries portion of the USGS Science Support Program, which funds approximately 30 projects per year with the Fish and Wildlife Service (FWS) to address research needs for fisheries management.

Reduce Fisheries Program Operations (-\$253,000/0 FTE): This reduces the support to protect and enhance the Nation's fisheries and aquatic resources, with particular focus on Interior trust responsibilities for protected species, migratory species, and species managed through tribal and other international treaties, including equipment, services, and work with partners.

Program Changes

Wildlife Program

(**-\$10,707,000 /-63 FTE**)

Eliminate Whooping Crane Propagation Program (-\$1,500,000/-5 FTE): This eliminates the largest dedicated captive breeding effort for Endangered Species Act-listed cranes and eliminates capacity within Interior for avian studies that require controlled studies with large, rare birds. The program, while providing valuable contributions to whooping crane recovery, is no longer required to meet species recovery goals.

Reduce Contaminants Research (-\$500,000/-3 FTE): This decreases the number of studies the USGS conducts on the sources and impacts of contaminants that may affect wildlife and other terrestrial organisms. This would also discontinue endocrine disruptor research on migratory birds, raptors, and amphibians.

Reduce Changing Arctic Ecosystems Research and Monitoring (-\$1,600,000/-11 FTE): This reduces science support for management and policy decisions, including those related to trust responsibilities defined by the Marine Mammal Protection Act. It reduces science to support adaptation of management by the FWS, the National Park Service (NPS), and the Bureau of Land Management (BLM) in northern Alaska, which affects Native communities. It also reduces the availability of information related to transmission of avian influenza by migratory waterfowl passing through Alaska that could infect other wildlife or poultry in the contiguous United States.

Reduce Species-Specific Wildlife Research (-\$6,599,000/-44 FTE): This reduces the science that supports Interior and other Federal, State, and tribal agencies' management of species under their authority, including marine mammals, ungulates, migratory and songbirds, and amphibians. It decreases support to states for management of game and waterfowl species that provide recreational opportunities to hunters. This decrease would also eliminate the USGS Natural Resource Preservation Program, which funds approximately 40 projects per year with the NPS to address research needs for wildlife management in National Parks.

Reduce Wildlife Program Operations (-\$508,000/0 FTE): This reduces science, technology, and decision support to inform management of migratory birds, terrestrial and marine mammals, amphibians and reptiles, and terrestrial plants, with particular focus on Interior trust responsibilities, including equipment, services, and work with partners.

Environments Program

(**-\$9,392,000 /-59 FTE**)

Reduce Ecosystem Services Tool Development and Case Studies (-\$1,000,000/-6 FTE): This reduces the development of tools and case studies within the national framework for ecosystem services, including delaying development of decision support systems for Interior bureaus and other Federal agencies.

Reduce Greater Everglades Research and Monitoring (-\$5,000,000/-33 FTE): This discontinues research and monitoring on effects of altered water flow on the ecology of the Greater Everglades. This will limit the scientific information available to the NPS, FWS, U.S. Army Corps of Engineers, and the State of Florida to help inform investments for management and restoration.

Reduce Chesapeake Bay Research and Monitoring (-\$3,000,000/-20 FTE): This decreases the amount of scientific information used by six States and multiple Federal agencies to develop effective management plans to reduce impacts of nutrients, sediment, and contaminants and improve habitat for waterfowl, fish, and shellfish.

Reduce Environments Program Operations (-\$392,000/0 FTE): This reduces the science to understand natural and human influences on the ecosystems, lands, and waters under management responsibility of Interior bureaus and other Federal, State, and tribal partners, including equipment, services, and work with partners.

Invasive Species Program **(-\$127,000 /0 FTE)**

Reduce Invasive Species Program Operations (-\$127,000/0 FTE): This reduces the development of tools, technologies, and decision support systems to detect, monitor, assess risk, and control aquatic and terrestrial invasive species, including invasive wildlife diseases. In addition, equipment, services and work with partners will be impacted.

Cooperative Research Units Program **(-\$262,000 /0 FTE)**

Reduce Cooperative Research Units Program Operations (-\$262,000/0 FTE): This reduces ability to provide a cost-effective, national network of Federal, State, and university partnerships per the Cooperative Research Units Act of 1960, with a legislated mission of research, education, and technical assistance focused on fish, wildlife, ecology, and natural resources. In addition, equipment, services and work with partners will be impacted.

Land Resources

National Land Imaging Program **(+3,730,000/-52 FTE)**

Landsat 9 Ground System Development (+\$22,400,000/0 FTE): This increase provides the additional funding required for the continued development of the Landsat 9 ground system and supports the launch date goal of fiscal year 2021. The funding would cover the following USGS activities: perform final design activities for the Mission Operations Center (MOC), Ground Network Element (GNE), and Data Processing and Archive System (DPAS), hold critical design reviews for each element, develop first releases, support NASA Spacecraft final design and initial development, and conduct other activities necessary to ensure that all ground system requirements for the Landsat 9 mission are met in accordance with science mission design criteria.

Program Changes

Eliminate Support for the National Civil Applications Center (-\$4,847,000/-31 FTE): This eliminates direct finding for the National Civil Applications Center and associated USGS research, monitoring, and data collection activities using classified remote sensing imagery, as well as its acquisition of imagery on behalf of other civil agencies. Both of the USGS secure compartmentalized information facilities (Reston, VA and Denver, CO) will be closed.

Reduce Satellite Operations (-\$8,996,000/-4 FTE): This reduction defers noncritical system maintenance and hardware and software refresh within archive operations, and distribution of satellite data other than Landsat. This reduction would also reduce support for requirements and capabilities analysis for a land observation satellite that may follow Landsat 9.

Eliminate AmericaView State Grant program (-\$1,215,000/0 FTE): This reduction eliminates State grants that support the use of Landsat and other public domain remote sensing satellite data through applied remote sensing research, K-12 and higher STEM education, workforce development and technology transfer.

Reduce Science, Research and Investigations (-\$3,272,000/-17 FTE): This reduction would impact Landsat based research across the United States, ending essentially all USGS remote sensing research being conducted in a variety of application areas, including water resource monitoring, Chesapeake Bay water quality, Rocky Mountain landslides permafrost studies and mapping of U.S. vegetation dynamics. The reduction would also delay the availability of the Land Change Monitoring, Assessment, and Projection (LCMAP) designed to provide the foundation for Federal land change monitoring activities, allowing time series modeling power of the Landsat data record going back to 1972. This reduction would slow the development of new information product development and map products that would affect land managers work associated with water resources, wildfire impacts, and our understanding of snow covered areas across the Country.

Reduce National Land Imaging Operations (-\$340,000/0 FTE): This reduction diminishes the NLI's ability to execute its core activities including collecting, processing and providing the Nation with digital land surface images. These images provide critical information needed for natural resource and infrastructure monitoring and management, including forest health, wildfire recovery, effects of drought on water supply, flood and other disaster recovery, agricultural production and energy exploration and extraction, including equipment, services, and work with partners.

Land Change Science Program

(-20,627,000/ -88 FTE)

Eliminate Biologic Carbon Sequestration (-\$5,237,000/-17 FTE): This eliminates projects to develop methods for the inventory and tracking of carbon stored in ecosystems in the United States, understand processes that control carbon sequestration and release in different ecosystems, design strategies to enhance carbon stored in National Wildlife Refuge ecosystems, model carbon flux in ecosystems, and create a standard methodology for the inventory of biological carbon sequestration for the entire United States.

Reduce Geologic Carbon Sequestration: (-\$2,627,000/-13 FTE): This greatly curtails work to monitor and evaluate induced seismicity associated with geologic CO₂ storage, evaluate the geochemistry of produced groundwater and the potential for CO₂ leakage from the injection zones, develop economic models for CO₂ storage in saline formations and associated with enhanced oil recovery operations. In addition, the budget constrains collaborative work with the Bureau of Land Management (BLM) and the State geological surveys under The Helium Stewardship Act of 2013, to assess the availability of recoverable natural helium and associated CO₂ found in natural gas reservoirs in the United States.

Eliminate Landscape Science Projects (-\$1,498,000/-4 FTE): This eliminates projects to develop methodologies for incorporating remote sensing products in landscape analyses, including land change effects on water quality in the Chesapeake Bay, wildlife habitat in the Rocky Mountains, and Pacific coastal fogs related to water availability for restoration. This reduction also eliminates support for carbon biogeochemical cycling and analyses of forest management practices effects on wildfires and biodiversity.

Eliminate Climate Research and Development Activities (-\$11,143,000/-54 FTE): This eliminates investigations of changes in land cover and interactions between land use, land change and regional climate, research to identify processes related to carbon in soils, studies of arid vegetation response to extended drought, investigations of hydrologic and biogeochemical change in Prairie Pothole wetlands, and investigations of heat exchange beneath polar ice sheets. The reduction also eliminates production of datasets of land management practices and the effects of climate fluctuations on recreational uses of wetlands and other lands characterized by organic soils and paleoclimate datasets that support modeling of wildlife and fisheries changes and the capacity to understand how and why landscapes change over time.

Reduce Land Change Science Operations (-\$122,000/0 FTE): This reduction diminishes the LCSP's ability to execute its core activities the development of information and tools identifying possible solutions to the environmental, natural resource, and economic challenges required to promote resilient communities and the sustainable use of the Nation's resources, including equipment, services, and work with partners.

National and Regional Climate Adaptation Science Centers **(-9,090,000/ -24 FTE)**

Eliminate Support for the National Phenology Network (-\$250,000/-2 FTE): This eliminates work on a 10-year retrospective report linking changes in climate to changes in timing of natural events, such as bird nesting, blooming of flowers and hatching of fish eggs. The report would have enhanced our understanding of the timing of events in plant and animal life cycles and how that timing can affect people and ecosystems. This type of information provides insight on the best times to hunt and fish, when to plant and harvest crops, and when to navigate waterways.

Eliminate Support for the GeoData Portal at the Office of Water Infrastructure (-\$200,000/-2 FTE): The eliminates the program's support for maintenance and new development and the addition

Program Changes

of new datasets in the GeoData Portal, as well as data management of large climate and land use/land cover model output. Terminating this support would make it harder to access and use data that feed into planning and decision support tools used for climate adaptation strategies that help minimize the economic and other risks of changes to watersheds, lands, and wildlife.

Realign the National and Regional Climate Adaptation Science Centers (-\$8,500,000/-20 FTE): This reduction would eliminate four (of eight) regional CASCs, refocusing work on the highest priority needs of Interior bureaus and States, supporting their development and adaptation of fish and wildlife management plans, and natural resource adaptation science needs. The realigned CASCs will continue cover science across the Nation; however, project capacity will need to adjust to the realigned number of centers, potentially reducing activities by approximately 50 percent.

Reduce National and Regional Climate Adaptation Science Centers Operations (NRCASCs) (-\$140,000/0 FTE): This reduction diminishes the NRCASCs ability to execute its core activities including developing tools and information needed by fish and wildlife managers to develop and execute management strategies to better adapt to changes in natural resources and to minimize economic and other risks, including equipment, services, and work with partners.

Energy and Mineral Resources

Mineral Resources Program (-\$644,000/ 0 FTE)

Reduce Mineral Resources Program Operations (-\$644,000/0 FTE): This reduces the MRP's ability to execute its core activities, such as conducting assessments of mineral resources across the Nation and research on mineral potential, production, and consumption, including equipment, services, and work with partners.

Energy Resources Program (-\$290,000/ 0 FTE)

Reduce Energy Resources Program Operations (-\$290,000/0 FTE): This reduces the ERP's ability to execute its core activities, including conducting energy resource assessments and research on geologic energy resources such as: oil, natural gas, coal, coalbed methane, gas hydrates, geothermal resources, uranium, oil shale, bitumen, and heavy oil, and includes equipment, services, and work with partners.

Environmental Health

Contaminant Biology Program (-\$2,087,000/-16 FTE)

Reduce Contaminant Research (-\$1,948,000/-16 FTE): This reduction decreases scientific information, such as sampling and analysis used to determine actual rather than perceived health risks

of legacy and emerging contaminants to humans, fish, and wildlife. This loss of information would impact specific regions of the Nation (e.g., the Chesapeake Bay watershed and the Great Lakes) as well as lands managed for recreational hunting and fishing, tribal subsistence, or other recreational purposes. The reduction also decreases the transferability of this information across the Nation, reducing the availability of comparative science to analyze similar circumstances of contaminant occurrence in other areas across the United States and inform policies and practices.

Reduce Contaminant Biology Program Operations (-\$139,000/0 FTE): This reduces the CBP's ability to execute its core activities, including conducting science regarding exposures to toxicological and infectious disease agents in the environment that is needed to make decisions of critical importance to the Nation, such as decisions related to resource development, disaster response, and infrastructure, and including equipment, services, and work with partners.

Toxic Substances Hydrology Program

(-\$2,498,000/-15 FTE)

Eliminate Radioactive Waste Disposal Science in Support of Energy and Land and Water Stewardship (-\$700,000/-5 FTE): This eliminates a project that informs decision makers, land managers, and landowners about the safe disposal of low-level radioactive waste on both private and public lands in arid environments, by showing the likelihood of radioactivity moving offsite, how far it may move, and how long it takes to get there.

Eliminate Municipal Wastewater Science to Support Land and Water Stewardship and Infrastructure (-\$100,000/-1 FTE): This eliminates a project providing science to help manage the safe disposal of wastewater in municipalities across the Nation and in areas such as coasts and National Parks. This non-regulatory science is used by States, municipalities, wastewater treatment facilities, and other stakeholders to understand the health implications of pathogens, nutrients, and chemicals in water bodies affected by municipal wastewaters and sewage. This will result in the loss of information available to decision makers about wastewater infrastructure in areas where water is reused, or where discharges and leakages occur from wastewater treatment facilities. Remaining funds will be used to close existing research sites.

Eliminate Contaminant Science in Support of Water and Land Stewardship, Energy, and Wastewater and Drinking Water Infrastructure (-\$1,550,000/-9 FTE): This reduction would mean a loss of specialized expertise needed by both ongoing and new USGS studies that provide non-regulatory, non-advocacy science to understand and address health hazards posed by environmental contaminants in tap waters, recreational waters, and fisheries (for example, harmful algal toxins, lead, arsenic, perfluorinated compounds, and other contaminants of emerging concern). Such information is utilized by policymakers at all levels, the private sector, and other stakeholders to understand actual versus perceived risks to health posed by environmental contaminants, and to develop appropriate, cost-effective, and technologically feasible policies and strategies to reduce exposures to environmental contaminants.

Program Changes

Reduce Toxic Substances Hydrology Program Operations (-\$148,000/0 FTE): This reduces the TSHP's ability to execute its core activities, including conducting science regarding exposures to toxicological and infectious disease agents in the environment that is needed to make decisions of critical importance to the Nation, such as decisions related to resource development, disaster response, and infrastructure, and including equipment, services, and work with partners.

Natural Hazards

Earthquake Hazards Program

(-9,561,000 /-12 FTE)

Eliminate Implementation of Earthquake Early Warning System for the West Coast

(-\$8,200,000/-10 FTE): This elimination would end USGS efforts to implement the *ShakeAlert* earthquake early warning system, suspending internal efforts and eliminating external funding to partners (California Institute of Technology, Central Washington University, University of California at Berkeley, University of Nevada at Reno, University of Oregon, and the University of Washington).

Reduce Support for Regional Earthquake Monitoring, Assessments and Research (-\$800,000/-2 FTE): This reduces support for regional earthquake monitoring, hazard assessment, and research in areas of moderate seismic risk, specifically Alaska and the Central and Eastern United States. This would also reduce grants supporting targeted research by academic, State, and private sector partners, which may slow the rate of updates to seismic provisions in building codes and provide less science to support risk mitigation actions. The USGS would also suspend its annual forecast of hazard related to both natural and induced seismicity.

Reduce Earthquake Hazards Operations (-\$561,000/0 FTE): This reduction would diminish the EHP's ability to execute its core activities including monitoring and reporting on earthquakes, assessing earthquake hazards, as well as delivery of earthquake products to emergency responders, including equipment, services, and work with partners.

Volcano Hazards Program

(-3,982,000 /-7 FTE)

Suspend Implementation of NVEWS (-\$1,500,000/-2 FTE): This suspends implementation of the National Volcano Early Warning System, including installations to close monitoring gaps on Very-High-Threat volcanoes in the contiguous United States and upgrade analog monitoring stations in Alaska to comply with National Telecommunications and Information Administration spectrum allocation restrictions, and developing a next generation lahar detection system for Mt. Rainier, Washington.

Reduce Volcano Hazard Assessments (-\$1,639,000/-3 FTE): This reduces the pace of hazard assessments at High- and Very-High-Threat volcanoes. The reduction would also reduce efforts to develop volcano hazard assessments used to inform monitoring and decisions on managing risks from

eruptions, narrowing the focus of assessments to understanding volcanic systems and technologies for future monitoring and widespread instrument deployment.

Suspend Maintenance of Monitoring Networks and Data Analysis at Yellowstone and Commonwealth of the Northern Mariana Islands (-\$500,000/-2 FTE): This suspends maintenance of USGS monitoring networks which will diminish monitoring of the Yellowstone volcanic region, including real-time temperature monitoring of stream and hydrothermal pools, resulting in significantly reduced awareness of changes within a large caldera system where ground deformation and hydrothermal explosions are commonplace. This reduction would also suspend maintenance of monitoring networks on three active volcanoes in the Commonwealth of the Northern Mariana Islands.

Reduce Volcano Hazards Operations (-\$343,000/0 FTE): This reduction would diminish the VHP's ability to execute its core activities to provide forecasts and warnings of hazardous volcanic activity at volcanoes in the United States with the current monitoring networks; to provide forecasts and warnings and situational awareness of hazardous volcanic activity; and to produce updated volcanic hazard assessments, including equipment, services, and work with partners.

Landslide Hazards Program

(-\$53,000/0 FTE)

Reduce Landslide Hazards Operations (-\$53,000/0 FTE): This reduction would diminish the LHP's ability to execute its core activities for landslide loss reduction including: providing debris-flow hazard assessments and early warning for areas recently burned by wildfire; supporting expansion of landslide alerts to selected non-burned areas; maintaining capability to respond to major landslide crises; and continuing to develop and improve methods for landslide hazard assessment and situational awareness, including equipment, services, and work with partners.

Global Seismographic Network

(-\$1,484,000/-2 FTE)

Suspend implementation of GSN seismic station upgrades (-\$1,455,000/-2 FTE): This reduction would suspend the deployment of 15 to 20 sensors procured by the Department of Energy, National Nuclear Security Administration to improve the GSN infrastructure by replacing aged and degraded sensors.

Reduce Global Seismographic Network Operations (-\$29,000/0 FTE): This reduction would diminish the GSN's ability to execute its core activities including operating the existing network to provide seismic data needed for earthquake alerts and situational awareness products, tsunami warnings, national security, hazard assessments and research, including equipment, services, and work with partners.

Program Changes

Geomagnetism Program

(-\$1,884,000/-15 FTE)

Eliminate the Geomagnetism Program (-\$1,884,000/-15 FTE): This eliminates the Geomagnetism Program, an element of the U.S. National Space Weather Program. This will reduce the accuracy of NOAA and U.S. Air Force forecasting of the magnitude and impact of geomagnetic storms. In addition to eliminating the data provided to partner Federal agencies, the elimination of the program will also reduce the availability of geomagnetic information to the oil drilling services industry, geophysical surveying industry, several international agencies, and electrical transmission utilities.

Coastal/Marine Hazards and Resources Program

(-\$5,152,000/-16 FTE)

Eliminate Marine Habitat/Resource Mapping and Ocean and Glacier Studies to Inform Resource Management (-\$1,600,000/-6 FTE): This reduction would eliminate monitoring, research, and model development to forecast the impacts on coastal waters, ecosystems and fisheries due to ocean acidification and changing fluxes of nutrients, freshwater, and sediment from retreating glaciers. This will reduce the information and tools available to resource managers to anticipate and respond to stresses on commercial, recreational, and subsistence fisheries in the Gulf of Mexico and Gulf of Alaska. Additionally, it reduces application of USGS mapping expertise to characterize marine habitats and sand resources required for beach nourishment in areas where operational costs are not provided by external partners.

Eliminate Elevation Model Development and Regional Coastal Resource Assessments

(-\$2,500,000/-7 FTE): This reduces the development of “user ready” regional onshore/offshore elevation models for regional restoration of San Francisco Bay, the Pacific Northwest, the Northern Gulf of Mexico and Florida. These models are also used for State and Federal coastal management and planning. It also reduces development and delivery of large-scale assessments of coral reef and associated community vulnerability including impacts of changing reef structure on tourism, recreational and commercial fisheries, and hazard exposure of military and other infrastructure in Florida, Hawaii, and the Pacific and Caribbean territories.

Reduce Support for Regional Coastal Management, Restoration, and Risk Reduction

(-\$559,000/-3 FTE): This would result in a reduction of activities in the Gulf of Mexico, Pacific and Atlantic regions resulting in fewer and delayed products to support planning and implementation of regional coastal management, restoration, and risk reduction strategies by Interior, other Federal and State agencies. For example, activities in the Fire Island National Seashore, New York, to inform State and Federal management and planning to reduce coastal hazards and manage protected resources and studies supporting the Puget Sound Partnership goals for regional restoration will be concluded. Regional studies supporting restoration in the Northern Gulf of Mexico and San Francisco Bay will be reduced, decreasing the scope and extending the timeline for delivery of products to inform regional restoration efforts locally and in similar coastal settings nationwide.

Reduce Coastal/Marine Hazards and Resources Operations (-\$493,000/0 FTE): This reduction would diminish the CMHRP’s ability to execute its core activities, including addressing coastal and marine issues of national consequence that have the greatest potential to impact public safety as well

as coastal and marine policy, planning, and management, including equipment, services, and work with partners.

Water Resources

Water Availability and Use Science Program (WAUSP)

(-\$12,201,000/-60 FTE)

Reduce National Research Program (-\$4,325,000/-28 FTE): This reduces research in the San Francisco Bay Delta, Klamath Lake, the Florida Everglades, and Chesapeake Bay to improve operational forecasting of water availability and ecological health. In addition, geomorphic and sediment research will be eliminated. This also reduces research at the 32 USGS Water Science Centers across the United States that address existing and emerging water availability and use issues. This reduces localized, regional, and national studies examining how changes in water budget components (including precipitation, evapotranspiration, streamflow, and groundwater) impact water availability. The ability to extrapolate current conditions, both spatially and temporally, and forecast future changes using surface and groundwater models would be reduced, limiting information for resource managers.

Eliminate Water Use Data and Research (-\$1,500,000/-1 FTE): This eliminates cooperative agreements with States to improve the availability, quality, compatibility, and delivery of water-use data that is collected or estimated by States in order to manage long-term water supplies.

Eliminate Mississippi Alluvial Plan Aquifer Assessment Project (-\$1,000,000/-7 FTE): This would eliminate the Mississippi Alluvial Plan Aquifer Assessment, including the collection of detailed information about the interaction of groundwater and streamflow that would support sustainable agriculture in Mississippi, Louisiana, Arkansas, Alabama and Tennessee.

Eliminate U.S.-Mexico Transboundary Aquifer Assessment Project (-\$1,000,000/-4 FTE): This eliminates the U.S.-Mexico Transboundary Aquifer Assessment, a collaboration with the USGS, the States of Arizona, New Mexico, and Texas through their Water Resources Research Institutes and the International Boundary and Water Commission, stakeholders, and Mexican counterparts to provide new information and a scientific foundation for State and local officials to address water-resource challenges along the U.S. – Mexico border.

Eliminate Water-Use Unconventional Oil and Gas (-\$250,000/-1 FTE): This eliminates a pilot study in the Williston Basin (Western Dakotas and eastern Montana) to provide tools and information to determine the quantities of water necessary to develop and recover unconventional oil and gas resources.

Eliminate Focus Area Studies (-\$1,600,000/-8 FTE): This eliminates collaborative studies in the Upper Rio Grande, the Red River, and the Coastal Carolina Basins with State and local partners to provide data, models and decision-support tools, such as water availability estimates, snow melt information, and groundwater and surface water models to improve water resource management.

Program Changes

Eliminate Two Regional Groundwater Evaluations (-\$789,000/-4 FTE): This eliminates two of 14 studies of regional groundwater, the Coastal Lowlands Aquifer System (CLAS), which extends from Texas to the Panhandle of Florida, and the California Coastal Basin Aquifers. The CLAS study focuses on land subsidence issues in Houston and developing tools to assist in managing the entire groundwater system from Texas to northern Florida. The California Coastal Basins study applies new modeling techniques to enable local agencies to identify groundwater issues, such as chronic lowering of groundwater levels, reduction of storage, seawater intrusion, degraded water quality, land subsidence, and depletion of interconnected surface waters.

Eliminate Groundwater Model Development, Maintenance and Sustainability (-\$1,095,000/-7 FTE): This eliminates maintenance and improvements on existing groundwater software tools, MODFLOW and GSFLOW. MODFLOW is the de facto international standard code for aquifer simulation and GSFLOW is a linked surface water and groundwater modeling code. Both tools provide valuable information used in resource management.

Reduce Water Availability and Use Science Program Operations (-\$642,000/0 FTE): This reduction would diminish the ability to execute its core activities including assessing and quantifying the availability of groundwater resources, providing a more accurate assessment of the status and trends of the water resources of the United States, as well as developing the basis for an improved ability to forecast the availability of water for future economic, energy production, and environmental uses. In addition, equipment, services and work with partners will be impacted.

Groundwater and Streamflow Information Program (GSWIP) (-\$3,982,000/-10 FTE)

Reduce National Research Program (NRP) (-\$1,540,000/-10 FTE): This reduces research on water quality and the development of effective remediation strategies, which may extend hazardous waste cleanup in many States by several years. It will also end the collection and provision of water-quality data and trend analysis on nutrients and sediments to Federal and State partners in the Gulf of Mexico and Chesapeake Bay, as well as affect local and State efforts to lower nutrient levels affecting drinking water intakes and local rivers and lakes.

Reduce National Groundwater Monitoring Network (NGWMN) (-\$1,700,000/0 FTE): This reduces cooperative agreements with States that support national and local groundwater databases that are shared through the NGWMN Data Portal. In addition, it will reduce support for a network of groundwater wells that monitor the effects of droughts and other factors on groundwater levels. The network consists of about 130 groundwater wells in 20 states. This may increase difficulties for States, regional authorities, and local agencies coordinating management activities related to drought, water resource planning and permitting on shared groundwater resources. It also reduces well maintenance and replacement, creating information gaps.

Reduce Groundwater and Streamflow Information Program Operations (- \$742,000/0 FTE): This reduction would diminish the ability to execute its core activities including strengthening the National streamgauge and groundwater monitoring networks, developing and implementing hazard

data collection, information presentation and new tools to minimize loss of life and property, research, development, as well as application of cost-effective monitoring, record maintenance, and data delivery. In addition, equipment, services and work with partners will be impacted.

National Water Quality Program (NWQP)

(-\$17,235,000/-108 FTE)

Reduce National Research Program (NRP) (-\$6,011,000/-40 FTE): This would suspend studies in Arizona, California, Colorado, and Minnesota that focus on how contaminants move through the environment, their degradation or, if they persist, whether or not they pose a risk to human or aquatic ecosystem health. It would suspend studies that examine how nutrients, carbon and sediment are transported and delivered to small streams in the agricultural Midwest and to large estuaries such as the Chesapeake Bay or in the Gulf of Mexico. Studies examining the post-wildfire impacts on water quality and ecosystems in the Western United States and the effects of climate variability on the condition of permafrost in Alaska would also be suspended. The ability to forecast which legacy or emerging contaminants pose a threat to drinking water supplies in Arizona and Colorado or the health of aquatic ecosystems in California, the upper Midwest, and the Gulf of Mexico would be sharply curtailed. The ability to extrapolate current conditions and forecast future changes in water quality in important watersheds, such as the Mississippi River Basin or critical aquifers like the Central Valley of California, would be delayed 5-10 years, suspending the production of critical information water resource managers use to evaluate water resources for agricultural irrigation and safe drinking water supplies across the United States.

Eliminate National Park Service Cooperative Water Partnership (NPS-CWP) (-\$1,743,000/-12 FTE): This funding decrease would eliminate the NWQP's NPS-CWP, which provides water-quality science support to the National Park Service. For over 20 years, the NPS-CWP has supported data collection and interpretative studies of priority water-quality issues in the Nation's national parks including the occurrence of emerging contaminants, harmful algal blooms, endocrine disrupting compounds, harmful algal blooms, and mercury and other metals in park waters. Collectively or individually, these sources of water-quality impairment threaten human and aquatic ecosystem health and have the potential to decrease the number of visitors and reduce revenue in affected parks. Twenty-one existing projects will be stopped that include studies examining threats to water quality in Crater Lake National Park (OR), Golden Gate National Recreational Area and Yosemite National Park (CA), Chattahoochee National Recreational Area (GA), Voyageurs National Park (MN), Fire Island National Seashore (NY), Saguaro National Park (AZ), Lake Mead (AZ, NV) Delaware River Gap (NJ, PA), Jamestown Island Colonial National Historic Park (VA), and New River Gorge (WV). Without these projects, and any future planned projects, the NPS will have less information with which to make decisions about water quality, which would impact the public water supply at the parks and potentially affect the health of park visitors and wildlife.

Eliminate National Atmospheric Deposition Program (NADP) (-\$1,576,000/-10 FTE): This decrease will eliminate USGS participation in the NADP a collaborative effort that involves about 250 Federal, State, tribal, academic, and local organizations who operate five national monitoring networks that measure atmospheric inputs of nutrients, acidic compounds, mercury, ammonia, and other chemicals to aquatic and terrestrial ecosystems. The decrease would eliminate monitoring at 82

Program Changes

sites in 38 States and Puerto Rico, which is about 30 percent of the program's network. NADP data, which go back 40 years at some sites, are used to produce the Environmental Protection Agency and the International Joint Commission air quality reports, to establish mercury fish consumption advisories and provide surveillance data for biological, chemical, or radiological agents derived from natural or manmade disasters, such as radioactive fallout from the 2011 Fukushima reactor meltdown.

Reduce National Water-Quality Assessment Project Lower Mississippi Stream Quality Assessment (-\$4,000,000/-28 FTE): This eliminates the planned NAWQA Project stream-quality assessment study of the Lower Mississippi River Basin (LMRB). The collaborative study would have characterized sources of water-quality and aquatic ecosystem impairment—contaminants, nutrients, sediment, and streamflow—and ecological conditions in streams in Arkansas, Louisiana, Mississippi, Missouri, Tennessee and Kentucky to determine the relative effects of these stressors on the health of aquatic communities and to identify which human and natural factors are most critical in controlling stream quality.

Reduce National Water-Quality Assessment Project Trends Assessments (-\$2,628,000/-18 FTE): This decrease will delay implementation of planned studies that will determine and explain which natural and human factors are most important in influencing long-term trends in surface water and groundwater quality. The decrease also eliminates planned sampling of groundwater-quality networks in seven States (AZ, IL, MN, NJ, SC, TX, and WA), and eliminates water-quality sampling at four percent of the long-term monitoring sites operated as part of the USGS National Water Quality Network for Streams and Rivers. This decrease would also delay or suspend a study of long-term water quality trends in the Nation's rivers and streams. The decrease will delay data analysis and reporting by four years and delay work at the regional and national scale to assess the effectiveness of investments in wastewater treatment plant upgrades and best management practices, particularly in agricultural areas.

Reduce National Water Quality Program Operations (-\$1,277,000/0 FTE): This decrease would reduce NAWQA Project activities assessing the current and future quality of the Nation's freshwater resources, evaluating which human and natural factors are driving observed geographic patterns and trends, and developing tools and models water resource managers and drinking-water suppliers can use to forecast short and long-term changes to water quality, such as forecasting harmful algal blooms or decadal-scale changes in groundwater quality. In addition, maintenance of monitoring equipment, data services and work with partners will be impacted.

Water Resources Research Act (WRRA)

(-\$6,488,000/-1 FTE)

Eliminate Water Resources Research Act Program (-\$6,488,000/-1 FTE): This eliminates a grant and cooperative agreement program for land grant universities. This would end USGS involvement in coordination and administrative support for all grants to Water Resource Research Institutes. Applied research projects that address a wide variety of water resource topics and problems at the State level would no longer receive funding through this expired program.

Core Science Systems

National Geospatial Program

(-11,375,000/-26 FTE)

Reduce Federal Geographic Data Committee Functions (-\$2,700,000/-7 FTE): This eliminates Interior sponsorship of several Federal Geographic Data Committee (FGDC) committees and projects, but retains core FGDC committee support, stakeholder engagement, and strategic planning support. Reductions and eliminations include activities supporting the Federal Geospatial Platform; the National Geospatial Advisory Committee; collaborating with Federal and non-Federal partners on geospatial standards; and supporting the development of the National Spatial Data Infrastructure.

Eliminate Geospatial Research and Reduce 3DEP Technical Support (-\$5,100,000/-19 FTE): This reduces support for technical operations and delivery functions within the 3D Elevation Program (3DEP), National Hydrography and Watershed Boundary Datasets, and US Topo Programs, including Alaska mapping. The reduction would eliminate the Center of Excellence for Geospatial Information Science and its associated research grants.

Reduce 3D Elevation Program (3DEP) Functions (-\$3,000,000/0 FTE): This defers completion of 3DEP national coverage by five years, delaying until 2033 the complete acquisition of light detection and ranging (lidar) data to enhance landscape-scale, three-dimensional maps for the Nation. The reduction results in a significant loss of leveraged partner funds.

Reduce National Geospatial Program Operations (-\$575,000/0 FTE): This reduction would diminish the National Geospatial Program's ability to execute its core activities including delaying major mapping efforts to produce and make available highly-accurate topographic, hydrographic, and geologic data and maps for the American public through the National Map and Federal Geospatial Platform. This reduces equipment, services, and work with Federal, State, and industry partners.

National Cooperative Geologic Mapping Program

(-2,314,000/-5 FTE)

Reduce National Cooperative Geologic Mapping Program Functions (-2,070,000/-5 FTE): This reduces FEDMAP, STATEMAP, and EDMAP funds proportionately based on the algorithm defined by the National Geologic Mapping Act of 1992 and subsequent reauthorizations. This would eliminate earthquake seismic hazard assessments in central Virginia impacting the USGS's ability to construct seismic hazard maps based upon the latest geologic maps for the central Virginia area. The USGS would reduce the number of geologic maps produced for the Nation; the loss of matching (1:1 match) partner funds from the State Geological Surveys through the STATEMAP grants program doubles this loss. This reduction would also affect EDMAP grants to colleges and universities.

Reduce National Cooperative Geologic Mapping Program Operations (-\$244,000/0 FTE): This reduction would diminish the National Cooperative Geologic Mapping Program's ability to execute its core activities including significantly delaying the number of geologic maps produced to current standards for the Nation. This reduces equipment, services, and work with Federal, State, and university partners.

Program Changes

Science Synthesis, Analysis, and Research Program

(-5,702,000/-27 FTE)

Reduce USGS Library Functions (-\$3,000,000/-20 FTE): This eliminates public access to USGS Library locations. The USGS would place all collections into a dark archive; reduce online journal subscriptions by at least fifty percent; and close libraries in three, or possibly all four locations (Menlo Park, CA; Flagstaff, AZ; Lakewood, CO; and Reston, VA).

Reduce Biogeographic Science Functions (-\$2,500,000/-7 FTE): This reduction would eliminate all national species occurrence data (e.g., species distributions) and systems, which impacts the USGS's ability to produce and maintain these data. The USGS would also eliminate contracts and partnership agreements with USGS Science Centers, universities, and other Federal agencies for assembling and integrating data on species distribution across the Nation. This would result in other Federal agencies, State, and local governments spending additional funding to individually assemble and integrate non-standard species data. This reduction also eliminates the biodiversity hub of EcoINFORMA (Ecoinformatics-based Open Resources and Machine Accessibility).

Reduce Science Synthesis, Analysis, and Research Program Operations (-\$202,000/0 FTE): This reduction would diminish the SSAR Program's ability to execute its core activities including the production and maintenance of species occurrence data; decreasing bibliographic research services; and limiting access to online journals—services essential to all of the USGS's mission areas and Interior science. This reduction would also reduce the ability to maintain and invest in information technologies that are essential to the core mission work of the program.

Science Support

Administration and Management

(-\$13,390,000/-140 FTE)

Reduce Administration and Management Services (-\$12,446,000/-140 FTE): A reduction to the A&M workforce would further delay hiring, which impacts mission areas research and prohibits us from meeting the OPM mandated 80-day hiring process. These reductions also limit strategic sourcing initiatives and decrease the timeliness of awards by our acquisition and contract staff, directly impacting the science, along with impacting States and universities that receive grants. In addition, these decreases will also reduce publications of scientific reports that are widely used by decision makers, natural resource planners, and Congress; eliminate youth outreach activities contributing directly to STEM capabilities for the Nation; impact cooperative work with international counterparts; and reduce technology transfers and patent programs resources, impacting our scientific inventions.

Reduce Administration and Management Operations (-\$944,000/0 FTE): This reduction would diminish A&M's ability to execute its core activities including hiring, contracting, accounting functions, and other activities that support the science mission of the bureau. This proposed reduction will reduce staff training and travel, procurement of needed equipment and services, and the ability to maintain and invest in information technology that are essential to the core mission work of the program.

Information Services

(-\$3,734,000/-5 FTE)

Reduce Information Services Program (-\$3,596,000/-5 FTE): The 2018 budget request would limit resources to fund cybersecurity efforts in the cloud and increases response times to requests for cybersecurity reporting. It would also reduce collaborative and automation activities that support the science mission and eliminate this program's support for the Open Data Initiative, Data.gov and Open Science Initiatives, and reduce resources supporting the Federal IT Acquisition Reform Act (FITARA) compliance. It would reduce investment in the information infrastructure, increasing risk of system failures and loss of science data.

Reduce Information Services Operations (-\$138,000/0 FTE): This reduction would limit resources to execute core activities, including cybersecurity, collaborative activities and automation activities that support the science mission of the bureau. This proposed reduction will reduce staff training and travel, procurement of needed equipment and services, and the ability to maintain and invest in information technology.

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Ecosystems



Ecosystems



USGS science happens in partnership with people on the land, expanding our capacity to protect fish and wildlife and improve our quality of life.

Cheatgrass and fire in the Great Basin

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Ecosystems	\$160,232	\$159,927	\$1,748	\$0	-\$29,547	\$132,128	-\$27,799
<i>FTE</i>	926	926	0	0	-180	746	-180
Status and Trends Program	\$20,473	\$20,434	\$206	\$0	-\$3,806	\$16,834	-\$3,600
<i>FTE</i>	109	109	0	0	-24	85	-24
Fisheries Program	\$20,886	\$20,846	\$253	\$0	-\$5,253	\$15,846	-\$5,000
<i>FTE</i>	134	134	0	0	-34	100	-34
Wildlife Program	\$45,757	\$45,670	\$508	\$0	-\$10,707	\$35,471	-\$10,199
<i>FTE</i>	269	269	0	0	-63	206	-63
Environments Program	\$38,415	\$38,342	\$392	\$0	-\$9,392	\$29,342	-\$9,000
<i>FTE</i>	208	208	0	0	-59	149	-59
Invasive Species Program	\$17,330	\$17,297	\$127	\$0	-\$127	\$17,297	\$0
<i>FTE</i>	67	67	0	0	0	67	0
Cooperative Research Units Program	\$17,371	\$17,338	\$262	\$0	-\$262	\$17,338	\$0
<i>FTE</i>	139	139	0	0	0	139	0

Summary of Program Changes

Request Component	(\$000's)	FTE	Fixed Costs	Page
Status and Trends Program	-3,806	-24	+206	F--7
Eliminate Curation of Smithsonian Museum Collections	-1,600	-11		F--8
Reduce Species-Specific Wildlife Research	-2,000	-13		F--8
Reduce Status and Trends Program Operations	-206	0		F--9
Fisheries Program	-5,253	-34	+253	F--11
Eliminate Unconventional Oil and Gas Research	-1,000	-7		F--12
Reduce Contaminants Research	-500	-4		F--12
Reduce Species-Specific Fisheries Research	-3,500	-23		F--12
Reduce Wildlife Program Operations	-253	0		F--12
Wildlife Program	-10,707	-63	+508	F--15
Eliminate Whooping Crane Propagation Program	-1,500	-5		F--16
Reduce Contaminants Research	-500	-3		F--16
Reduce Changing Arctic Ecosystems Research and Monitoring	-1,600	-11		F--16
Reduce Species-Specific Wildlife Research	-6,599	-44		F--16
Reduce Wildlife Operations	-508	0		F--17
Environments Program	-9,392	-59	+392	F--19
Reduce Ecosystem Services Tool Development and Case Studies	-1,000	-6		F--20
Reduce Greater Everglades Research and Monitoring	-5,000	-33		F--20
Reduce Chesapeake Bay Research and Monitoring	-3,000	-20		F--20
Reduce Environments Program Operations	-392	0		F--20
Invasive Species Program	-127	0	+127	F--23
Reduce Invasive Species Program Operations	-127	0		F--24
Cooperative Research Units Program	-262	0	+262	F--25
Reduce Cooperative Research Units Program Operations	-262	0		F--26
Total Program Change	-29,547	-180	+1,748	

Summary of Budget Request

The 2018 budget request for the Ecosystems Mission Area is \$132,128,000 and 746 FTE, and includes a program change of -\$29,547,000 and -180 FTE from the 2017 Annualized Continuing Resolution (CR) level. This includes a fixed costs change of \$1,748,000.

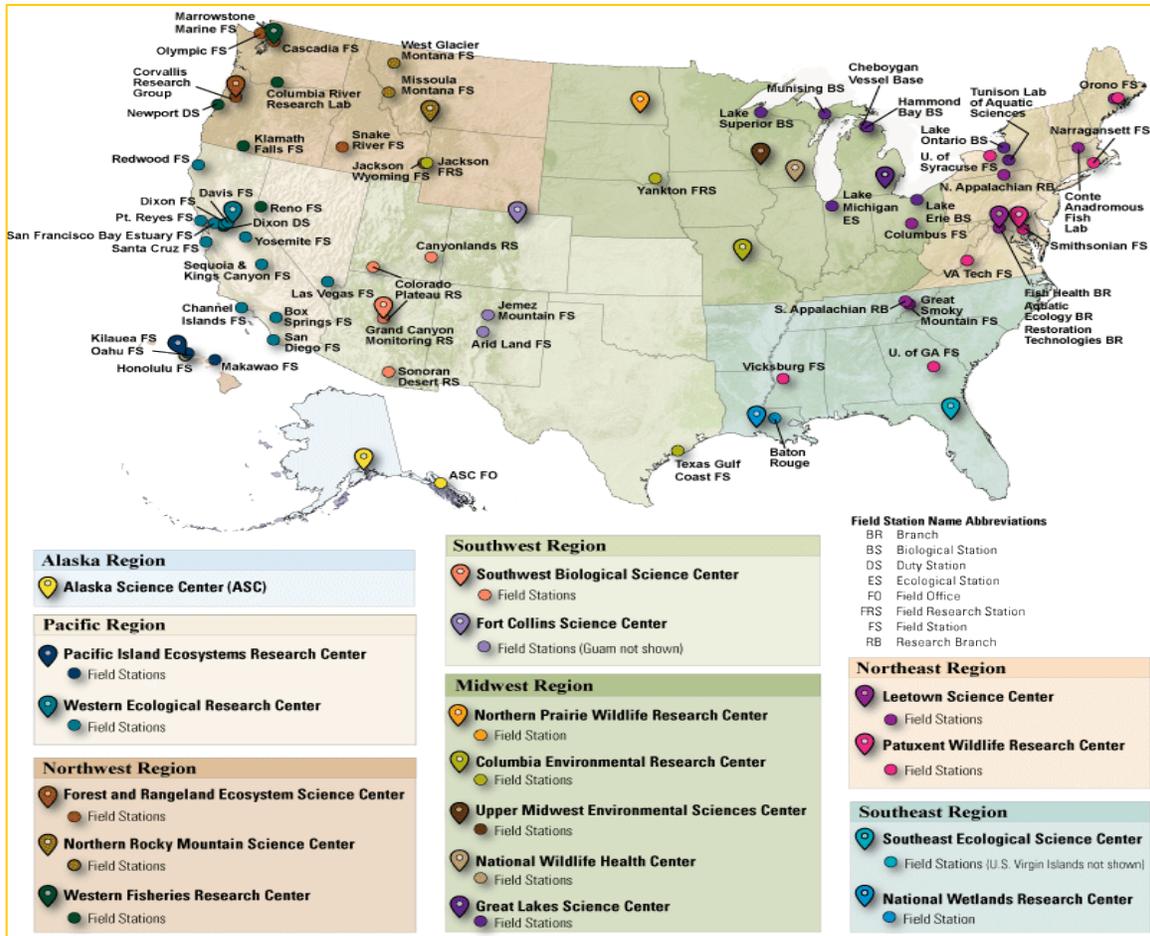
Overview

Through the Ecosystems Mission Area, the USGS provides scientific information and decision support to meet Interior's shared responsibility for land and species management, to fulfill treaty obligations with Tribes and foreign governments, to develop energy and mineral resources on Interior lands and the outer Continental Shelf, and to supply water for irrigation and other human needs. USGS science protects and

conserves the Nation's fish and wildlife heritage by bridging the gap between science and management for at-risk species and species of management concern. The USGS works with many partners to sustain the hunting, fishing, and wildlife-related recreation needs of the public by providing data, science research and monitoring that informs and supports the hunting and recreational fishing sectors that contribute \$144 billion in expenditures and 480,000 American jobs (*2017 National Recreation Economy Report, Outdoor Industry Association*). The USGS also identifies conservation measures designed to preclude the need for listing species as endangered or threatened; help listed species recover; prevent or control invasive species and wildlife disease outbreaks; and apply decision science so that management and policy actions are transparent and durable.

To accomplish the USGS's science mission, the Ecosystems Mission Area (<https://go.usa.gov/xXHvf>) is organized into six subactivities:

- Status and Trends (<https://go.usa.gov/xXHvA>)
- Fisheries Program (<https://go.usa.gov/xXHv6>)
- Wildlife Program (<https://go.usa.gov/xXHvM>)
- Environments Program (<https://go.usa.gov/xXHvz>)
- Invasive Species (<https://go.usa.gov/xXHvh>)
- Cooperative Research Units (<https://go.usa.gov/xXHwc>)



Map of Ecosystem Science Centers, Field Stations and Laboratories (Note: Map excludes the 40 Cooperative Research Units (CRU) – refer to the CRU Subactivity Section for those locations. (USGS created)

Ecosystems Mission Area funded work is conducted within 16 Science Centers, 60 Field Stations, and 40 Cooperative Research Units dispersed across the United States. This distributed workforce enables our scientists to work directly with resource managers on the species and lands for which they are making critical management decisions. Partnerships with other Federal, State, local, and tribal entities leverage millions of dollars in additional financial and in-kind support to greatly increase the effectiveness and relevancy of the Ecosystems research program.

Core priorities for the **Ecosystems Mission Area** include:

- **Fish and Wildlife Heritage:** Science that facilitates the conservation and enhancement of rare and declining species, migratory species, and sustainable harvest of game, waterfowl, fish, and furbearing animals.
- **Land and Water Stewardship:** Decision support tools and advanced monitoring systems to help society manage the challenges related to balancing competing demands for land, water, and natural resources.
- **Invasive Species and Wildlife Disease (Biothreats):** Science to improve methods and technologies for early detection, risk assessment, and control of emergent or new incursions of invasive species or wildlife disease.

Program Performance

Ecosystems sciences are essential for making cost-effective resource management decisions for the Nation's lands and waterways, and provide decision makers with regional and nationwide monitoring of key environmental indicators for terrestrial, freshwater, and marine habitats, and information on the abundance and distribution of fish and wildlife, invasive species, wildlife disease, and other natural resources. Data holdings and observation networks maintained by the Ecosystems Mission Area are vital to understand the status, trends, and health of our Nation's natural resources. Many of these databases include decades-long records of observations, collected under strict standards of quality assurance and quality control.

Strategic Actions Planned through 2018

The **Ecosystems programs** will conduct work in the following priority areas:

Fish and Wildlife Heritage:

- Continue to provide the science needed to maintain sustainable harvests of fish and wildlife.
- Work collaboratively with Interior bureaus and other Federal, State, local and tribal agencies to conserve species and habitats before Federal protection is needed by assessing fish and wildlife populations, life histories, and factors affecting at-risk and threatened and endangered species.
- Facilitate enhanced recreational, commercial, and subsistence fisheries in large river systems by designing more effective fish passage structures and evaluating the outcomes of dam removal.

Land and Water Stewardship:

- Reduce fire risk to communities by developing new methods to control fuel loads, understand factors influencing fire movement, identifying factors causing loss of homes and habitat, and developing strategies to protect communities and fish and wildlife species.
- Work collaboratively with Interior bureaus and other Federal, State, local and tribal agencies to develop methods and tools to evaluate potential impacts of solar power plants on wildlife and statistical tools that enable resource managers to make decisions to protect wildlife around wind energy farms.
- Inform long-term conservation and management strategies by providing science on sage steppe biome, interactions of rangeland fire and drought management, and wildlife and invasive species interactions under stressed conditions.
- Protect, manage, and rebuild coastal ecosystems by developing tools, data, and technologies that protect lives and infrastructure during coastal storms; support recreational and commercial fisheries, create jobs, and support local communities.
- Develop automated methods and tools supporting satellite-based drought monitoring that will help managers identify the onset and severity of drought events in near real-time to effectively allocate scarce water resources.

Invasive Species and Wildlife Disease (Biothreats):

- Expand the national Nonindigenous Aquatic Species (NAS) database to add more species profiles and promote online reporting of non-native aquatic species for watch lists, allocation of early detection and response efforts, and conduct risk assessments.
- Improve detection and control methods for economically and ecologically costly invasives including Asian carp, sea lamprey, brown treesnakes, and Burmese pythons.
- Enhance wildlife disease risk assessment, surveillance, and management tools including the national wildlife disease online reporting tool (WHISPers), avian influenza risk assessment Web tool, and chronic wasting disease online surveillance design tool for State agencies.



Ecosystems Status and Trends Program

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Ecosystems	\$160,232	\$159,927	\$1,748	\$0	-\$29,547	\$132,128	-\$27,799
<i>FTE</i>	926	926	0	0	-180	746	-180
Status and Trends Program	\$20,473	\$20,434	\$206	\$0	-\$3,806	\$16,834	-\$3,600
<i>FTE</i>	109	109	0	0	-24	85	-24

Summary of Budget Request

The 2018 budget request for the Status and Trends Program is \$16,834,000 and 85 FTE, and includes a program change of -\$3,806,000 and -24 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$206,000.

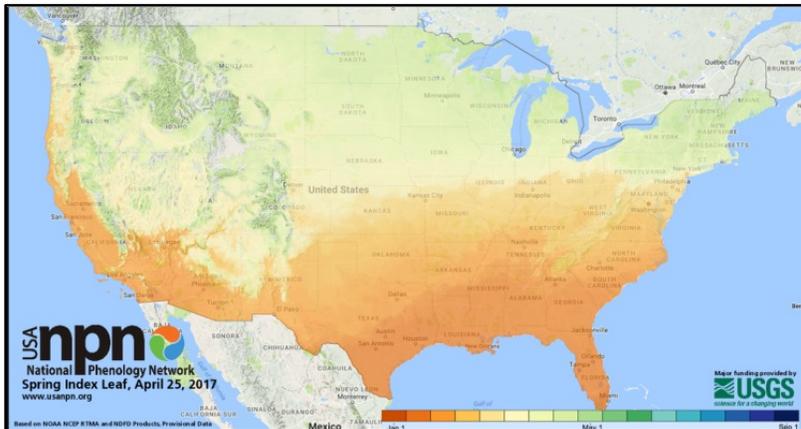
Overview

Living resources and their habitats are undergoing constant change. The USGS's Status and Trends Program provides science and technology to understand the current condition (status) and changes to that condition (trends) for species under management responsibility of Interior bureaus and other Federal, State, and tribal partners. To protect, conserve, and if necessary, enhance species under their jurisdiction, resource managers rely on timely, accurate information on species status and trends at geographic and historical scales to support management actions. USGS scientists develop monitoring protocols to assess population size and range, identify patterns of change of those populations using historic and current data, study links between populations of different species and relationships with other environmental changes, and then develop predictive models to evaluate outcomes of potential management actions using innovative sampling designs and statistical methods. Program activities are designed to better understand the effectiveness of management practices to improve conditions for key species, so as to efficiently target limited time and resources to accomplish the desired management outcome.

The 2018 Budget Request supports:

- Population assessments of Great Lakes forage fish used by States, Tribes, and provinces to collectively manage a \$6 billion commercial and recreational fishing industry (USGS Great Lakes Deepwater Program).

- Population assessments of migratory birds used by National Flyway Councils to manage waterfowl hunting in the United States in cooperation with Canada and Mexico (USGS Bird Banding Laboratory).
- National level modeling of plant and animal life-cycle events to predict and manage invasive species, insect pests, wildlife disease, aeroallergens, recreational opportunities, and crop and range production using citizen science (National Phenology Network).



Spring Indices: Indicators of Phenological Activity

The Spring Leaf Index is a synthetic measure of early season events in plants, based on recent temperature conditions.

This USGS model allows the public to track the progression of spring onset across the country.

- Development of information and tools used by our partners to assess, conserve, and enhance fish and wildlife habitat while facilitating energy development across the western frontier in cooperation with local partners (Wyoming Landscape Conservation Initiative).
- Population assessments of North American bats to understand impacts of an invasive fungal disease, bat white nose syndrome, on control of insects that threaten agricultural production and human health (North American Bat Monitoring Program [NABat]).

2018 Program Changes

Eliminate Curation of Smithsonian Museum Collections (-\$1,600,000/-11 FTE): This reduction eliminates active curation of mammal and bird collections housed at the Smithsonian Institution and the research associated with the collection. It would also eliminate USGS research on systematics of North American species important to Interior for management of trust responsibilities and development of modern museum methods, including three-dimensional imaging and DNA cataloging to preserve specimens and facilitate rapid electronic sharing of species information.

Reduce Species-Specific Wildlife Research (-\$2,000,000/-13 FTE): This reduces the science that supports Interior and other Federal, State, and tribal agencies' management of species under their authority, such as manatees, grizzly bears, walruses, polar bears, and migratory birds. This decreases support to States for management of game, fish, furbearer species, and waterfowl that provide recreational fishing and hunting opportunities.

Reduce Status and Trends Program Operations (-\$206,000/0 FTE): This reduces the support of field research to understand the current condition (status) and changes to that condition (trends) for species under management responsibility of Interior bureaus and other Federal, State, and tribal partners, including equipment, services, and work with partners.

Science Collaboration

The Status and Trends Program responds to the monitoring and information needs and requirements of resource management bureaus within Interior and other science and resource management organizations by working with them to design, develop, and support research, monitoring, and assessment activities required for resource management and policy decisions by a variety of stakeholders. As examples, the USGS is collaborating with the U.S. Fish and Wildlife Service (FWS), National Park Service (NPS), U.S. Forest Service (USFS), the Canadian Wildlife Service, and Bat Conservation International to develop a continental-scale, decadal assessment of bat populations; with State, tribal and local departments to inform resource management decisions related to the multi-billion dollar fishery in the Great Lakes; and with Federal and State agencies, county and conservation district representatives, universities, conservation organizations, energy companies, county officials, and landowners to provide the science to inform energy development, ranching and grazing, or wildlife habitat enhancement in Wyoming and other semi-arid regions of the western United States.

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Ecosystems Fisheries Program

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Ecosystems	\$160,232	\$159,927	\$1,748	\$0	-\$29,547	\$132,128	-\$27,799
<i>FTE</i>	926	926	0	0	-180	746	-180
Fisheries Program	\$20,886	\$20,846	\$253	\$0	-\$5,253	\$15,846	-\$5,000
<i>FTE</i>	134	134	0	0	-34	100	-34

Summary of Budget Request

The 2018 budget request for the Fisheries Program is \$15,846,000 and 100 FTE, and includes a program change of -\$5,253,000 and -34 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$253,000.

Overview

Over 46 million recreational fishers annually generate approximately \$48 billion for the American economy in equipment, fuel purchases, guide services, and travel and lodging (American Sportfishing Association, 2015). However, almost 40 percent of the Nation's freshwater species at risk of decline or vulnerable to extinction (National Fish Habitat Action Plan, 2012). Thriving fisheries and healthy watersheds are vital to America's food supply, outdoor recreation, and diverse and abundant ecosystems. The USGS Fisheries Program provides science and technology to support protection and enhancement of the Nation's fisheries and aquatic resources, with particular focus on Interior trust responsibilities for protected species, migratory species, and species managed through tribal and other international treaties. USGS's capacity and expertise are applied to the priorities of species conservation, habitat restoration, disease prevention and management, energy development, and water quantity and quality needs.

The 2018 budget request supports:

- Risk assessments and advanced tool development for discovery, surveillance, and control of fish diseases of salmon and trout used in international, Federal, State, and tribal hatcheries.
- Monitoring, modeling, and tool development to understand relationships between water flow and chemistry, including extreme weather events such as drought and flood, on economically, ecologically, and culturally important fish for use in water allocation decisions.
- Development of advanced remote sensing technologies, such as echosounders, acoustic telemetry, environmental DNA and autonomous underwater vehicles to provide better, faster, safer, and

cheaper data over larger geographic areas and all weather conditions for more effective fisheries management in large waters, such as the Great Lakes and Alaska.

- Design and evaluation of fish passage structures and dam removal plans to enhance fisheries or prevent invasive species movement in large rivers such as the Columbia, Connecticut, Klamath, Elwha, Merrimack, Upper Mississippi, and Penobscot to support recreational, commercial, and subsistence fisheries such as salmon, trout, eels, lamprey, sturgeon, herring, and shad.
- Evaluation of habitat projects to enhance anadromous fish populations (i.e., fish born in fresh water, spending adult life in the sea, and returning to fresh water to spawn; salmon, smelt, shad, striped bass, and sturgeon are common examples) by tribal partners, including the Nisqually Indian Tribe, Swinomish Indian Tribe, and the Yakama Nation to most effectively target limited financial resources.

2018 Program Changes

Eliminate Unconventional Oil and Gas Research (-\$1,000,000/-7 FTE): This eliminates research on ecological effects of unconventional oil and gas development in the Marcellus (Pennsylvania) and Bakken (North Dakota) shales. This would decrease information for Federal and State resource management agencies that guides natural gas development in ways that avoid or minimize impacts to valued fish and wildlife habitat. The USGS would also discontinue development of genetic (specific genes) and genomic (all of an organism's genes) indicators of environmental stress that can be used by resource managers, public health agencies, and other responders to detect and respond to leaks and reduce risks to fish, wildlife, and humans.

Reduce Contaminants Research (-\$500,000/-4 FTE): This decreases the number of studies the USGS will conduct on the sources and impacts of contaminants that may affect commercial and sport fish, forage fish, and Federal species of management concern. This would also discontinue the development of genetic and genomic tools to study impacts of endocrine disruptors on sport fish populations such as small mouth bass.

Reduce Species-Specific Fisheries Research (-\$3,500,000/-23 FTE): This reduces the science that supports Interior and other Federal, State, and tribal agencies' management of species under their authority, such as salmon, trout, sturgeon, shad, and migratory fish. This decreases support to states for management of sports fisheries that provide recreational opportunities to anglers. This decrease would also eliminate the Fisheries portion of the USGS Science Support Program, which funds approximately 30 projects per year with the U.S. Fish and Wildlife Service (FWS) to address research needs for fisheries management.

Reduce Fisheries Program Operations (-\$253,000/0 FTE): This reduces the support to protect and enhance the Nation's fisheries and aquatic resources, with particular focus on Interior trust responsibilities for protected species, migratory species, and species managed through tribal and other international treaties, including equipment, services, and work with partners.

Science Collaboration

The Fisheries Program focuses on the study of aquatic animals and their habitats in close coordination with Interior bureaus and other Federal, State, and tribal agencies to meet pressing management needs for science, advanced technologies, and decision support. For example, the USGS coordinates with the FWS and the National Park Service (NPS) to establish research priorities for conservation of federally protected species, including freshwater mussels and other species of concern; with the FWS, the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries), and coastal states on research needs for anadromous fish, such as salmon, sturgeon, and shad, that cross multiple state and federal boundaries; with the U.S. Army Corps of Engineers (USACE) on fisheries research and monitoring needs for management of the Upper Mississippi River Basin; and with the Great Lakes Fisheries Commission on research and monitoring needs for interjurisdictional fisheries managed jointly with Canada.

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Ecosystems Wildlife Program

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Ecosystems	\$160,232	\$159,927	\$1,748	\$0	-\$29,547	\$132,128	-\$27,799
<i>FTE</i>	926	926	0	0	-180	746	-180
Wildlife Program	\$45,757	\$45,670	\$508	\$0	-\$10,707	\$35,471	-\$10,199
<i>FTE</i>	269	269	0	0	-63	206	-63

Summary of Budget Request

The 2018 budget request for the Wildlife Program is \$35,471,000 and 206 FTE, and includes a program change of -\$10,707,000 and -63 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$508,000.

Overview

Abundant wildlife populations and the habitats upon which they depend are an enduring part of the United States' rich natural heritage. Their presence boosts the economy directly through hunting, bird watching, and other recreational opportunities, and they contribute to food security, medical research, and genetic diversity. Healthy habitats that support wildlife also provide healthy soils, clean water, and storm mitigation. The USGS Wildlife Program provides science, technology, and decision support to inform management of migratory birds, terrestrial and marine mammals, amphibians and reptiles, and terrestrial plants, with particular focus on Interior trust responsibilities under the Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), Marine Mammal Protection Act (MMPA), Bald and Golden Eagle Protection Act, and other Federal statutes. USGS science spans all aspects of wildlife biology and ecology needed by Interior and other Federal, State, and tribal managers to make informed, cost-effective, and balanced decisions of economic, social, ecological, and cultural importance.

The 2018 Budget Request supports:

- Surveys and investigations on sustainable waterfowl harvest used by wildlife agencies to establish hunting regulations through the National Flyway Councils in support of a \$3.0 billion waterfowl hunting industry.
- Development of tools, technologies, advanced models, and decision support for use by Interior Bureaus and other Federal, State and tribal agencies in design and siting of energy, transportation, and other infrastructure to reduce conflict with wildlife and comply with laws and regulations.

- Population assessments, life history studies, and investigations into factors affecting change among at-risk and endangered species in support of listing, downlisting, and delisting decisions under the ESA, including a focus on collaborative efforts with states to conserve species and habitats before listing is required.
- Surveillance, diagnostics, and source tracking of avian influenza in wild birds to support the U.S. Department of Agriculture (USDA) program to predict, avoid, and contain influenza outbreaks in domestic poultry flocks similar to the one that caused \$3.3 billion in economic losses in 2015.
- Detection, surveillance, and mitigation tools to assess occurrence, and develop management options for chronic wasting disease in large game species such as deer and elk, with recent focus on use of anti-prion enzymes from native lichens as a potential management tool in infected game farms.

2018 Program Changes

Eliminate Whooping Crane Propagation Program (-\$1,500,000/-5 FTE): This eliminates the largest dedicated captive breeding effort for Endangered Species Act-listed cranes and eliminates capacity within Interior for avian studies that require controlled studies with large, rare birds. The program, while providing valuable contributions to whooping crane recovery, is no longer required to meet species recovery goals.

Reduce Contaminants Research (-\$500,000/-3 FTE): This decreases the number of studies the USGS conducts on the sources and impacts of contaminants that may affect wildlife and other terrestrial organisms. This would also discontinue endocrine disruptor research on migratory birds, raptors, and amphibians.

Reduce Changing Arctic Ecosystems Research and Monitoring (-\$1,600,000/-11 FTE): This reduces science support for management and policy decisions, including those related to trust responsibilities defined by the Marine Mammal Protection Act. It reduces science to support adaptation of management by the FWS, the National Park Service (NPS), and the Bureau of Land Management (BLM) in northern Alaska, which affects Native communities. It also reduces the availability of information related to transmission of avian influenza by migratory waterfowl passing through Alaska that could infect other wildlife or poultry in the contiguous United States.

Reduce Species-Specific Wildlife Research (-\$6,599,000/-44 FTE): This reduces the science that supports Interior and other Federal, State, and tribal agencies' management of species under their authority, including marine mammals, ungulates, migratory and songbirds, and amphibians. It decreases support to states for management of game and waterfowl species that provide recreational opportunities to hunters. This decrease would also eliminate the USGS Natural Resource Preservation Program, which funds approximately 40 projects per year with the NPS to address research needs for wildlife management in National Parks.

Reduce Wildlife Program Operations (-\$508,000/0 FTE): This reduces science, technology, and decision support to inform management of migratory birds, terrestrial and marine mammals, amphibians and reptiles, and terrestrial plants, with particular focus on Interior trust responsibilities, including equipment, services, and work with partners.

Science Collaboration

The USGS Wildlife Program provides scientific information to Interior bureaus and other Federal, State, and tribal partners to inform decisions on wildlife resources under their management authorities, including birds, mammals, amphibians, reptiles, and other terrestrial animals. Primary collaborators within Interior are the FWS, the NPS, the BLM, the Bureau of Ocean Energy Management (BOEM), the Bureau of Indian Affairs, and the Office of Insular Affairs. USGS science from the Wildlife Program is needed by agencies to determine appropriate harvest levels by hunters, manage disease outbreaks in both wildlife and domestic animals, ensure public safety, and manage wildlife on National Refuges, Parks, and BLM Units. In addition, USGS coordinates with the FWS Ecological Services offices on implementation of the ESA, including providing science for decisions to list, delist, or downlist species and develop recovery plans.

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Ecosystems Environments Program

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Ecosystems	\$160,232	\$159,927	\$1,748	\$0	-\$29,547	\$132,128	-\$27,799
<i>FTE</i>	926	926	0	0	-180	746	-180
Environments Program	\$38,415	\$38,342	\$392	\$0	-\$9,392	\$29,342	-\$9,000
<i>FTE</i>	208	208	0	0	-59	149	-59

Summary of Budget Request

The 2018 budget request for the Environments Program is \$29,342,000 and 149 FTE, and includes a program change of -\$9,392,000 and -59 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed cost change of \$392,000.

Overview

Knowledge of ecosystems and the trust resources they support is critical to the well-being of the Nation because ecosystems supply the natural resources and other goods and services that the American people require. Decisions on siting energy and mineral development, allocating water resources, conserving habitat for hunting, fishing and recreation, repairing degraded lands and waters, and other land uses benefit from an understanding of ecosystems. The USGS Environments Program provides science to understand natural and human influences on the ecosystems, lands, and waters under management responsibility of Interior bureaus and other Federal, State, and tribal partners. This helps land managers balance land uses, resolve and prevent resource management conflicts, restore and maintain trust resources for future generations, and keep communities safe. To facilitate this process, USGS scientists analyze data collected over many decades to predict and assess the effects of threats like wildfire and drought on existing and projected land uses, and develop tools to help managers understand risk and make cost-effective resource management decisions. USGS scientists develop new techniques to improve the condition of degraded lands, and provide information on costs and return on those investments. Information and tools resulting from USGS studies help streamline energy and mineral development permitting processes by helping managers select the most cost-effective and least impactful alternative.

The 2018 Budget Request supports:

- Data and tools used by fire and land management agencies, States, Tribes, landowners, and communities to predict, suppress, restore fire damaged lands, and prevent wildfires, which threaten human lives and health, cause billions in property damage, and degrade water quality across the United States.
- Data, tools, and technologies to protect, manage, and rebuild coastal ecosystems throughout the United States that protect lives and infrastructure during coastal storms and produce recreational and commercial fisheries that create jobs and decrease foreign imports of seafood.
- Population assessments, technologies, models, and decision support tools on seabird migrations and deep sea coral communities used by the Bureau of Ocean Energy Management (BOEM) to inform permitting of offshore wind farms in the Atlantic Ocean.
- Population assessments, remote sensing technologies, models, and decision support tools on polar bears and walrus used by BOEM and the U.S. Fish and Wildlife Service (FWS) to inform permitting of offshore oil and gas development in Alaska.
- Monitoring, assessment, and metagenomics of algal species and toxins contributing to the incidence and severity of harmful algal blooms to improve management practices for farming and land management.

2018 Program Changes

Reduce Ecosystem Services Tool Development and Case Studies (-\$1,000,000/-6 FTE): This reduces the development of tools and case studies within the national framework for ecosystem services, including delaying development of decision support systems for Interior bureaus and other Federal agencies.

Reduce Greater Everglades Research and Monitoring (-\$5,000,000/-33 FTE): This discontinues research and monitoring on effects of altered water flow on the ecology of the Greater Everglades. This will limit the scientific information available to the NPS, FWS, U.S. Army Corps of Engineers, and the State of Florida to help inform investments for management and restoration.

Reduce Chesapeake Bay Research and Monitoring (-\$3,000,000/-20 FTE): This decreases the amount of scientific information used by six States and multiple Federal agencies to develop effective management plans to reduce impacts of nutrients, sediment, and contaminants and improve habitat for waterfowl, fish, and shellfish.

Reduce Environments Program Operations (-\$392,000/0 FTE): This reduces the science to understand natural and human influences on the ecosystems, lands, and waters under management responsibility of Interior bureaus and other Federal, State, and tribal partners, including equipment, services, and work with partners.

Science Collaboration

The Environments Program works with Interior bureaus and other Federal, State and tribal resource management agencies to design and conduct research and monitoring required for land and water management and policy decisions, and provide integrated applied information and decision support tools. As examples, the USGS collaborates with Wyoming, the Bureau of Land Management, the Forest Service, the Bureau of Reclamation, the FWS, and the National Park Service, to assess and facilitate responsible natural gas development; with BOEM on science for energy development on the outer continental shelf; and with the FWS and the NOAA Fisheries to assess potential conflicts between wildlife and offshore wind energy development.

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Ecosystems Invasive Species Program

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Ecosystems	\$160,232	\$159,927	\$1,748	\$0	-\$29,547	\$132,128	-\$27,799
<i>FTE</i>	926	926	0	0	-180	746	-180
Invasive Species Program	\$17,330	\$17,297	\$127	\$0	-\$127	\$17,297	\$0
<i>FTE</i>	67	67	0	0	0	67	0

Summary of Budget Request

The 2018 budget request for the Invasive Species Program is \$17,297,000 and 67 FTE, a program change of -\$127,000 and 0 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$127,000.

Overview

Fighting the economic, ecologic and health threats posed by over 6,500 plant and animal invaders costs the United States economy over \$120 billion annually (*Ecological Economics, Volume 52, Issue 3, February 2005*). Invasive plants and animals cause significant economic losses and damage forests, croplands, rangelands, and aquatic resources. Examples of issues and damages include blocked water facilities and waterways, increased fire vulnerability and diminished grazing value, harm to the fisheries industry, and wildlife diseases that threaten human health and agriculture. Invasive species are contributing factors in 42 percent of all threatened and endangered species listings under the Endangered Species Act. The USGS Invasive Species Program develops tools, technologies, and decision support systems to detect, monitor, assess risk, and control aquatic and terrestrial invasive species, including invasive wildlife diseases, across the United States and its Territories.

The 2018 Budget Request supports:

- Deliver critical data to the public on distribution of aquatic invasive species through a Web-based platform that serves as an early warning and alert system for new invasions (Nonindigenous Aquatic Species database - <https://nas.er.usgs.gov/>).
- Technical capacity to rapidly respond to new invasions, including method development to detect Rapid Ohī'a Death fungus in Hawaiian trees; nationwide surveillance for salamander Bsal (*Batrachochytrium salamandrivorans*) fungus prior to invasion; and immediate response to a 2016 invasive mussel detection in Montana that threatens the Columbia River basin.

- Testing and refinement of new molecular and remote sensing technologies including environmental DNA (eDNA), drones, and infrared remote sensing to identify invasive species early in an invasion when chances of eradication success are highest.
- Supporting early detection and rapid response for invasive reptiles such as Burmese pythons and Argentine black and white tegus in Florida, boa constrictors in the Virgin Islands, and brown treesnakes on Guam, including the Brown Treesnake Rapid Response Team.
- Species-specific controls for invasive species to minimize application costs and ecological effects of treatments including targeted chemicals for Asian carp and zebra and quagga mussels, pheromones (chemical substances) for sea lamprey, and microbes to control mosquitoes, common reed, and cheatgrass.
- Providing much-needed data and technical expertise to natural resource managers working to reduce the economic and ecological impacts of salt cedar in the southwest and cheatgrass throughout the west.
- Improving the power of early detection tools, developing containment and control methodologies such as carbon dioxide barriers, targeted chemical controls, and integrated management strategies as part of the intergovernmental team preventing the spread of Asian carp into the Great Lakes.

2018 Program Changes

Reduce Invasive Species Program Operations (-\$127,000/0 FTE): This reduces the development of tools, technologies, and decision support systems to detect, monitor, assess risk, and control aquatic and terrestrial invasive species, including invasive wildlife diseases. In addition, equipment, services and work with partners will be impacted.

Science Collaboration

USGS scientists partner with Interior and other Federal, State, tribal, and territorial agencies, non-governmental entities, and private industry to help solve problems posed by invasive species. The USGS provides science to combat invasive species by investigating by investigating new and emerging priorities of national concern, developing early detection and rapid response methods, and developing innovative control technologies. USGS invasive species efforts are cost-effective and provide resource managers with tools and guidance to control invasive species.



Ecosystems

Cooperative Research Units Program

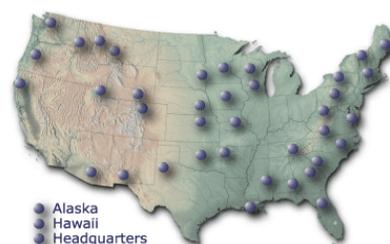
	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Ecosystems	\$160,232	\$159,927	\$1,748	\$0	-\$29,547	\$132,128	-\$27,799
<i>FTE</i>	926	926	0	0	-180	746	-180
Cooperative Research Units Program	\$17,371	\$17,338	\$262	\$0	-\$262	\$17,338	\$0
<i>FTE</i>	139	139	0	0	0	139	0

Summary of Budget Request

The 2018 budget request for the Cooperative Research Units is \$17,338,000 and 139 FTE, a program change of -\$262,000 and 0 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$262,000.

Overview

The Cooperative Research Unit (CRU) program meets the science and technical assistance needs of Federal, State, and local natural resource managers. Each of the 40 CRUs, located in 38 States, is a partnership of the USGS, other Interior bureaus, other Federal agencies, a State fish and wildlife agency, a host university, and the Wildlife Management Institute. The FWS is a formal cooperator in most of the CRUs. Since 1935, this cooperative relationship has provided a strong connection between the USGS, Federal and State management agencies, and the national university community. Surveys of cooperators indicate a greater than 95 percent satisfaction rate with program execution. The CRU structure leverages cooperator resources to deliver program outcomes that exceed what any cooperator could achieve alone. The majority of CRU appropriated funding is invested in scientist salaries with funding for research projects supplied by program partners. Collectively, the cooperators provide a three-to-one match for USGS funding. The program positions USGS scientists at universities to help identify and respond to field-level natural resource information needs, coordinate pooling of resources among agencies, trains and mentors graduate students; and facilitates Federal and other natural resource managers' access to university expertise and facilities.



Locations of the Cooperative Research Units

The 2018 budget request supports:

- A cost-effective, national network of Federal, State, and university partnerships pursuant to the Cooperative Research Units Act of 1960, with a legislated mission of research, education, and technical assistance focused on fish, wildlife, ecology, and natural resources.
- A network of expertise for actionable science, research, teaching, and technical assistance that is responsive to needs of State and Federal resource agency decision-makers.
- Science capabilities responsive to resource management needs of Interior bureaus.
- A premier program for developing the future workforce through graduate education, mentoring, and training to serve the broad natural resources management community successfully.

2018 Program Changes

Reduce Cooperative Research Units Program Operations (-\$262,000/0 FTE): This reduces ability to provide a cost-effective, national network of Federal, State, and university partnerships per the Cooperative Research Units Act of 1960, with a legislated mission of research, education, and technical assistance focused on fish, wildlife, ecology, and natural resources. In addition, equipment, services and work with partners will be impacted.

Science Collaboration

Each CRU is embedded within a university, but its research program is driven by Federal and State management agency needs. This bridges gaps between natural resource science and natural resource management. Most CRUs have decades-long relationships between the Unit scientists and the resource management partners they serve, building on this legacy scientific support for management that sustains and advances public benefits. The long-term and geographically broad scales of science fostered through these long-standing partnerships allow scientists to answer the needs of resource managers.

Land Resources



Land Resources



USGS Landsat images of Ohio/Mississippi River confluence before and during floods of 2011.

USGS science increases our knowledge of land resources and the awareness of the impacts of land changes, improving our economy, safety and quality of life.

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Land Resources	\$139,975	\$139,709	\$602	-\$1,477	-\$25,987	\$112,847	-\$26,862
<i>FTE</i>	<i>414</i>	<i>414</i>	<i>0</i>	<i>-7</i>	<i>-164</i>	<i>243</i>	<i>-171</i>
National Land Imaging Program	\$72,194	\$72,057	\$340	\$0	\$3,730	\$76,127	\$4,070
<i>FTE</i>	<i>146</i>	<i>146</i>	<i>0</i>	<i>0</i>	<i>-52</i>	<i>94</i>	<i>-52</i>
Land Change Science Program	\$41,346	\$41,267	\$122	-\$1,477	-\$20,627	\$19,285	-\$21,982
<i>FTE</i>	<i>208</i>	<i>208</i>	<i>0</i>	<i>-7</i>	<i>-88</i>	<i>113</i>	<i>-95</i>
National and Regional Climate Adaptation Science Centers	\$26,435	\$26,385	\$140	\$0	-\$9,090	\$17,435	-\$8,950
<i>FTE</i>	<i>60</i>	<i>60</i>	<i>0</i>	<i>0</i>	<i>-24</i>	<i>36</i>	<i>-24</i>

Summary of Program Changes

Request Component	(\$000's)	Internal Transfers	FTE	Fixed Costs	Page
National Land Imaging Program	+3,730	0	-52	+340	G--9
Landsat 9 Ground System Development	+22,400	0	0		G--11
Eliminate Support for National Civil Applications Center	-4,847		-31		G--11
Reduce Satellite Operations	-8,996		-4		G--11
Eliminate AmericaView State Grant Programs	-1,215		0		G--11
Reduce Science Research and Investigations	-3,272		-17		G--11
Reduce National Land Imaging Operations	-340		0		G--11
Land Change Science Program	-20,627	+29,318	+61	+122	G--13
Transfer from Climate Research and Development	0	+21,454	119		G--15
Transfer from Carbon Sequestration	0	+9,341	37		G--15
Eliminate Biologic Carbon Sequestration	-5,237		-17		G--16
Transfer to Energy	0	-1,477	-7		G--16
Reduce Geologic Carbon Sequestration	-2,627		-13		G--16
Eliminate Landscape Science Projects	-1,498		-4		G--16
Eliminate Climate Research and Development Activities	-11,143		-54		G--17
Reduce Support Land Change Science Operations	-122		0		G--17
National and Regional Climate Adaptation Science Centers	-9,090	0	-24	+140	G--19
Eliminate Support for National Phenology Network	-250	0	-2		G--21
Eliminate Support for GeoData Portal at the Office of Water Infrastructure	-200	0	-2		G--21
Realign the National and Regional Climate Adaptation Science Centers	-8,500	0	-20		G--22
Reduce National and Regional Climate Adaptation Science Centers Operations	-140		0		G--22
Climate Research and Development Program	0	-21,454	-119	0	N/A
Transfer to Land Change Science	0	-21,454	-119		
Carbon Sequestration Program	0	-9,341	-37	0	N/A
Transfer to Land Change Science	0	-9,341	-37		
Total Program Change	-25,987	-1,477	-171	+602	

Summary of Budget Request

The 2018 budget request for the Land Resources Mission Area is \$112,847,000 and 243 FTE, and includes a program change of -\$25,987,000 and -171 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$602,000.

Overview

The former USGS Climate and Land Use (CLU) Mission Area has been restructured into the Land Resources Mission Area (LRMA). The new structure aligns with the functions, capabilities, and activities that the LRMA will focus on in 2018 and beyond. For more information on this restructure, including a crosswalk showing the shifts of major programs and funding levels between CLU and LRMA, please see the Technical Adjustments chapter, Section B.

The USGS LRMA delivers data, tools, techniques, and analyses that advance understanding of landscapes, the forces that shape them, and the interactions of plants, animals, and people that live within them. LRMA scientists and engineers are world leaders in the research, monitoring, and remote sensing necessary to understand and detect changes that affect land resources and processes that are essential to the Nation's economic growth and societal well-being. The resulting data and research products of the LRMA provide an unbiased scientific foundation for decisions about the management of natural and built landscapes and how they might be adapted to secure the Nation's interests.

The information and applications produced by the LRMA are widely used by Interior other governmental entities at all levels, and the public to reduce the adverse impacts of natural and manmade change and support beneficial outcomes. These efforts, broadly framed as adaptation, are important to the Department of the Interior as the largest manager of the Nation's land, water and biological resources. The LRMA research, modeling and forecasting supports adaptive management efforts, such as managing forests during severe droughts; anticipating changes in permafrost, glaciers, and wildfire patterns in the Arctic; and understanding flood-related risks.

The LRMA delivers observations, scientific understanding, and decision support for land resource management in the United States through its three major subactivities:

- National Land Imaging Program (formerly the Land Remote Sensing Program)
<https://remotesensing.usgs.gov/>
- Land Change Science Program (merger of the former Land Change Science and Climate Research & Development Programs) https://www2.usgs.gov/climate_landuse/lcs/;
https://www2.usgs.gov/climate_landuse/clu_rd/
- National and Regional Climate Adaptation Science Centers (formerly the National Climate Change and Wildlife Science Center/Department of Interior Climate Science Centers)
<https://nccwsc.usgs.gov/>

The National Land Imaging (NLI) Program delivers remote sensing observation capacity, data, and research to understand how landscapes and associated natural resources are changing at global and regional scales. It collects, archives, and distributes a broad array of data from near-earth and satellite-based remote sensing platforms. The NLI Program provides long-term records of changes in landscapes, real-time change-detection capabilities, and associated interpretive tools that decision makers use for land and resource management decisions. It also provides resource managers with analysis to apply land and natural resources research, monitoring, and action-related resources where they are most likely to be

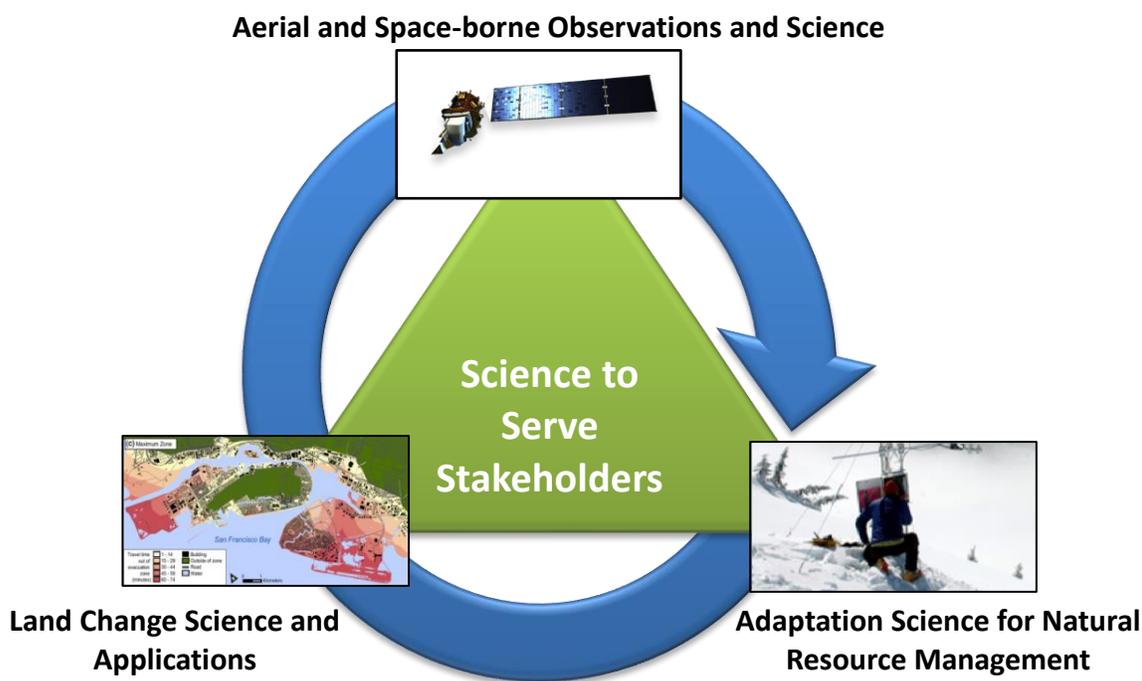
meaningful and relevant. The NLI Program fills a key role in the delivery of observations of the Earth's surface through its Landsat satellite missions that are designed and implemented in collaboration with NASA. Studies show significant returns on the Landsat program investment. A study by the National Geospatial Advisory Committee found nearly \$100 million in annual savings from Landsat-derived applications for irrigated agriculture in the western United States. A study by the USGS from over 11,000 current users of Landsat data (*"The Users, Uses, and Value of Landsat Satellite Imagery – Results from the 2012 Survey of Users"* <http://pubs.usgs.gov/2013/1269/>), estimated the annual economic benefit of Landsat data to be \$1.8 billion for U.S. users, and the National Research Council found that "The economic and scientific benefits to the United States of Landsat imagery far exceed the investment in the system." Taken as a whole, USGS data holdings and observation networks are vital to understanding the status of trends and health of our Nation's ecosystems and natural resources.

The Land Change Science Program (LCSP) conducts fundamental and applied research to understand the forces that shape landscapes and their potential uses, to distinguish between land surface change resulting from natural forces and those that are associated with land use decisions, and to provide the scientific bases for land use decisions that affect the safety of communities, economic prosperity, and natural resources of the Nation. The program delivers research products, information, and computer programs that help decision makers apply the knowledge and data gained from on-the-ground and remote sensing observation systems to land use planning, natural resource management, and adaptation planning decisions. Understanding the drivers, interactions, and consequences of land change is one focus of the program. One ongoing study is developing a national-scale dataset that combines paleoclimate and instrumental records to reconstruct the spatial extent, duration, and impacts of past droughts on terrestrial and aquatic habitats. These data are providing insights into the drivers of changing water availability to improve capabilities to anticipate drought impacts in the future. Another study is integrating data from ecology, geology, and hydrology to examine how changing land use, sea level, and other factors combine to shape coastal landforms and influence the communities and infrastructure that rely upon coastal habitats. Another product of the LCSP, the National Land Cover Database (NLCD) serves as the definitive Landsat-based, high-resolution, land cover database for the Nation. The NLCD provides spatial reference and descriptive data for characteristics of the land surface such as impacts on urban, agriculture, and forest systems; percent impervious surface; and percent tree-canopy cover. The NLCD supports a wide variety of Federal, State, local, tribal, and nongovernmental applications that seek to assess ecosystem status and health, understand the patterns of biodiversity, predict economic effects of land use decisions and climate fluctuations, and develop land management policy.

The National and Regional Climate Adaptation Science Centers (NRCASCs) deliver the on-the-ground observations and research required to understand how changes in climate, land use, and associated changes in land cover are affecting land resources and associated populations of fish and wildlife species essential to the Nation's natural heritage. It provides information essential to the development of tools and applications that help resource managers understand which observed changes are meaningful, what the observations suggest about the condition and sustainability of natural resources, and what can be done to support conservation priorities of the Nation. The NRCASCs serve essential roles in adaptation planning initiatives across the Nation, supporting regional and nationwide monitoring of key indicators of the environmental variability of terrestrial, freshwater, and coastal habitats, along with the abundance and

distribution of biota, invasive species, wildlife disease, and other ecological features. They likewise serve as an essential interface between Federal researchers, land managers, and front line stewards of natural resources.

The Land Resources Mission Area



Collectively, the subactivities within the LRMA deliver ground-based data and analyses, remotely-sensed data and analyses, investigative research, and tools and applications necessary for the science-based stewardship of lands, natural resources, and their uses in support of economic prosperity consistent with a shared conservation ethic; the NLCD (<http://www.mrlc.gov/>), a tool developed by LRMA is an example of this collaboration. The NLCD provides valuable information on the types of land cover changes that are occurring, information that is essential for assessing water quality and quantity, and the risks from natural hazards. The services and products of the LRMA are interwoven among activities of other USGS Mission Areas, Federal agencies, and university partners. They also provide foundational knowledge and data for a variety of Federal, State, local, tribal, and private sector stakeholders, enabling each to serve the needs of a much broader stakeholder base.

Partners and stakeholders are faced with countless decisions each year on issues as diverse as species protection and recovery, fish and game regulations, land use planning, natural resources conservation and stewardship, water allocations, and permitting for economic activities such as energy development, mining, silviculture, agriculture, and residential and commercial development. Uncertainty in the outcomes and consequences of those decisions on the Nation's natural resources is complicated by threats

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posed by natural disasters, changes in water availability and use, changes in the occurrence of extreme weather events, invasive species, emerging wildlife diseases, and human demands for water, land, food, energy and mineral resources. Without science to help inform the decision process, our Nation's natural wealth—the goods and services provided by the Nation's lands and associated natural resources vital to the health and well-being of human societies—are placed at risk. USGS data holdings and observation networks are vital to understanding the status and trends and health of our Nation's lands, associated natural resources, and supported ecosystems. Many of these databases include decades-long records of observations, collected under strict standards of quality assurance and quality control and made available for public use.

The 2018 budget request allows the USGS to focus on its core Land Resources mission to observe, classify, detect, and understand land surface change and to deliver information required by land and natural resource managers. The 2018 Budget supports:

- Operating the Landsat program, including the Landsat 7 and 8 spacecraft currently on orbit, and archiving, processing and disseminating Landsat satellite data.
- Developing the Landsat 9 ground system.
- Providing regional support for Interior bureaus and other resource managers through Climate Adaptation Science Centers.
- Gathering and delivering of remote sensing, land cover, and land use data to the public.
- Continuing priority investigations of land resources and processes, including responses to natural disturbances and other drivers of change.

Program Performance

In 2016, the National Land Imaging Program's (NLI) efforts resulted in 1,100 new images being generated every day from two operational Landsat satellites (Landsat 7 and Landsat 8), distributing 20 million Landsat products and other satellite, non-satellite, and geospatial products annually. These images provide an unmatched capability to observe land use and land use change in local, regional, and global scales. Imaging is essential because it provides regular and continuous observations of the Earth otherwise unavailable to researchers, natural resource managers, and others who work across wide geographical areas and applications. Landsat data informs public policy and economic decisions in many disciplines, especially human health, agriculture, climate, energy, fire, natural disasters, urban growth, water management, ecosystems and biodiversity, and forest management.

The Land Change Science Program (LCSP) coordinates the National Land Cover Database (NLCD) in cooperation with other Federal partners in the Multi-Resolution Land Characteristics (MRLC) Consortium. NLCD provides the Nation with current, consistent, and public domain information on the Nation's land cover. Land cover information provides Federal, State, local, and tribal officials with the

information necessary for land use planning and land management policies. The current production schedule is for new datasets to be created every five years. In 2016, the NLCD had mapped 15 percent of the Earth's surface area; by the end of 2017 that percentage should increase to 78 percent and by the end of 2018 it is expected to be at 100 percent, thereby successfully completing the 5 year cycle.

The regional Climate Adaptation Science Centers (the Centers) continued to focus on high-priority science that identified potential impacts to various natural and cultural resources and expanded its collaboration with other science providers in the public and private sectors. Benefits to the scientific community and the public included research and tools that improve understanding and therefore the ability to plan for land use and land cover change, impacts of droughts/floods/water availability, and coastal response to sea level rise. The Centers also provided support to 35 graduate students through a unique Science to Action Fellowship program as well as grants through the Centers host universities and consortium partners to apply scientific research to real-world natural resource planning decisions that factor in human activity and development on fish, wildlife, and ecosystems.

Strategic Actions Planned through 2018

The **National Land Imaging Program** will:

- Continue to develop the Landsat 9 mission ground and flight systems in close collaboration with NASA with a target launch in fiscal year 2021. The USGS will refine the ground system design and procure data processing, ground network, and mission operations center initial software and hardware in 2018.
- Implement an initial operating capability of the Land Change Monitoring, Assessment, and Projection (LCMAP) suite of utilities that will allow users to access the entire Landsat archive, to examine past land surface conditions, reconstruct trends change through time, identify land change as it occurs, develop more frequent land cover products with a greater degree of automation, and project future conditions. LCMAP initial operational capability will occur in late 2018, providing Landsat analysis-ready data and land change products for all U.S. lands, with full operating capability expected in 2019.

The **Land Change Science Program** will:

- Compile a continental-scale synthesis of natural patterns of drought to quantify the extent and magnitude of past long-term droughts, as well as their impacts on terrestrial and aquatic communities and other natural resources. Results will improve capabilities to anticipate future changes in water availability and the impacts on society, agriculture, and ecosystems.
- Prepare a synthesis of glacier and permafrost change patterns in Alaska, and summarizing the resulting impacts on water availability, sea level, ground stability and erosion, terrestrial and aquatic communities and other natural resources. Results will improve capabilities to anticipate future changes and the impacts on society, infrastructure, and ecosystems.
- Develop spatial models that couple hydrodynamics and vegetation to project changes in coastal habitats and ecosystem processes in the southeastern United States. These models will allow

resource managers to evaluate potential impacts of various land use and water management strategies and improve the likelihood of effective and sustainable outcomes.

The **National and Regional Climate Adaptation Science Centers** will:

- Deliver ready-to-use science to support tribal efforts in planning for and adapting to climate change impacts to fish and wildlife resources. The USGS is working with south-central U.S. Tribes to increase basic knowledge of climate science, connect them with tools to assess their communities' vulnerabilities, and build their skills to develop adaptation and mitigation strategies. Scientists will conduct multiple two-day training sessions for Native American Tribes in Louisiana and New Mexico to increase participants' knowledge that will help them better manage their resources in the context of a changing climate. In conjunction with the Bureau of Indian Affairs, much of the work piloted in the South Central region will be used to expand tribal capacity building across the Centers network.
- Projects focusing on the impacts of drought on fish and wildlife species have been initiated across the West. The goal is to develop a common understanding of how drought may affect resources in arid the regions of the West. One example of this work is the effort to share latest science on long-term drought history in the Upper Missouri Headwaters (upstream from Three Forks, MT) and future climate projections of relevance to drought planning to designated Drought Planners from eight watersheds that are preparing drought plans as part of the Montana Drought Resilience Partnership, a pilot project of the National Drought Resilience Partnership. The MT State Department of Natural Resources and Conservation is the primary lead on the drought planning work, and a key partner working with the Centers.
- Arctic regions are experiencing the impacts of changes in climate, causing impacting how local communities utilize fish and wildlife species. Work with the University of Alaska – Fairbanks to produce a summary of the “state of our knowledge” regarding climate adaptation and resilience across the Arctic for local communities. Ultimately, this summary will be published as a chapter in the forthcoming Arctic Resilience Assessment, a science-based report that aims to better understand the impacts of change in the Arctic.



Land Resources National Land Imaging

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Land Resources	\$139,975	\$139,709	\$602	-\$1,477	-\$25,987	\$112,847	-\$26,862
<i>FTE</i>	<i>414</i>	<i>414</i>	<i>0</i>	<i>-7</i>	<i>-164</i>	<i>243</i>	<i>-171</i>
National Land Imaging Program	\$72,194	\$72,057	\$340	\$0	\$3,730	\$76,127	\$4,070
<i>FTE</i>	<i>146</i>	<i>146</i>	<i>0</i>	<i>0</i>	<i>-52</i>	<i>94</i>	<i>-52</i>

Summary of Budget Request

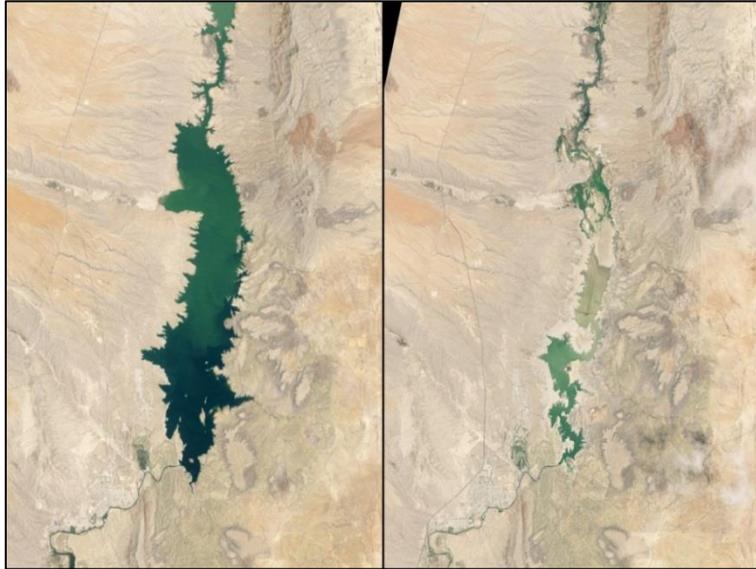
The 2018 budget request for National Land Imaging is \$76,127,000 and 94 FTE, a program change of +\$3,730,000 and -52 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$340,000.

Program Overview

The National Land Imaging (NLI) Program provides a comprehensive, impartial record of conditions across the planet's land surface, to support civil Earth observation research and operational applications. The program is a leader in defining the future of land remote sensing (<http://remotesensing.usgs.gov/>). The NLI Program collects, processes, and provides the Nation with digital land-surface images acquired by satellite and airborne sensors for decision makers in all 50 States and 185 countries for natural resource and infrastructure monitoring and management, such as: forest health, wildfire recovery, effects of drought on water supply, flood and other disaster recovery, education, agricultural production, energy exploration and extraction (including oil, gas, coal, and other metal and mineral resources) and creating commercial geospatial products and services. All USGS-owned images and derived information products are available via the Internet under a free and open data-access policy (<http://eros.usgs.gov/find-data>).

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Within the NLI Program, the USGS operates the Landsat 7 and Landsat 8 satellites, typically collecting over 1,000 scenes per day (each scene covers over 12,000 square miles). Landsat is the only operational civil satellite with both thermal and shorter wavelengths sensors, which are used extensively in water and agricultural management. The advantages these sensors provide include capabilities such as enabling users to monitor water use, discriminate moisture content of soils and vegetation, and estimate heat units in urban areas.



Landsat over time aids water resource managers, for example, by recording drought conditions at Elephant Butte Reservoir, New Mexico, which provides half the water supply to El Paso, Texas.

The NLI program also manages the USGS partnership with the National Aeronautics and Space Administration (NASA) for the Sustainable Land Imaging Program, ensuring that the USGS and NASA work together to engineer cost effective solutions to maintain sustained land remote sensing capabilities for another 20 years. This effort includes a Landsat 9 mission, which the partnership is currently developing. Landsat 9 will be an improved version of Landsat 8, with a more robust backup system and a broader suite of operational products that capitalize on recent developments in processing and utilizing analysis ready data. NASA and the USGS are working toward an anticipated launch date of fiscal year 2021 for Landsat 9. NLI operational elements, including satellite operations and image data collection, archiving, processing, and distribution are performed by the USGS Earth Resources Observation and Science (EROS) Center near Sioux Falls, SD. In its National Satellite Land Remote Sensing Data Archive, EROS houses nearly 7 million Landsat satellite scenes acquired globally since 1972. In its Long Term Archive for aerial photos and geospatial data, EROS houses over six million high-definition aerial mapping photos of U.S. sites, some dating to 1937. The NLI Program also coordinates the Unmanned Aircraft Systems (UAS) project, providing scientists



Monitoring of coalmine reclamation in West Virginia (left), using a UAS equipped with electro-optical cameras (right).

a way to look longer, closer, and more frequently at some of the Earth's most remote locations, previously too expensive or dangerous to monitor closely, such as the interior of volcanos or the depths of coal mines.

2018 Program Changes

Landsat 9 Ground System Development (+\$22,400,000/-0 FTE): This increase provides the additional funding required for the continued development of the Landsat 9 ground system and supports the launch date goal of fiscal year 2021. The funding would cover the following USGS activities: perform final design activities for the Mission Operations Center (MOC), Ground Network Element (GNE), and Data Processing and Archive System (DPAS), hold critical design reviews for each element, develop first releases, support NASA Spacecraft final design and initial development, and conduct other activities necessary to ensure that all ground system requirements for the Landsat 9 mission are met in accordance with science mission design criteria.

Eliminate Support for the National Civil Applications Center (-\$4,847,000/-31 FTE): This eliminates direct funding for the National Civil Applications Center and associated USGS research, monitoring, and data collection activities using classified remote sensing imagery, as well as its acquisition of imagery on behalf of other civil agencies. Both of the USGS secure compartmentalized information facilities (Reston, VA and Denver, CO) will be closed.

Reduce Satellite Operations (-\$8,996,000/-4 FTE): This reduction defers noncritical system maintenance and hardware and software refresh within archive operations, and distribution of satellite data other than Landsat. This reduction would also reduce support for requirements and capabilities analysis for a land observation satellite that may follow Landsat 9.

Eliminate AmericaView State Grant program (-\$1,215,000/-0 FTE):

This reduction eliminates State grants that support the use of Landsat and other public domain remote sensing satellite data through applied remote sensing research, K-12 and higher STEM education, workforce development and technology transfer.

Reduce Science, Research and Investigations (-\$3,272,000/ -17 FTE): This reduction would impact Landsat based research across the United States, ending essentially all USGS remote sensing research being conducted in a variety of application areas, including water resource monitoring, Chesapeake Bay water quality, Rocky Mountain landslides permafrost studies and mapping of U.S. vegetation dynamics. The reduction would also delay the availability of the Land Change Monitoring, Assessment, and Projection (LCMAP) designed to provide the foundation for Federal land change monitoring activities, allowing time series modeling power of the Landsat data record going back to 1972. This reduction would slow the development of new information product development and map products that would affect land managers work associated with water resources, wildfire impacts, and our understanding of snow covered areas across the Country.

Reduce National Land Imaging Program Operations (-\$340,000/0 FTE): This reduction diminishes the NLI's ability to execute its core activities including collecting, processing and providing the Nation

with digital land surface images. These images provide critical information needed for natural resource and infrastructure monitoring and management, including forest health, wildfire recovery, effects of drought on water supply, flood and other disaster recovery, agricultural production and energy exploration and extraction, including equipment, services, and work with partners.

Science Collaboration

The NLI Program advances the science and methods for collecting, analyzing, and understanding user needs in order to continually improve its product and service portfolio. It establishes and maintains business policies and cooperative support structures that encourage and expand partnerships with Federal, commercial, academic, and foreign cooperators. The program collaborates with many Federal partners, including:

- Department of the Interior bureaus
- National Aeronautics and Space Administration (NASA)
- National Oceanic and Atmospheric Administration (NOAA)
- U.S. Department of Agriculture (USDA)
- National Geospatial Intelligence Agency (NGA) on remote sensing science
- Data science business partners
- Commercial satellite data providers
- The Group on Earth Observations (GEO)
- The Committee on Earth Observing Satellites (CEOS)
- The European Space Agency (ESA) on data, science and technology leveraging
- Geoscience Australia on Data Cube science
- Other foreign remote sensing science cooperators to expand the understanding of, access to, and value of NLI products and services

Through the Interior Remote Sensing Working Group and other venues, USGS collaborates with other Interior bureaus to better understand their needs for land imaging observations, products and services, and to seek departmental input on its new products and land imaging initiatives. Interior bureaus use Landsat data and products for work including: drought, invasive species, fire mitigation, water use and availability information, energy and mineral development. For example, the Bureau of Land Management maps land cover in Alaska and monitors rangeland conditions throughout the West, Reclamation maps irrigated crop types to model and monitor water demand, and the National Park Service produces burn severity maps within 30 million acres distributed across over 270 parks. NLI also leads the development of an annual Interior Remote Sensing Report to highlight and share key remote sensing technology applications that support science and land management across the Department's mission areas (<http://eros.usgs.gov/doi-remote-sensing-activities/2016/Home>). Through its various activities and collaborations, the NLI program is helping define the future of land remote sensing.



Land Resources Land Change Science

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Land Resources	\$139,975	\$139,709	\$602	-\$1,477	-\$25,987	\$112,847	-\$26,862
<i>FTE</i>	<i>414</i>	<i>414</i>	<i>0</i>	<i>-7</i>	<i>-164</i>	<i>243</i>	<i>-171</i>
Land Change Science Program	\$41,346	\$41,267	\$122	-\$1,447	-\$20,627	\$19,285	-\$21,982
<i>FTE</i>	<i>208</i>	<i>208</i>	<i>0</i>	<i>-7</i>	<i>-88</i>	<i>113</i>	<i>-95</i>

Summary of Budget Request

The 2018 budget request for the Land Change Science Program is \$19,285,000 and 113 FTE, a program change of -\$20,627,000 and +61 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed cost change of \$122,000. The change in funding and FTE represents an internal transfer of +\$21,454,000 and 119 FTE from the Climate Research and Development Program, and an internal transfer of +\$9,341,000 and 37 FTE from the Carbon Sequestration Program. It also includes an internal transfer of -\$1,477,000 and -7 FTE to the Energy Resources Program (ERP) within the Energy and Mineral Resources Mission Area.

Program Overview

The Land Change Science Program (LCSP) provides resource managers, policy makers, and the public with the data and tools required to forecast future resource condition and availability. Working with resource managers, LCSP scientists develop information and tools identifying possible solutions to the environmental, natural resource, and economic challenges required to promote resilient communities and the sustainable use of the Nation's resources. The program conducts research to understand and anticipate how ecosystem change, natural disturbances, and resource use affect natural resources and human communities. It uses long-term (historical) records of resource condition and use to document trends in the availability and quality of natural resources, assesses the impacts of land cover and environmental changes, and develops tools for decision makers to use for knowledgeable resource allocation decisions. The Program draws on USGS expertise in geology, ecology, hydrology, and geography to document patterns of change over a range of timescales and to assess and model/anticipate impacts of these changes at local, regional, and national scales. Its research is aimed at understanding how the processes that control the composition, distribution, and functioning of land and associated natural

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resources are affected by natural disturbances (such as droughts, fire, sea level change) and land use changes (such as urbanization, agriculture, water management).

The LCSP is composed of three main components: scientific research that documents patterns of landscape variability and the impacts on natural resources; land cover monitoring and assessments to support development and testing of tools and models to be used by stakeholders via LCMAP and related analysis utilities; and risks and vulnerability assessments.

Land Change Science Program activities are planned and conducted over three- to five-year increments to address specific research questions and to develop applications to meet the needs of stakeholders. This strategy provides sufficient time and stability for a project to accomplish their stated goals and produce products and applications. It also provides the LCSP with the flexibility to address emerging critical areas (such as droughts or storm surges) by coordinating among existing areas of expertise to establish appropriate research teams.



By combining analysis of meteorological data (such as information obtained from the Garden Wall weather station at 7,400 ft. in Glacier National Park, Montana) and measurements of snowpack depth, structure and water content, USGS researchers are improving avalanche forecasting in the park. This provides real-time snow safety and weather data to aid snow removal operations and recreational use of the park.

The merged research and application activities that previously were housed under the Land Change Science Program and Climate Research and Development Program will integrate: (1) research activities aimed at understanding how natural forces and land-use changes alter the processes that influence the functioning and stability of the terrestrial and aquatic landscapes that support our Nation's communities, infrastructure, and natural resources; (2) land use and land cover change at multiple scales, documenting the geographic variability of change and defining the environmental, economic and social drivers of change, as well as assessing the impacts of these changes; and (3) computer models, sensitivity analyses, and information about geographic distributions of people and infrastructure, along with the probability of specific disturbance factors, to evaluate a community's vulnerability and risk to a hazard event.



Scientists supported by the LCS Program develop assessments of tsunami hazards and models estimating evacuation travel times to safety such as this map of pedestrian travel time in the City of Alameda, California. Their research has been used to analyze 73 communities (49 incorporated cities, seven tribal reservations and 17 counties) from northern California to northern Washington State that are directly threatened by tsunami waves associated with a Cascadia subduction zone earthquake.

2018 Internal Transfer

Internal Transfer from the former Climate and Research and Development Program to Land Change Science Program (+\$21,454,000/119 FTE): Paleontological, biogeochemical, and geographic expertise previously funded by the Climate Research and Development Program will be utilized by the Land Change Science Program (LCSP) to conduct investigations, deliver datasets, and support the development of geospatial tools intended to support delivery of research and data required to: understand the forces that shape landscapes and their potential uses; distinguish between changes resulting from natural forces and those that are associated with land use decisions; and to provide the scientific bases for decisions related to land use decisions that affect the safety of communities, economic prosperity, and natural resources of the Nation. Examples of projects to be transferred to the LCSP include development of land use and land cover change projection tools designed to help resource managers anticipate, plan for, and adapt to changes in climate and associated resource management challenges; development of geological data sets that can be used to understand how landscapes and associated natural resources have been affected by past variations in climate, water availability, and natural disturbances over time to improve understandings of our Nation's present vulnerabilities to similar variations and the threats they pose to economic prosperity and natural heritage; and investigations of arctic landscapes and the challenges that changes in temperatures and water availability might present for the development, use, and conservation of natural resources. Of the amounts transferred, \$11.1 million and 54 FTE of Climate R&D will be proposed for termination.

Internal Transfer from the former Carbon Sequestration Program to Land Change Science Program (+\$9,341,000/37 FTE): The USGS Carbon Sequestration Program focuses on two aspects of carbon sequestration: biologic carbon sequestration and geologic carbon sequestration. The biologic carbon sequestration project focuses on the science behind removing carbon from the atmosphere and storing it in vegetation (particularly forests and wetlands), soil and sediments, and aquatic environments.

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The geologic carbon sequestration project researches the effects and capacity of pumping CO₂ deep underground: Will it induce seismic activity; what are the potential benefits in terms of enhanced oil recovery; how much CO₂ can be stored underground and where is it most feasible; and will the CO₂ storage affect drinking water? Authorized by the Energy Independence and Security Act (EISA) of 2007 (P.L. 110-140), which calls for the USGS to develop a methodology for, and then complete a national assessment of, the geologic storage capacity for CO₂. It also directed Interior to conduct a national assessment to quantify the amount of carbon stored in ecosystems, the capacity of ecosystems to sequester additional carbon, and the rate of greenhouse gases fluxes in and out of the ecosystems (biologic carbon sequestration). Of the amount transferred, \$7.9 million and 30 FTE of biologic and geologic carbon sequestration research is proposed for termination.

Internal Transfer from the Land Resources Mission Area, Carbon Sequestration Program to the Energy and Mineral Resources Mission Area, Energy Resources Program (-\$1,477,000/7 FTE): Carbon Sequestration – Geologic Research and Assessments project work will continue after transfer to the Energy and Mineral Resources Mission Area. The project will work on a national assessment of the technically recoverable hydrocarbon resources resulting from CO₂ injection and storage through CO₂-enhanced oil recovery. The goals of this work are to (1) complete and publish an assessment methodology; (2) conduct a national assessment of recoverable oil and associated CO₂ storage that is expected in future CO₂-enhanced oil recovery operations; and (3) publish the assessment results. In addition this funding will allow for a limited amount research on improving the geologic and technical foundation of CO₂ storage in various geologic basins.

2018 Program Changes

Eliminate Biologic Carbon Sequestration (-\$5,237,000/-17 FTE for a total of \$0 and 0 FTE):

This eliminates projects to develop methods for the inventory and tracking of carbon stored in ecosystems in the United States, understand processes that control carbon sequestration and release in different ecosystems, design strategies to enhance carbon stored in National Wildlife Refuge ecosystems, model carbon flux in ecosystems, and create a standard methodology for the inventory of biological carbon sequestration for the entire United States. These projects are conducted with partner land management agencies.

Reduce Geologic Carbon Sequestration: (-\$2,627,000/-13 FTE for a total of \$0 and 0 FTE): This greatly curtails work to monitor and evaluate induced seismicity associated with geologic CO₂ storage, evaluate the geochemistry of produced groundwater and the potential for CO₂ leakage from the injection zones, develop economic models for CO₂ storage in saline formations and associated with enhanced oil recovery operations. In addition, the budget constrains collaborative work with the Bureau of Land Management (BLM) and the State geological surveys under The Helium Stewardship Act of 2013, to assess the availability of recoverable natural helium and associated CO₂ found in natural gas reservoirs in the United States.

Eliminate Landscape Science Projects (-\$1,498,000/-4 FTE):

This eliminates projects to develop methodologies for incorporating remote sensing products in landscape

analyses, including land change effects on water quality in the Chesapeake Bay, wildlife habitat in the Rocky Mountains, and Pacific coastal fogs related to water availability for restoration. This reduction also eliminates support for carbon biogeochemical cycling and analyses of forest management practices effects on wildfires and biodiversity.

Eliminate Climate Research and Development Activities (-\$11,143,000/-54): This eliminates investigations of changes in land cover and interactions between land use, land change and regional climate, research to identify processes related to carbon in soils, studies of arid vegetation response to extended drought, investigations of hydrologic and biogeochemical change in Prairie Pothole wetlands, and investigations of heat exchange beneath polar ice sheets. The reduction also eliminates production of datasets of land management practices and the effects of climate fluctuations on recreational uses of wetlands and other lands characterized by organic soils and paleoclimate datasets that support modeling of wildlife and fisheries changes and the capacity to understand how and why landscapes change over time.

Reduce Land Change Science Program Operations (-\$122,000/-0 FTE): This reduction diminishes the LCSP's ability to execute its core activities the development of information and tools identifying possible solutions to the environmental, natural resource, and economic challenges required to promote resilient communities and the sustainable use of the Nation's resources, including equipment, services, and work with partners.

Science Collaboration

The LCSP works with various domestic and international environmental and resource management partners, including Interior bureaus, Federal agencies (U.S. Forest Service, NOAA), and State and non-governmental organizations (such as universities, museums, the Association of American Geographers and the World Bank). The program provides vital land cover information to these partners, as well as integrating their data in environmental and economic risk and vulnerability assessments. The program provides regional- to national-scale syntheses on patterns and impacts of drought and other environmental stressors that are used in resource management planning and in model development and improvement activities. The program also develops methodologies and tools to consistently measure and analyze the volume of water contained in alpine glaciers of North America and elsewhere. These partners choose to work with the USGS and the LCSP because of its broad, interdisciplinary expertise; rigorous set of protocols (USGS Fundamental Science Practices); production of unbiased, objective, and impartial scientific data; innovative monitoring technology, models, and research tools; and robust data management and delivery systems.

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Land Resources

National and Regional Climate Adaptation Science Centers

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Land Resources	\$139,975	\$139,709	\$602	-\$1,477	-\$25,987	\$112,847	-\$26,862
<i>FTE</i>	<i>414</i>	<i>414</i>	<i>0</i>	<i>-7</i>	<i>-164</i>	<i>243</i>	<i>-171</i>
National and Regional Climate Adaptation Science Centers	\$26,435	\$26,385	\$140	\$0	-\$9,090	\$17,435	-\$8,950
<i>FTE</i>	<i>60</i>	<i>60</i>	<i>0</i>	<i>0</i>	<i>-24</i>	<i>36</i>	<i>-24</i>

Summary of Budget Request

The 2018 budget request for the National and Regional Climate Adaptation Science Centers is \$17,435,000 and 36 FTE, a program change of -\$9,090,000 and -24 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$140,000.

Overview

Managers of natural resources need to understand the impacts of an evolving climate (which can exacerbate ongoing stresses such as drought, fire regimes and invasive species) in order to develop strategies that allow managers to adapt to a changing environment. The National and Regional Climate Adaptation Science Centers (NRCASCs) program (formerly the National Climate Change and Wildlife Science Center/Department of Interior Climate Science Centers; see the Technical Adjustment chapter for more information) were created by Congress to address challenges resulting from climate and land-use change and to work collaboratively with fish and wildlife managers to provide rigorous scientific information and effective tools for adaptation planning. The Centers provide fish and wildlife managers with the tools and information they need to develop and execute management strategies that adapt to changes in natural resources, and minimize economic and other risks. The scientific work done within NRCASCs is responsive to the following guiding principles:

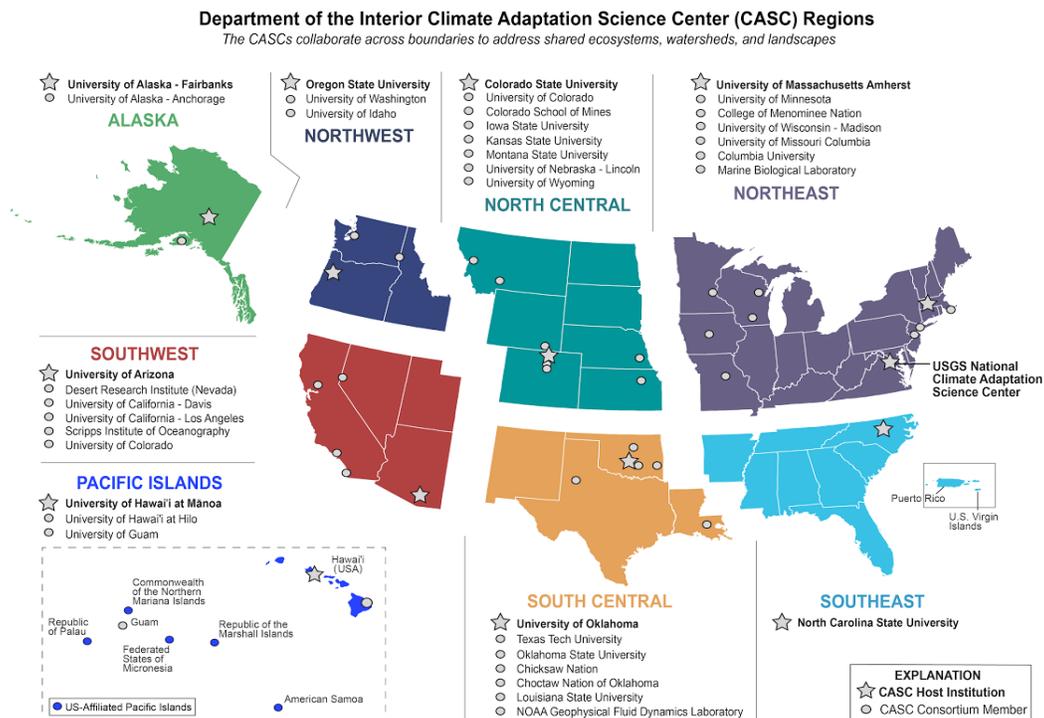
- Responsive to the needs of resource managers.
- Prioritizes evaluation, translation, and synthesis of climate impact-research findings.
- Promotes rigorous, objective, and integrated research to advance fundamental understanding of climate impacts to fish and wildlife resources.

Land Resources

- Develops approaches to ensure broad dissemination of results to the public and foster professional scrutiny, critique, and learning.
- Promotes institutional efficiencies through partnerships to avoid duplication of effort and leveraging opportunities in climate impact research.

The NRCASC manages the regional Climate Adaptation Science Centers (the Centers) and conducts research on the impacts of a changing environment on natural resources at a national level. The regional science Centers focus on the impacts of climate variability on key fish and wildlife resources in their respective regions. Each regional science center has a Federal director and a host university, but partner with other universities in their region. The following table shows the regional the Centers as of April 2017.

Regional CASC (date established)	Host Institution
Alaska (2010)	University of Alaska
Northwest (2010)	Multi-institution consortium headed by Oregon State University
Southeast (2010)	North Carolina State University
Southwest (2011)	Multi-institution consortium headed by University of Arizona
North Central (2011)	Multi-institution consortium headed by Colorado State University
South Central (2012)	Multi-institution consortium headed by University of Oklahoma
Northeast (2012)	Multi-institution consortium headed by University of Massachusetts, Amherst
Pacific Islands (2012)	Multi-institution consortium headed by University of Hawaii, Manoa



The map above shows the locations of the USGS National Climate Adaptation Science Center, the eight regional CASCs, and their respective university partners in 2017.

The NRCASCs work closely with other USGS programs and larger Federal science groups and consist of cooperative Federal-university research centers to provide the varied science expertise needed to address key resource management problems. Strategic science planning at the Centers begins with input from fish and wildlife management partners in each region. Each regional science center has a Stakeholder Advisory Committee with representatives from various Department of the Interior bureaus, other State and Federal agencies, and Tribes, as well as other science providers in the region. All regional, the Centers have five-year strategic plans that outline regional science priorities. These plans, along with ongoing stakeholder input, are used to guide annual science planning and funding decisions. The NRCASC has created a national strategic science plan to provide a framework for the climate variability impacts research conducted or coordinated by the regional Centers. This plan also establishes a context for a regional and national synthesis of science products and information across the NRCASCs network. The NRCASC's Federal Advisory Committee, the Advisory Committee on Climate Change and Natural Resource Science provides input to this national science plan, including developing recommendations on ways to increase the "actionable science" produced by the science centers, guidelines for interacting with tribal nations, and methods for evaluating the performance and effectiveness of the program.



Warming Waters Threaten Montana's Prized Westslope Cutthroat Trout The native Westslope Cutthroat Trout has drawn generations of fly-fishers to western Montana's remote Flathead River system. Trout fishing contributes tens of millions of dollars to Montana's economy each year, and the Westslope Cutthroat is one of the State's most highly prized fish. A NRCASCs project shows rising temperatures are resulting in a loss of the cold-water habitat this species needs, which in turn could have a negative economic impact: declining Cutthroat Trout populations could result in loss tourism revenues.

The 2018 Budget focuses science efforts on the highest priority needs for Interior, State, and tribal partners. Work on climate impacts to fish and wildlife resources will become the focus of the regional centers and continued partnerships with University partners to leverage resources in support of science needs will be the business model employed to make effective use of our resources.

2018 Program Changes

Eliminate Support for National Phenology Network (-\$250,000/-2 FTE): This eliminates work on a 10-year retrospective report linking changes in climate to changes in timing of natural events, such as bird nesting, blooming of flowers and hatching of fish eggs. The report would have enhanced understanding of the timing of events in plant and animal life cycles and how that timing can affect people and ecosystems. This type of information provides insight on the best times to hunt and fish, when to plant and harvest crops, and when to navigate waterways.

Eliminate Support for the GeoData Portal at the Office of Water Infrastructure (-\$200,000/-2 FTE): The eliminates the program's support for maintenance and new development and the addition of

Land Resources

new datasets in the GeoData Portal, as well as data management of large climate and land use/land cover model output. Terminating this support would make it harder to access and use data that feed into planning and decision support tools used for climate adaptation strategies that help minimize the economic and other risks of changes to watersheds, lands, and wildlife.

Realign the National and Regional Climate Adaptation Science Centers (formerly Climate Science Centers) (-\$8,500,000/-20 FTE): This reduction would eliminate four (of eight) regional CASCs, refocusing work on the highest priority needs of Interior bureaus and States, supporting their development and adaptation of fish and wildlife management plans, and natural resource adaptation science needs. The realigned CASCs will continue cover science across the Nation; however, project capacity will need to adjust to the realigned number of centers, potentially reducing activities by approximately 50 percent.

Reduce National and Regional Climate Adaptation Science Centers Program Operations (NRCASCs) (-\$140,000/0 FTE): This reduction diminishes the NRCASCs ability to execute its core activities including developing tools and information needed by fish and wildlife managers to develop and execute management strategies to better adapt to changes in natural resources and to minimize economic and other risks, including equipment, services, and work with partners.

Science Collaboration

The National and regional CASCs are committed to a partnership-driven model. At the national and regional level, major guidance on preferred science priorities and projects is provided by Federal, State and tribal fish and wildlife managers. The Department of the Interior established the Advisory Committee on Climate Change and Natural Resource Science to provide advice on the operations, partnerships, and science conducted by the NRCASCs. The regional science centers are continuing to focus efforts on the co-production of actionable science, whereby researchers work closely with the end users of the science information (e.g., natural resource managers), from development of the research question to the analysis and production of the research output. In this way, the national and regional centers can provide information that directly meets the needs of decision makers.

All work conducted by the regional science centers is done in conjunction with university partners to best leverage DOI investment by providing access to not only government science expertise, but also expertise that resides within the research universities. Further, investment by DOI has been used by our university partners as a match to attract further investment, both public and private in the enterprise. This business model has allowed DOI to leverage small investments that result in larger science outcomes in support of DOI priorities.

**Energy and Mineral
Resources, and
Environmental Health**



Energy and Mineral Resources, and Environmental Health



USGS science informs decision making to improve our economy, security, and quality of life.

Earth scientists collect soil samples to better understand the potential for undiscovered mineral resources and to understand natural levels of metals in soils. Source: Sue Karl, USGS.

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Energy and Mineral Resources, and Environmental Health	\$94,511	\$94,331	\$1,221	\$1,477	-\$5,519	\$91,510	-\$2,821
<i>FTE</i>	524	524	0	0	-24	500	-24
Energy and Mineral Resources	\$73,066	\$72,927	\$934	\$1,477	-\$934	\$74,404	\$1,477
<i>FTE</i>	407	407	0	7	0	414	7
Mineral Resources Program	\$48,371	\$48,279	\$644	\$0	-\$644	\$48,279	\$0
<i>FTE</i>	277	277	0	0	0	277	0
Energy Resources Program	\$24,695	\$24,648	\$290	\$1,477	-\$290	\$26,125	\$1,477
<i>FTE</i>	130	130	0	7	0	137	7
Environmental Health	\$21,445	\$21,404	\$287	\$0	-\$4,585	\$17,106	-\$4,298
<i>FTE</i>	117	117	0	0	-31	86	-31
Contaminant Biology Program	\$10,197	\$10,178	\$139	\$0	-\$2,087	\$8,230	-\$1,948
<i>FTE</i>	57	57	0	0	-16	41	-16
Toxic Substances Hydrology Program	\$11,248	\$11,226	\$148	\$0	-\$2,498	\$8,876	-\$2,350
<i>FTE</i>	60	60	0	0	-15	45	-15

Summary of Program Changes

Request Component	(\$000's)	Internal Transfers	FTE	Fixed Costs	Page
Energy and Mineral Resources	-934	+1,477	+7	+934	H-1
Mineral Resources Program	-644	0	0	+644	H--9
Reduce Mineral Resources Program Operations	-644	0	0		H--10
Energy Resources Program	-290	+1,477	+7	+290	H--13
Coal and CO2 Sequestration/Utilization	0	1,477	7		H--14
Reduce Energy Resources Program Operations	-290	0	0		H--15
Environmental Health	-4,585	0	-31	+287	H--17
Contaminant Biology Program	-2,087	0	-16	+139	H--17
Reduce Contaminant Research	-1,948	0	-16		H--19
Reduce Contaminant Biology Program Operations	-139	0	0		H--19
Toxic Substances Hydrology Program	-2,498	0	-15	+148	H--21
Eliminate Radioactive Waste Disposal Science in Support of Energy and Land and Water Stewardship	-700	0	-5		H--23
Eliminate Municipal Wastewater Science to Support Land and Water Stewardship and Infrastructure	-100	0	-1		H--23
Eliminate Contaminant Science in Support of Water and Land Stewardship, Energy, and Wastewater and Drinking Water Infrastructure	-1,550	0	-9		H--24
Reduce Toxic Substances Hydrology Program Operations	-148	0	0		H--24
Total Program Change	-5,519	+1,477	-24	+1,221	

Summary of Budget Request

The 2018 budget request for Energy and Mineral Resources, and Environmental Health (EMEH) is \$91,510,000 and 500 FTE, and includes a program change of -\$5,519,000 and -24 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$1,221,000. The 2018 budget request for EMEH also includes an internal transfer of +\$1,477,000 from the Land Resources Mission Area, Carbon Sequestration Program to the Energy and Mineral Resources Mission Area, Energy Resources Program.

EMEH Activity Overview

The Energy and Mineral Resources, and Environmental Health (EMEH) Activity provides objective science and information about the Nation's energy and mineral resources, including identification of critical resources, as well as the availability and economic and environmental effects of resources over their lifecycle. EMEH leverages USGS expertise to provide decision makers in other agencies the impartial science critical to safeguarding both economic security and public health and safety. While EMEH functions as one budget activity, in practice, each subactivity operates autonomously as two separate mission areas, each with its own Strategic Science Plan and Associate Director.

Energy and Mineral Resources Subactivity Overview

Energy and mineral resources are a critical component of the Nation's economy. The United States has not achieved energy independence and is completely dependent upon foreign nations for 20 different mineral commodities, including several that are critical for national security. The Nation depends on energy to power homes and businesses, as well as minerals to manufacture products such as cell phones, laptops, and cars. As demands for energy and mineral resources grow, USGS research and



Figure 1: A USGS geologist completes field work in Alaska. The USGS delivers objective science to understand mineral resource potential, production, consumption and interaction with the environment. Source: USGS MRP.

assessments become increasingly critical to understand the occurrence, quality, supply, and use of national and global resources. The impartial, in-depth science provided by the USGS Mineral Resources Program (MRP) and the Energy Resources Program (ERP) facilitates resource discovery and responsible natural resource development as well as providing information and analyses for strategic, evidence-based economic and geopolitical decisions.

The Energy and Mineral Resources (EM) Subactivity (https://www2.usgs.gov/energy_minerals/) consists of the following two program elements:

- Mineral Resources Program (<http://minerals.usgs.gov>)
- Energy Resources Program (<http://energy.usgs.gov>)

In the 2018 request, there is a proposed technical adjustment for an internal transfer, in which the balance of remaining funding for geologic carbon sequestration research related to the Energy and Independence Security Act of 2007 would be transferred from the Land Resources Mission Area, Carbon Sequestration Program to the Energy and Mineral Resources Subactivity, Energy Resources Program (+\$1,477,000/+7 FTE). The transferred projects would be included in the ERP projects related to coal and CO₂ sequestration/utilization. More information on this transfer is available in the Technical Adjustments chapter, Section B.

Energy and Mineral Resources, and Environmental Health

The 2018 budget request supports building upon existing Energy and Mineral Resources priorities and capabilities, including:

- Conducting regional, national and global assessments of energy resources to understand the distribution, quantity, and quality of various types of energy resources such as oil, gas, coal, uranium, and geothermal.
- Evaluating the geological aspects of geothermal, gas hydrates, wind energy resources, and carbon sequestration.
- Investigating the environmental effects of energy resource occurrence, production and use (e.g., produced waters associated with oil and gas development).
- Conducting assessments to understand the origin, formation, and distribution of mineral resources in regions across the Nation.
- Developing geophysical and geochemical methods in support of mineral resource research.
- Creating georeferenced national databases, including mines and soil geochemistry.
- Continuing three-dimensional geologic mapping of the Nation.
- Continuing work to understand the supply chain vulnerabilities and lifecycles of critical minerals, including rare earth elements.

Environmental Health Subactivity Overview

The Environmental Health (EH) Subactivity provides science that enhances the Nation's health and resource security by understanding and helping minimize health threats from environmental contaminants and pathogens to natural resources critical to the Nation's economy and prosperity. States, municipalities, industry, Tribes, and the public regularly grapple with complex environmental concerns that generate considerable economic uncertainty, media attention, debate, and public worry about possible health impacts. As an objective scientific voice, industry and regulatory authorities often seek USGS expertise to provide impartial science on contentious environmental issues. A key role for the EH Subactivity is to provide impartial, non-regulatory science to understand actual versus perceived risks to the health of humans and other organisms. As a result, EH science can help reduce costs and balance regulatory burdens with opportunities to protect health. On matters of human health, EH collaborates with partners from other Federal health agencies (e.g., the National Institute of Environmental Health Sciences, the National Institute for Occupational Safety and Health, and the Centers for Disease Control and Prevention), State and local health departments, academia (including schools of public health or medicine), and other public health experts. EH also works with many other partners outside of human health agencies, including the U.S. Department of Agriculture, the National Park Service, and the U.S. Fish and Wildlife Service, among others.

The Environmental Health Subactivity (<https://www2.usgs.gov/envirohealth/>) consists of the following two program elements:

- Contaminant Biology Program (<https://www2.usgs.gov/envirohealth/cbp/>)
- Toxic Substances Hydrology Program (<https://toxics.usgs.gov/>)

The 2018 budget request supports the continuation of core work related to natural resource stewardship, energy and mineral resource development, and public safety and security. Projects will focus on:

- Helping protect employee, resident, and visitor health on public lands (including national parks, lands managed by the Bureau of Land Management, and U.S. National Forest lands) as well as on Native lands.



Figure 2: Scientists supported by the Environmental Health Subactivity and other USGS Mission Areas often brave cold and other adverse conditions to collect samples for analysis back in the laboratory. Such science is crucial to help understand actual versus perceived risks to the health of humans or other organisms from natural or human sourced contaminants in the environment. Source: Adam Benthem, USGS.

- Drinking water and food safety.
- Helping understand actual versus perceived health implications of byproducts from energy and mineral resource development.
- Understanding and mitigating harmful algal blooms and algal toxins.
- Anticipating and mitigating the health impacts of disasters.

Through these activities, Environmental Health science will help protect public safety and health while minimizing regulatory burdens and enhancing our Nation’s natural resource infrastructure.

Environmental Health collaborates with a number of governmental partners, including Federal partners, who seek the quality of non-regulatory science that the USGS provides. This has led to an increased number of projects funded by external partners that have provided science insights and multi-disciplinary exposures that enhance the broader USGS ability to produce high-quality science.

The combined work of the Contaminant Biology Program and the Toxic Substances Hydrology Program supports multiple Department of the Interior priorities, including:

- **Energy:** Perceived health impacts from byproducts of energy development are an important factor in public acceptance of energy resource development, and the USGS provides non-regulatory, impartial science to inform all parties about actual versus perceived impacts.
- **Infrastructure:** USGS Environmental Health science helps inform upgrades to wastewater and drinking water treatment infrastructure, road building, and other infrastructure development on public lands.
- **Recreation and Sporting, and Land and Water Stewardship:** USGS Environmental Health science provides key impartial information related to land management decisions that balance hunting, fishing, and outdoor recreation with the Nation's energy, mineral, and other resource development priorities. For example, EH-supported science can help make sound decisions regarding the permitting of energy and mineral resource development while minimizing health risks due to potential contaminant and pathogen exposures on fish and wildlife species of high interest for conservation or that are Interior trust obligations. USGS Environmental Health science also helps protect the health of visitors and workers on Federal lands from exposures to environmental contaminants and pathogens.
- **Tribal Nations:** Environmental factors are recognized drivers of Native health. USGS Environmental Health science helps inform efforts to protect the health of Native populations, and the fish and wildlife they rely on as sources of nutrition, from environmental contaminants and pathogens.
- **Management and Efficiencies:** USGS Environmental Health science helps enhance efficiency and management of Interior activities, by informing decision making, reducing costs, and balancing regulatory burdens and red tape with opportunities to protect health. For example, USGS science informs policy decisions regarding pre-mining environmental conditions, mine permitting, and abandoned mine cleanup on Interior lands. USGS science also helps inform policy decisions by Interior health specialists to protect Interior workers (including wildland fire fighters) from exposures to geologically-sourced contaminants such as asbestos and arsenic in dusts and wildland fire emissions.

Program Performance

Energy and Mineral Resources Subactivity

In 2016, improvements were made to the Mineral Resources Program site, including interactive map applications, allowing users easier access to data in map form. In 2017 and 2018, the Mineral Resources Program will expand geophysical and remote sensing work in different regions of the United States, including Alaska and the midcontinent region, producing new digital geologic maps with a searchable database. This work will facilitate the identification and evaluation of mineral and energy resources potential in these geographic regions. The USGS will also increase its work on understanding new sources of critical minerals. In 2017 and 2018, the Energy Resources Program will continue collaborative assessments with the Mineral Resources Program of domestic uranium, and will expand unconventional oil and gas research on the geologic causes of variability in petroleum and water recovery, in addition to releasing a global assessment of unconventional oil and gas resources. Lastly, in 2018, the Energy

Resources Program will implement an externally vetted Quality Management System across its Energy Geochemistry Laboratories. The Energy Resources Program also expects completion of a strategic evaluation of the program being conducted by the National Academies of Sciences, Engineering and Medicine.

Environmental Health Subactivity

The Environmental Health Subactivity met or exceeded its 2016 performance targets, with 247 knowledge products, such as publications, provided to the public and decision makers, which is a 21 percent increase over the prior year. Successful accomplishment of program objectives is dependent upon having the right types and quantities of scientists, facilities, and information technology systems to aid in scientific research, information sharing, and information publication.

Strategic Actions Planned through 2018

The **Energy and Mineral Resources** programs will conduct work in following areas:

Mineral Resources Program:

- Continue support for collection, analysis, and dissemination of minerals information and materials flow studies.
- Conduct work on new sources of critical minerals and on the lifecycles of critical minerals.
- Improve the understanding of the genesis and distribution of the Nation's critical mineral resources, particularly in Alaska and the midcontinent and southeast regions of the United States.
- Conduct work on environmental impacts of resource extraction and understanding how mineral resources interact with the environment to affect human and ecosystem health.

Energy Resources Program:

- Release USGS assessments of undiscovered, technically recoverable oil and gas resources in U.S. and non-U.S. basins. Continue the underlying geological, geophysical and geochemical research that underpins the assessments.
- Expand unconventional oil and gas research efforts, begun in 2016, on the geologic causes of variability in the recovery of petroleum and water, and studies of baseline water quality.
- Continue research into geothermal resources aimed at improving the viability of Enhanced Geothermal Systems and studying environmental impacts of geothermal energy development on Federal lands.
- Support USGS gas hydrate studies with the USGS Coastal/Marine Hazards and Resources Program, and contribute to DOE- and industry-sponsored cooperative gas hydrate projects, aiming for initiating a multi-year gas hydrate production test on the Alaska North Slope in 2018.
- Continue efforts to assess domestic coal resources in the remaining basins of the United States that have yet to be evaluated.

Energy and Mineral Resources, and Environmental Health

- Submit for external peer review the USGS-reviewed assessment methodology of the potential environmental impacts associated with uranium resource development. The assessment methodology, a collaborative effort between the Energy Resources Program and the USGS Toxic Substances Hydrology Program, will be reviewed by a panel of external technical experts.

The **Environmental Health** programs will conduct work in the following areas:

- **Harmful Algal Toxins:** Continue to develop and apply new methods to forecast, detect, predict extent of, and help understand health implications of toxins produced by harmful algal blooms.
- **Drinking Water Infrastructure:** Continue science to understand occurrences and potential health implications of contaminants and pathogens related to the sources, treatment methods, and conveyance of private and public drinking waters, including sites in national parks.
- **Energy and Mineral Resource Development:** In collaboration with other USGS Mission Areas, continue science activities to examine potential implications of past, current, and future energy and mineral resource development on the health of humans and other organisms, in order to inform land stewardship decisions and abandoned mine lands cleanup.
- **Compounds Used to Enhance Public Safety and Management of Natural Resources:** Continue science activities to understand occurrences and potential health implications of environmental exposures to compounds used for control of vector-borne disease agents, agricultural pest control, agricultural productivity enhancement, and natural resource and fire management.
- **Disasters and Natural Hazards:** Continue science activities to understand implications of contaminants and pathogens produced by disasters on the health of humans and other organisms.
- **Environmental Mercury Research:** Continue science activities to better understand exposures of humans and other organisms to environmental mercury, and on the toxicological and ecological significance of these exposures to the health of aquatic and terrestrial organisms.
- **Environmental Pathogen Exposures:** Continue science to understand occurrences, environmental viability, and potential health effects of pathogens found in, or released from hosts into, waters, sediments, soils, dusts, and foods (e.g., highly pathogenic avian influenza virus, the soil fungus that causes Valley Fever, and the amoeba that causes Primary Amoebic Meningoencephalitis).



Energy and Mineral Resources

Mineral Resources Program

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Energy and Mineral Resources, and Environmental Health	\$94,511	\$94,331	\$1,221	\$1,477	-\$5,519	\$91,510	-\$2,821
<i>FTE</i>	524	524	0	0	-24	500	-24
Energy and Mineral Resources	\$73,066	\$72,927	\$934	\$1,477	-\$934	\$74,404	\$1,477
<i>FTE</i>	407	407	0	7	0	414	7
Mineral Resources Program	\$48,371	\$48,279	\$644	\$0	-\$644	\$48,279	\$0
<i>FTE</i>	277	277	0	0	0	277	0

Summary of Budget Request

The 2018 budget request for the Mineral Resources Program (MRP) is \$48,279,000 and 277 FTE, a program change of -\$644,000 and -0 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$644,000.



Figure 3: Critical minerals play everyday roles in energy, communication, and national security. Source: USGS MRP.

Overview

The USGS Mineral Resources Program (MRP) is the sole Federal source of scientific information and unbiased research on nonfuel mineral potential, production, consumption, and interaction with the environment. The MRP supports data collection and research on a wide variety of nonfuel mineral resources that are important to the economic stability and national security of the United States.

The USGS has served as a trusted source of information on mineral resources since Congress established it in 1879. In the intervening years, the Nation has evolved significantly, but the need for mineral resources and the science and tools to understand them is greater than ever.

Minerals are a critical part of everyday life and are essential to developing and sustaining a high-tech economy. From smart phones, computers and hybrid cars, to aircraft, new energy technologies and advanced national defense systems—the need for minerals is great and ever increasing. According to a 2008 report by the National Academy of Sciences, every year, the Nation needs more than 25,000 pounds of new nonfuel minerals per person to produce items needed for everyday use. Yet, the Nation continues to be 100 percent dependent upon foreign countries for 20 minerals and imports a majority of its supply for an additional 30 minerals. Combined, these minerals have uses ranging from everyday commodities to smartphones to weapons systems.

Therefore, understanding information about national and global mineral potential, production, and consumption is geopolitically and economically important.

Furthermore, a detailed scientific understanding of how minerals interact with the environment is essential to inform decision making on public lands and resources and for protecting and improving public health, safety, and environmental quality.

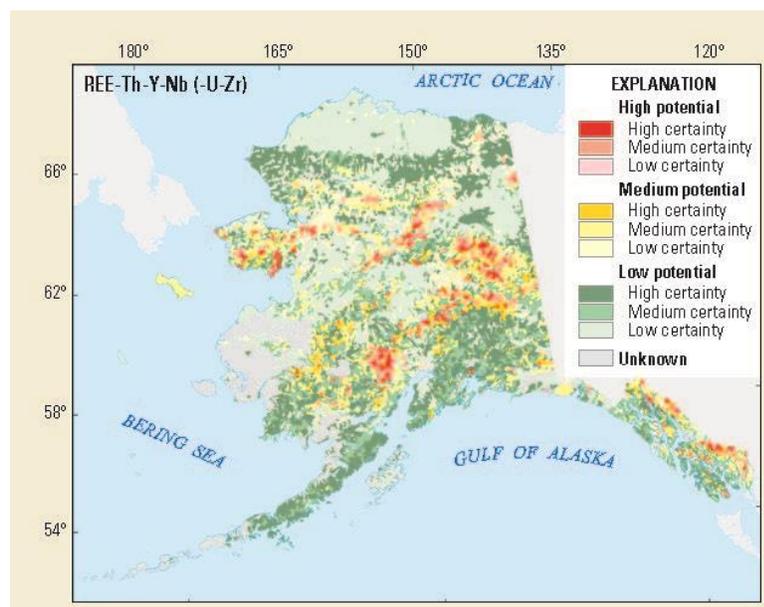


Figure 4: Estimated mineral resource potential for selected rare earth elements and other critical minerals in Alaska. Source: USGS MRP.

The 2018 President's budget request focuses on building upon MRP's core work, including:

- Conducting research on the origin, distribution, and formation of known mineral deposits.
- Conducting research on undiscovered mineral resources.
- Conducting geologic, geochemical, and geophysical mapping of mineral resources in regions across the Nation.
- Continuing work to understand the supply chains and lifecycles of critical minerals and rare earth elements.

2018 Program Change

Reduce Mineral Resources Program Operations (-\$644,000/0 FTE): This reduces the MRP's ability to execute its core activities, such as conducting assessments of mineral resources across the Nation and research on mineral potential, production, and consumption, including equipment, services, and work with partners.

Science Collaboration

The MRP collaborates with a number of external organizations, including Federal agencies and multi-agency working groups, States (through groups such as the Association of American State Geologists), as well as industry stakeholders, to leverage the expertise and contributions of partners toward the goal of a more thorough understanding of our Nation's mineral potential, production, and consumption. The MRP has been closely involved with critical minerals efforts in developing a critical mineral early-warning screening tool in collaboration with Federal agency partners, including the Department of Energy, the Department of Defense, and the Department of Commerce, among others) and industry stakeholders. Additionally, both the State of Alaska and the Bureau of Land Management (BLM) derive value from the MRP's critical mineral resource assessments conducted in Alaska, as resource development

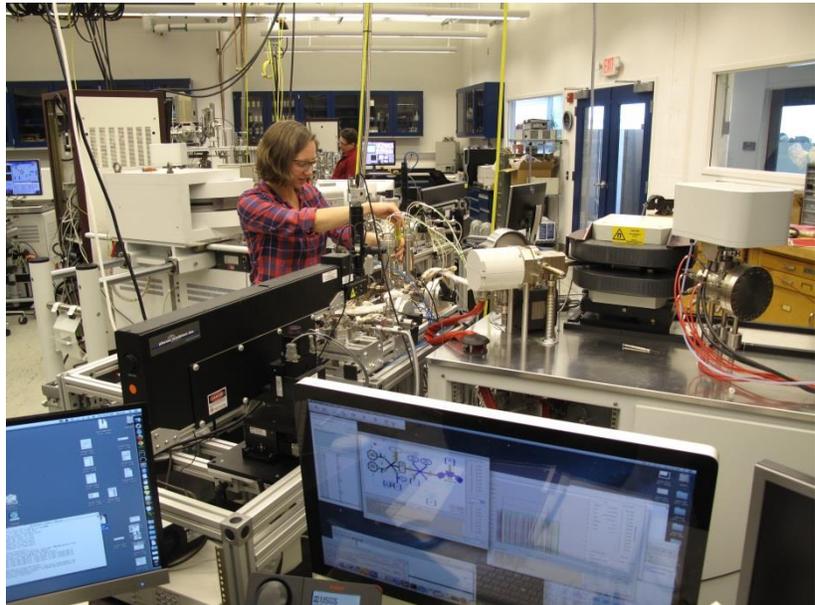


Figure 5: Geochemical research provides essential data for mineral resource assessments. Source: USGS MRP.

is an important part of the economy of that State, and the BLM considers the MRP's mineral resource assessments essential for their mandated duties to manage Federal land. The MRP's National Minerals Information Center supplies Federal government agencies (including the U.S. Census Bureau, the Department of Defense, the Federal Reserve Board, the Office of the U.S. Trade Representative, and various national security agencies) with important information regarding the mineral supply and demand of the United States and other nations, which these agencies utilize to make strategic economic, trade, and national security decisions.

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Energy and Mineral Resources

Energy Resources Program

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Energy and Mineral Resources, and Environmental Health	\$94,511	\$94,331	\$1,221	\$1,477	-\$5,519	\$91,510	-\$2,821
<i>FTE</i>	524	524	0	0	-24	500	-24
Energy and Mineral Resources	\$73,066	\$72,927	\$934	\$1,477	-\$934	\$74,404	\$1,477
<i>FTE</i>	407	407	0	7	0	414	7
Energy Resources Program	\$24,695	\$24,648	\$290	\$1,477	-\$290	\$26,125	\$1,477
<i>FTE</i>	130	130	0	7	0	137	7

Summary of Budget Request

The 2018 budget request for the Energy Resources Program (ERP) is \$26,125,000 and 137 FTE, a program change of -\$290,000 and -0 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$290,000. Additionally, there is an internal transfer from the Land Resources Mission Area, Carbon Sequestration Program, to the Energy and Mineral Resources Subactivity, Energy Resources Program of +\$1,477,000 and +7 FTE. The transferred funds from the Land Resources Mission Area’s geologic carbon sequestration project would be used for ERP work on Coal and CO₂ Sequestration/Utilization.

Overview

The USGS Energy Resources Program (ERP) is the sole provider of unbiased, publicly available estimates of geological energy resources for the United States (exclusive of the U.S. Outer

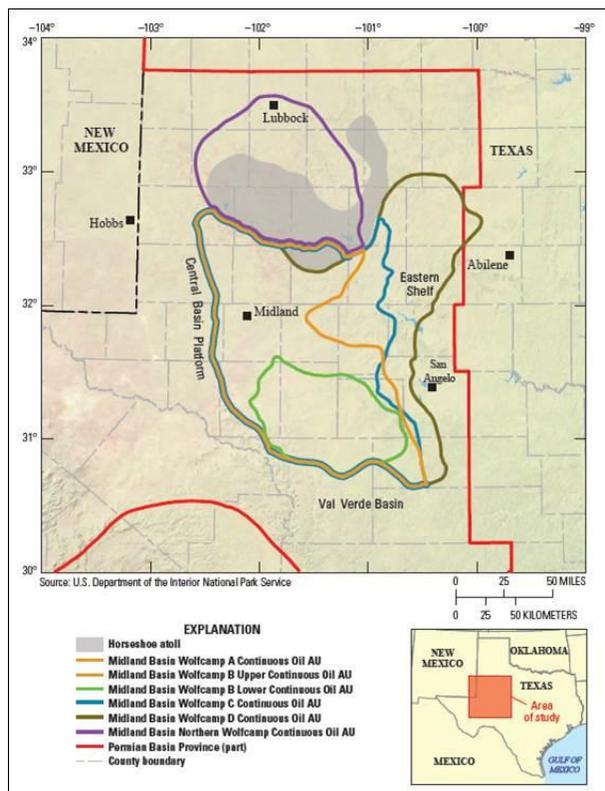


Figure 6: Assessment Units of the Wolfcamp Shale, Midland Basin in Texas. Released in November 2016, this is the largest estimate of continuous oil that the USGS has ever assessed in the United States. Source: USGS ERP.

Continental Shelf), and provides publicly available estimates related to global oil and gas resources. The ERP addresses the challenge of increasing demand for energy sources by conducting basic and applied research on geologic energy resources and on the environmental and economic impacts of their use. Among the geologic energy resources that the ERP studies are: oil, natural gas, coal, coalbed methane, gas hydrates, geothermal resources, uranium, oil shale, bitumen, and heavy oil. ERP science informs decision making related to domestic and foreign energy resources, as well as the management of energy resources on Federal lands.

As demand for energy resources continues to increase, understanding the Nation's supply and recoverability of energy resources is important for sustaining a strong national economy. The ERP provides the publicly available data and tools to inform energy policy discussions and to support science-based decisions that facilitate an all-of-the-above approach to energy development and responsible use of resources.

The 2018 President's budget focuses on:

- Conducting assessments of undiscovered, technically recoverable energy resources to understand the distribution, quantity, and quality of various types of domestic energy resources, such as oil, gas, coal, uranium, and geothermal.
- Initiating long-term production testing of gas hydrate potential on the Alaska North Slope.
- Conducting additional geologic mapping and interpretation of Arctic petroleum systems.
- Furthering our understanding of Enhanced Geothermal Systems and the potential impact they may have on the Nation's energy supply.

2018 Internal Transfer

Internal Transfer from the Land Resources Mission Area, Carbon Sequestration Program to the Energy and Minerals Resources Mission Area, Energy Resources Program (+\$1,477,000/+7 FTE): Carbon Sequestration – Geologic Research and Assessments project work will continue after transfer to the Energy and Mineral Resources Mission Area. The project will work on a national assessment of the technically recoverable hydrocarbon resources resulting from CO₂ injection and storage through CO₂-



Figure 7: USGS scientists drilling a research core near Waco, Texas. This core was drilled by USGS during field work for an oil and gas assessment for the Eagle Ford of the Gulf Coast Basins. Cores like these provide information on the various rock layers, such as their make-up, age, etc. Source: USGS ERP.

enhanced oil recovery. The goals of this work are to: (1) complete and publish an assessment methodology; (2) conduct a national assessment of recoverable oil and associated CO₂ storage that is expected in future CO₂-enhanced oil recovery operations; and (3) publish the assessment results. In addition, this funding will allow for a limited amount research on improving the geologic and technical foundation of CO₂ storage in various geologic basins.

2018 Program Change

Reduce Energy Resources Program Operations (-\$290,000/0 FTE): This reduces the ERP's ability to execute its core activities, including conducting energy resource assessments and research on geologic energy resources such as: oil, natural gas, coal, coalbed methane, gas hydrates, geothermal resources, uranium, oil shale, bitumen, and heavy oil, and includes equipment, services, and work with partners.

Science Collaboration

The Energy Resources Program participates in valuable scientific collaborations with a number of external partners. The ERP works with Federal government agencies, including the U.S. Department of Energy and the U.S. Environmental Protection Agency, on the Federal Multiagency Collaboration on Unconventional Oil and Gas (UOG) Research, a scientific research collaboration designed to better understand UOG resources and their impacts. Other ERP partners on its UOG projects have included State geological surveys, industry, academia (including the University of Texas at El Paso, the New Mexico Institute of Mining and Technology, the University of Kentucky, the California Institute of Technology, and Hebrew University), the National Institute of Standards and Technology, the Oak Ridge National Laboratory, and the National Institute of Environmental Health Sciences. The BLM partners with ERP on a variety energy resource projects, including the ERP's work on geothermal energy on Federal lands.

The Science and Decisions Center (SDC), within ERP, conducts research and applications to make scientific information, particularly that regarding energy and mineral resources, more useful and useable for land and resource management decisions so that societal and economic consequences of alternatives, including tradeoffs, can be assessed. SDC collaborates with other Federal agencies, universities, and non-governmental organizations in its efforts to increase the use and value of scientific information in decision making. For instance, the SDC's Multi-Resource Analysis proof-of-concept studies to integrate energy, mineral, water, and biologic assessments have included participation by Sandia National Laboratory, the University of Mexico, and Brigham Young University – Idaho. Additionally, the SDC's work on developing accounts for natural capital in the United States includes collaboration with scientists from Federal agencies such as the Department of the Interior (U.S. Fish and Wildlife Service), the National Oceanic and Atmospheric Administration, the U.S. Environmental Protection Agency, the U.S. Department of State, as well as other academic, non-profit and for-profit organizations, such as the University of Minnesota, the University of Hawaii, Australian National University, Statistics Canada, and Ernst and Young. The SDC's work on innovation, citizen science, and crowd sourcing has included collaborations across the Federal government.

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Environmental Health Contaminant Biology Program

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Energy and Mineral Resources, and Environmental Health	\$94,511	\$94,331	\$1,221	\$1,477	-\$5,519	\$91,510	-\$2,821
<i>FTE</i>	524	524	0	0	-24	500	-24
Environmental Health	\$21,445	\$21,404	\$287	\$0	-\$4,585	\$17,106	-\$4,298
<i>FTE</i>	117	117	0	0	0	86	-31
Contaminant Biology Program	\$10,197	\$10,178	\$139	\$0	-\$2,087	\$8,230	-\$1,948
<i>FTE</i>	57	57	0	0	-16	41	-16

Summary of Budget Request

The 2018 budget request for the Contaminant Biology Program (CBP) is \$8,230,000 and 41 FTE, a program change of -\$2,087,000 and -16 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$139,000.

Overview

Environmental Health is comprised of the Contaminant Biology Program (CBP) and the Toxic Substances Hydrology Program (TSHP). Working in close collaboration, both programs provide decision makers the science regarding exposures to toxicological and infectious



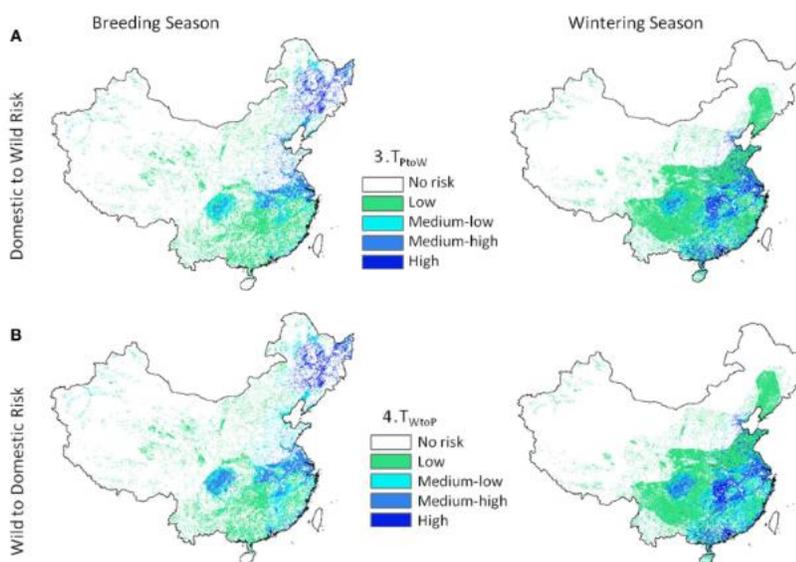
Figure 8: Shooting nuisance ground squirrels is an important form of non-chemical pest control throughout the West, where the squirrel carcasses become a food source for avian scavengers such as golden eagles (*Aquila chrysaetos*). USGS scientists funded by the Contaminant Biology Program developed a new tool that will be critical to future research designed to understand the health risks, if any, to avian scavengers due to incidental lead exposures through prey consumption. Source: Garth Herring, USGS.

disease agents in the environment that is needed to make resource development, disaster response, and infrastructure decisions. The objective, non-regulatory research produced by both CBP and TSHP is used by many Federal partners to support sound decision making while protecting American heritage in fishing, hunting, and outdoor recreation.

The USGS Contaminant Biology Program develops and applies advanced laboratory methods and field investigations to understand potential biological health effects from exposures to chemical and microbial hazards in the environment. The CBP provides science that advances informed decision making by:

- Identifying and assessing risks from exposure to environmental disease agents.
- Developing strategies to prevent and mitigate those risks.
- Collaborating closely with public health and agricultural partners to identify and understand the critical linkages among the health of the environment, fish and wildlife, domesticated animals, and humans
- Preparing the Nation for, and responding to, impacts and related health threats of natural and human-caused disasters.

The 2018 President's budget request aligns CBP science activities with the Toxic Substances Hydrology Program in order to provide an integrated scientific understanding about the origins and movement of contaminants and pathogens in the environment, and whether or not there are actual health concerns. The science resulting from this collaborative and integrated design helps land and water stewards understand the full spectrum of tradeoffs related to their decisions and actions by focusing on actual versus perceived health risks.



H5N1 transmission risk models at the interface of wild and domestic birds in China [Prosser et al. 2013]. Left panels show breeding season, right panels show wintering season models.

Figure 9: The Contaminant Biology Program supported development of a visualization tool that helps USGS Ecosystem Mission Area researchers and public health officials see how relationships between poultry density and waterfowl migration routes affect the threat of avian influenza to people and the poultry industry. The information developed by this and subsequent research on the life cycle of avian influenza in environmental waters and soils will help inform land and water stewardship decisions designed to control its spread. Source: USGS – Patuxent Wildlife Research Center.

In 2018, the CBP will focus on the biological effects of:

- Organic contaminants such as hormones, other endocrine disruptors, and byproducts of oil and gas production (to the capacity that CBP will be equipped to pursue those topics subsequent to the proposed reductions).
- Inorganic contaminants such as mercury, lead, and other metals.
- Harmful algal toxins and other biogenic contaminants
- Avian influenza and other pathogens.
- Contaminants and pathogens released during both human-caused and natural disasters
- The effects of contaminants and pathogens on the health of Department of Interior (Interior) Trust species.

2018 Program Changes

Reduce Contaminant Research (-\$1,948,000/-16 FTE): This reduction decreases scientific information, such as sampling and analysis used to determine actual rather than perceived health risks of legacy and emerging contaminants to humans, fish, and wildlife. This loss of information would impact specific regions of the Nation (e.g., the Chesapeake Bay watershed and the Great Lakes) as well as lands managed for recreational hunting and fishing, tribal subsistence, or other recreational purposes. The reduction also decreases the transferability of this information across the Nation, reducing the availability of comparative science to analyze similar circumstances of contaminant occurrence in other areas across the United States and inform policies and practices.

Reduce Contaminant Biology Program Operations (-\$139,000/-0 FTE): This reduces the CBP's ability to execute its core activities, including conducting science regarding exposures to toxicological and infectious disease agents in the environment that is needed to make decisions of critical importance to the Nation, such as decisions related to resource development, disaster response, and infrastructure, and including equipment, services, and work with partners.



Figure 10: Science funded by the Contaminant Biology Program found an association between the decline in environmental concentrations of legacy organic contaminants over the last 35 years with a rebound in the osprey (*Pandion haliaetus*) population of the Chesapeake Bay. These results inform land and water stewards as they evaluate the efficacy of efforts to enhance osprey populations in the Bay. Source: Rebecca S. Lazarus, USGS.

Science Collaboration

In order to provide valuable scientific contributions that take into account stakeholder needs and leverage the diverse expertise of partners, the Contaminant Biology Program coordinates with a number of partner organizations in conducting its work, including Federal, State, and local agencies, as well as Tribes, academia and non-governmental organizations. For example, science supported by the Contaminant Biology Program is designed and conducted to address Department of Interior priorities, such as those related to energy, land and water stewardship, recreation and sporting, and tribal Nations through a range of health effects research. Recent research includes contaminant and pathogen exposures to species of concern economically, ecologically and recreationally, such as sturgeon, smallmouth bass, osprey, and golden eagles, as well as native pollinators. Other Federal partners, such as the National Institutes of Health, the National Institute of Environmental Health Sciences, the Centers for Disease Control and Prevention, the Environmental Protection Agency, and the Department of Energy work with CBP-supported scientists on a range of issues, including research to discern the actual and perceived health risks related to contaminants and pathogens in drinking water and food.

The Contaminant Biology Program has a strong network of partners among state natural resource, agriculture, and public health agencies, along with local governments. These entities are often Contaminant Biology Program partners on science regarding: the health of fish in the states within the Chesapeake Bay watershed, including New York, Pennsylvania, Maryland, Virginia, West Virginia, and Washington, D.C.; the health of sturgeon in the Missouri river; and science to support the safe and effective use of chemicals for natural resource and agricultural purposes, such as fire suppressants in national forests and Western state parks, and invasive carp control in Illinois. Through these and many other partnerships, the Contaminant Biology Program, in close collaboration with the Toxic Substances Hydrology Program, is able to leverage cross-organizational efficiencies and expertise to address some of the most pressing environmental health challenges of the 21st century.



Figure 11: Science supported by the Contaminant Biology Program showed that trout in streams degraded by acidic runoff and metals from abandoned mines and natural sources will shift their diets from aquatic insects such as mayflies, caddisflies, and stoneflies, to terrestrial insects such as beetles and wasps. These results inform land stewardship decisions supporting sporting and recreation in these watersheds, by demonstrating the importance of restoring riparian habitat favorable for terrestrial insects. Source: Peter Leipzig-Scott, USGS.



Environmental Health Toxic Substances Hydrology Program

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Energy and Mineral Resources, and Environmental Health	\$94,511	\$94,331	\$1,221	\$1,477	-\$5,519	\$91,510	-\$2,821
<i>FTE</i>	524	524	0	0	-24	500	-24
Environmental Health	\$21,445	\$21,404	\$287	\$0	-\$4,585	\$17,106	-\$4,298
<i>FTE</i>	117	117	0	0	0	86	-31
Toxic Substances Hydrology Program	\$11,248	\$11,226	\$148	\$0	-\$2,498	\$8,876	-\$2,350
<i>FTE</i>	60	60	0	0	-15	45	-15

Summary of Budget Request

The 2018 budget request for the Toxic Substances Hydrology Program (TSHP) is \$8,876,000 and 45 FTE, a program change of -\$2,498,000 and -15 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$148,000.

Overview

Environmental Health is comprised of the Contaminant Biology Program (CBP) and the Toxic Substances Hydrology Program (TSHP). Working in close collaboration, both programs provide the science needed to safeguard the Nation's health, economy, and resources by helping understand and minimize exposures to toxicological and infectious disease agents in the environment. The objective, non-regulatory research produced by both CBP and TSHP is used by many Federal partners to support sound decision making while protecting American heritage in fishing, hunting, and outdoor recreation.

The USGS Toxic Substances Hydrology Program develops and applies advanced analytical methods, field investigations, laboratory studies, and modeling capabilities to understand the sources, movement, and exposure pathways of chemical and microbial hazards in the environment. Industrial, agricultural, mining, and other human activities, as well as disasters such as hurricanes, can significantly affect contaminant and pathogen exposures to humans and other organisms by the introduction or mobilization of contaminants such as synthetic chemicals (e.g., pesticides and pharmaceuticals), naturally-occurring elements (e.g., arsenic or uranium), and microbes (e.g., viruses and bacteria) in ways that may not be immediately apparent. Exposure to contaminants and pathogens in surface water, groundwater, soil, sediment, and the atmosphere can have both short- and long-term health and economic impacts. TSHP

research provides the science needed to develop balanced policies and practices that identify and minimize potential exposures to contaminants and pathogens and incorporate the most cost-effective cleanup and waste-disposal strategies that target only the highest priority and most important health risks.

A primary focus of the Toxic Substances Hydrology Program in 2018 will be to provide decision makers a better understanding of the sources, movement, fate, exposure pathways, and biological effects of these contaminants, contaminant mixtures, and pathogens. Such understanding is critical for development of effective strategies to prevent or mitigate health impacts to humans and other organisms. As decision makers and the public regularly contend with complex concerns about possible health impacts, the impartial and rigorous science conducted by the CBP and the TSHP is critical for distinguishing between actual versus perceived health risks.

Examples of the topics that will be studied by the Toxic Substances Hydrology Program in 2018 include:

- Characterization of contaminants and pathogens in tap water, and their implications for human health.
- Detection and quantification of harmful algal toxins, their sources, and implications for the health of humans, pets, fish, and wildlife.
- Description of the actual, as opposed to perceived, implications of organic and inorganic byproducts from energy resource development on the health of humans and other organisms.
- Understanding and helping mitigate potential health effects from exposures of humans, pets, fish, and wildlife to contaminants and pathogens produced by disasters.
- Understanding and helping mitigate potential health effects from environmental exposures of humans, fish, and wildlife to compounds associated with vector-borne disease agent control, agricultural pest control, agricultural productivity enhancement, and resource management (e.g., fire retardants, dust control agents, and compounds used to kill invasive species).

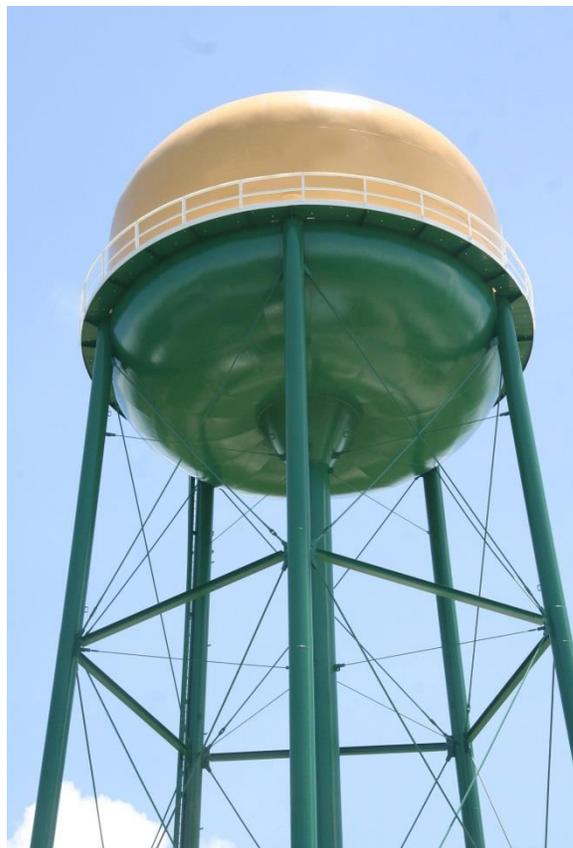


Figure 12: Science funded by the Toxic Substances Hydrology Program to collect data on contaminants and pathogens in drinking water is needed by human-health researchers and others to understand actual versus perceived health risks related to the sources, treatment, and distribution infrastructure associated with private and public drinking water. Source: Barb Sturner, Federal Emergency Management Agency.

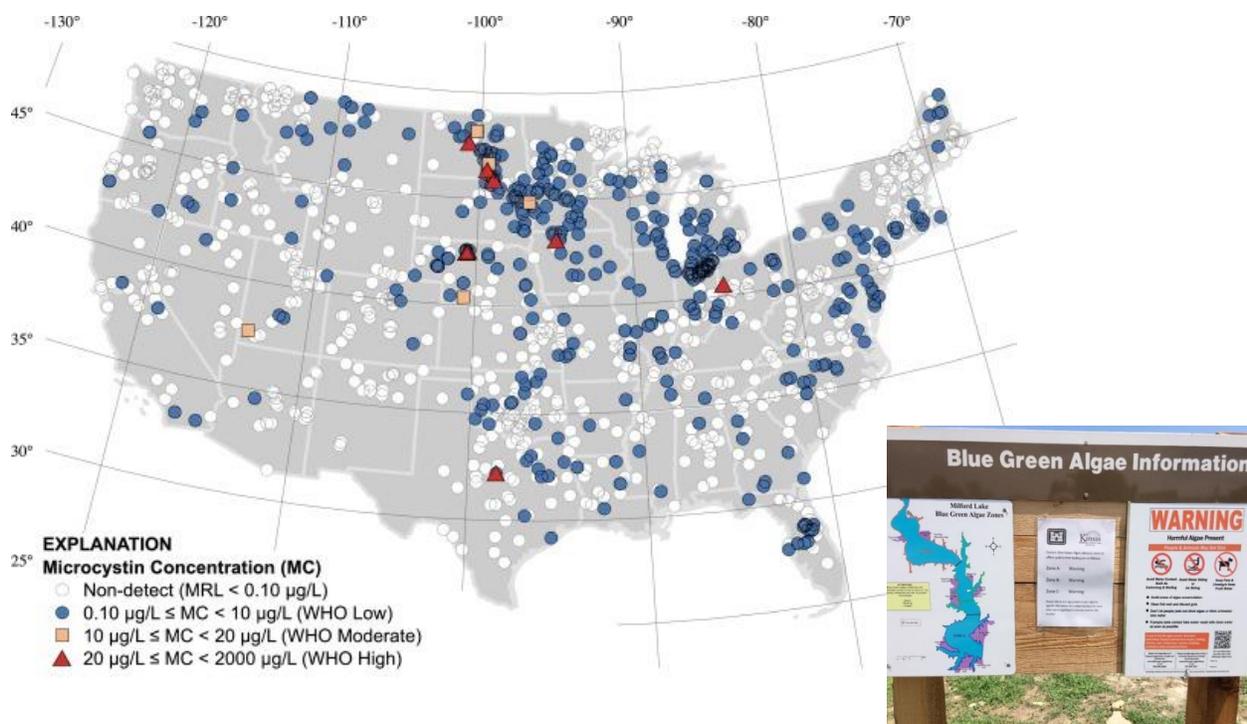


Figure 13: Science supported by the Toxic Substances Hydrology Program and the USGS Water Resources Mission Area show that algal toxins are present in streams, lakes, and estuaries all over the Nation. These results inform decisions by land and water stewards in support of recreation, sporting, and public health. Source: USGS.

2018 Program Changes

Eliminate Radioactive Waste Disposal Science in Support of Energy and Land and Water Stewardship (-\$700,000/-5 FTE): This eliminates a project that informs decision makers, land managers, and landowners about the safe disposal of low-level radioactive waste on both private and public lands in arid environments, by showing the likelihood of radioactivity moving offsite, how far it may move, and how long it takes to get there.

Eliminate Municipal Wastewater Science to Support Land and Water Stewardship and Infrastructure (-\$100,000/-1 FTE): This eliminates a project providing science to help manage the safe disposal of wastewater in municipalities across the Nation and in areas such as coasts and National Parks. This non-regulatory science is used by States, municipalities, wastewater treatment facilities, and other stakeholders to understand the health implications of pathogens, nutrients, and chemicals in water bodies affected by municipal wastewaters and sewage. This will result in the loss of information available to decision makers about wastewater infrastructure in areas where water is reused, or where discharges and leakages occur from wastewater treatment facilities. Remaining funds will be used to close existing research sites.

Eliminate Contaminant Science in Support of Water and Land Stewardship, Energy, and Wastewater and Drinking Water Infrastructure (-\$1,550,000/-9 FTE): This reduction would mean a loss of specialized expertise needed by both ongoing and new USGS studies that provide non-regulatory, non-advocacy science to understand and address health hazards posed by environmental contaminants in tap waters, recreational waters, and fisheries (for example, harmful algal toxins, lead, arsenic, perfluorinated compounds, and other contaminants of emerging concern). Such information is utilized by policymakers at all levels, the private sector, and other stakeholders to understand actual versus perceived risks to health posed by environmental contaminants, and to develop appropriate, cost-effective, and technologically feasible policies and strategies to reduce exposures to environmental contaminants.

Reduce Toxic Substances Hydrology Program Operations (-\$148,000/-0 FTE):

This reduces the TSHP's ability to execute its core activities, including conducting science regarding exposures to toxicological and infectious disease agents in the environment that is needed to make decisions of critical importance to the Nation, such as decisions related to resource development, disaster response, and infrastructure, and including equipment, services, and work with partners.

Science Collaboration

The Toxic Substances Hydrology Program coordinates with a number of partner organizations in conducting its work, including Federal, State, and local agencies, as well as academia and non-governmental organizations. On matters of human health, the TSHP collaborates with health experts from other Federal, State, local, Tribal, academic, and other

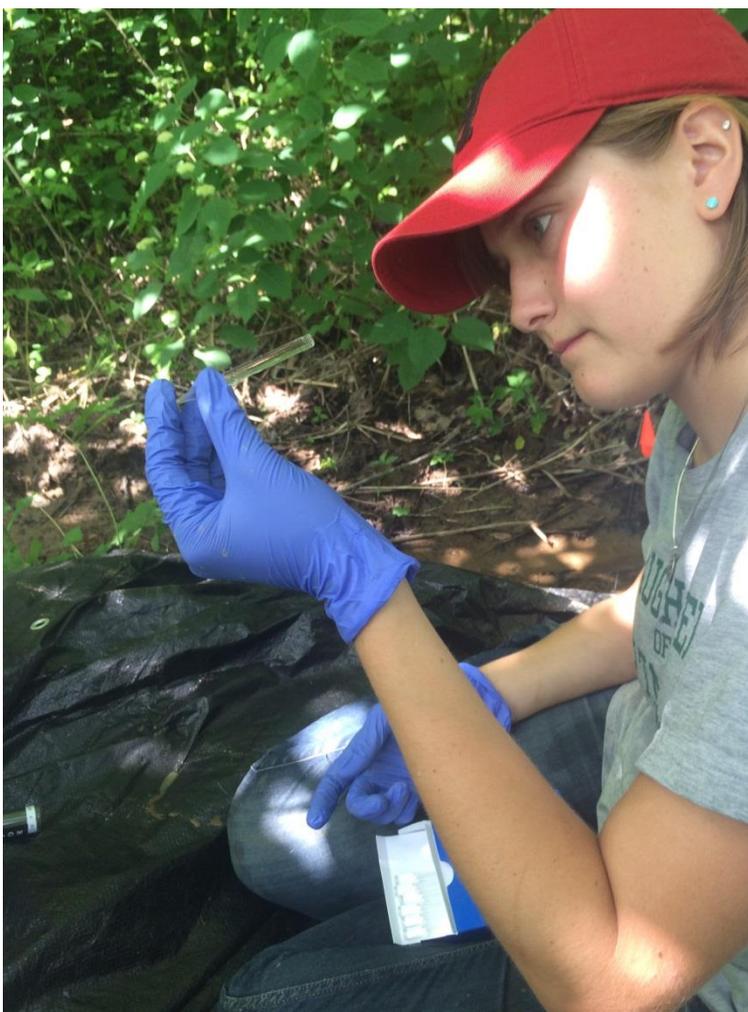


Figure 14: Recent field sampling supported by the Toxic Substances Hydrology Program shows that chemical contaminants which had been previously detected in a small creek close to a wastewater injection facility were *not* detected further downstream where the waters are used for recreation and drinking water purposes. Such underground injection of wastewaters associated with energy development activities like hydraulic fracturing is a common way to dispose of liquid by-products of the energy industry. Source: Denise M. Akob, USGS.

entities, such as the Department of Interior Office of Occupational Safety and Health, the National Park Service Office of Public Health, the National Institute of Environmental Health Sciences, the Centers for Disease Control and Prevention, the National Institute for Occupational Safety and Health, the National Cancer Institute, State and local health public health departments, Harvard School of Public Health, Mt. Sinai School of Public Health, National Jewish Health Center, and many others.

The TSHP collaborates on harmful algal blooms and toxins with the USGS Ecosystems and Water Mission Areas, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, and the Environmental Protection Agency (EPA) in the Cyanobacteria Assessment Network (CyAN), a multi-agency project working to develop a satellite-based early warning system to detect algal blooms in fresh waters of the United States. The TSHP and the USGS National Water Quality Program (NWQP) recently collaborated with the EPA, States, and Tribes to complete the largest survey of cyanotoxins and potential harmful algal bloom recreational risks in more than 1,000 U.S. lakes and reservoirs. The study found that algal toxins were present in 32 percent of the Nation's lakes and reservoirs nationally, reinforcing the widespread need for heightened monitoring and awareness to minimize exposures to algal toxins and protect public health. The TSHP and NWQP also worked with State partners to identify cyanotoxins and microcystins in 39 percent of wadeable streams measured in the Southeastern United States, a previously overlooked source of algal toxin exposures to humans and ecosystems.

On fish and wildlife health research, such as health impacts on fish from exposures to contaminants and pathogens in the Chesapeake Bay watershed, the Toxic Substances Hydrology Program works with organizations such as the U.S. Fish and Wildlife Service, the Virginia Department of Environmental Quality, the Pennsylvania Department of Environmental Protection, and the EPA. Through these and many other partnerships, the TSHP, in close collaboration with the USGS Contaminant Biology Program, is able to leverage cross-organizational efficiencies and expertise to address some of the most pressing environmental health challenges of the 21st century.

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Natural Hazards



Natural Hazards



Earthquake-triggered landslide, Haiti

The USGS protects life, health, and property by effectively delivering natural hazards science.

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Natural Hazards	\$139,013	\$138,748	\$1,479	\$0	-\$22,116	\$118,111	-\$20,637
<i>FTE</i>	627	627	0	0	-52	575	-52
Earthquake Hazards Program	\$60,503	\$60,388	\$561	\$0	-\$9,561	\$51,388	-\$9,000
<i>FTE</i>	232	232	0	0	-12	220	-12
Volcano Hazards Program	\$26,121	\$26,071	\$343	\$0	-\$3,982	\$22,432	-\$3,639
<i>FTE</i>	142	142	0	0	-7	135	-7
Landslide Hazards Program	\$3,538	\$3,531	\$53	\$0	-\$53	\$3,531	\$0
<i>FTE</i>	22	22	0	0	0	22	0
Global Seismographic Network	\$6,453	\$6,441	\$29	\$0	-\$1,484	\$4,986	-\$1,455
<i>FTE</i>	12	12	0	0	-2	10	-2
Geomagnetism Program	\$1,888	\$1,884	\$0	\$0	-\$1,884	\$0	-\$1,884
<i>FTE</i>	15	15	0	0	-15	0	-15
Coastal/Marine Hazards and Resources Program	\$40,510	\$40,433	\$493	\$0	-\$5,152	\$35,774	-\$4,659
<i>FTE</i>	204	204	0	0	-16	188	-16

Summary of Program Changes

Request Component	(\$000's)	FTE	Fixed Costs	Page
Earthquake Hazards Program	-9,561	-12	+561	I--9
Eliminate implementation of Earthquake Early Warning System for the West Coast	-8,200	-10		I--10
Reduce Support for Regional Earthquake Monitoring, Assessments and Research	-800	-2		I--10
Reduce Earthquake Hazards Operations	-561	0		I--10
Volcano Hazards Program	-3,982	-7	+343	I--13
Suspend Implementation of NVEWS	-1,500	-2		I--14
Reduce Volcano Hazard Assessments	-1,639	-3		I--14
Suspend Maintenance of Monitoring Networks and Data Analysis at Yellowstone and Commonwealth of the Northern Mariana Islands	-500	-2		I--14
Reduce Volcano Hazards Operations	-343	0		I--15
Landslide Hazards Program	-53	0	+53	I--17
Reduce Landslide Hazards Operations	-53	0		I--18
Global Seismographic Network	-1,484	-2	+29	I--21
Suspend implementation of GSN seismic station upgrades	-1,455	-2		I--22
Reduce Global Seismographic Network Operations	-29	0		I--22
Geomagnetism Program	-1,884	-15	0	I--23
Eliminate the Geomagnetism Program	-1,884	-15		I--24
Coastal/Marine Hazards and Resources Program	-5,152	-16	+493	I--25
Eliminate Marine Habitat/Resource Mapping and Ocean and Glacier Studies to Inform Resource Management	-1,600	-6		I--26
Eliminate Elevation Model Development and Regional Coastal Resource Assessments	-2,500	-7		I--26
Reduce Support for Regional Coastal Management, Restoration, and Risk Reduction	-559	-3		I--27
Reduce Coastal-Marine Hazards and Resources Program Operations	-493	0		I--27
Total Program Change	-22,116	-52	+1,479	

Summary of Budget Request

The 2018 budget request for the Natural Hazards Mission Area is \$118,111,000 and 575 FTE, a program change of -\$22,116,000 and -52 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$1,479,000.

Overview

The Natural Hazards Activity is comprised of six subactivities:

- Earthquake Hazards Program (EHP; <http://earthquake.usgs.gov>)
- Volcano Hazards Program (VHP; <http://volcanoes.usgs.gov>)
- Landslides Hazards Program (LHP; <http://landslides.usgs.gov>)
- Global Seismographic Network (GSN; <http://earthquake.usgs.gov/monitoring/gsn>)
- Geomagnetism Program (<http://geomag.usgs.gov>)
- Coastal/Marine Hazards and Resources Program (CMHRP; <http://marine.usgs.gov>)



USGS hazard science helps protect the safety, security, and economic well-being of the Nation by:

- Effectively delivering hazard assessments and issuing warnings and advisories for earthquakes, landslides, volcanic eruptions, and coastal erosion.
- Informing warnings and advisories, and hazard assessments issued by others for floods, magnetic storms, tsunamis, and wildfires.
- Providing timely and accurate information to emergency managers and response officials, the media and the public.
- Informing and educating at-risk or impacted communities during crises and to anticipate and prepare for future hazard events.

To achieve its primary mission, and to fulfill its responsibilities for loss and risk reduction, the USGS Natural Hazards Mission Area (NHMA) develops, delivers, and applies several interlocking components of hazard science: observations and targeted research underpin assessments, forecasts, warnings, and crisis and disaster response. The research, data, products, and detailed information that the USGS provides enables Federal, State, tribal, local, and private-sector end-users to better understand, anticipate and reduce their risks associated with natural, technological, and environmental hazards, and enables science-based decisions that effectively enhance resilience and reduce impacts from those threats.

The USGS NHMA has set goals and identified strategic actions that will lead to more accurate, higher resolution, and timely assessments and warnings. Effective and more accurate assessments and warnings provide opportunity for improved planning, preparedness and response decisions, and reduce hazard vulnerability and losses. The programs of the NHMA provide situational awareness products and

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targeted scientific information to emergency responders, policymakers and the public to reduce natural hazard risks and losses, and increase community resilience. In order to successfully accomplish these risk reduction strategic objectives, the NHMA maintains a breadth of scientists, facilities, and information technology systems to aid scientific research and information sharing and product delivery and publication. In addition, strong communication, collaboration, and cooperation are required among a number of Federal and State agencies for the success of the USGS natural hazards programs. Federal partner agencies include the National Oceanic and Atmospheric Administration (NOAA), the National Science Foundation, the Department of Defense, Department of Energy, the Federal Emergency Management Agency, and several Interior bureaus including the National Park Service, U.S. Fish and Wildlife Service, and the Bureau of Ocean Energy Management

The 2018 budget request allows the USGS to focus NHMA activities on its core mission of natural hazard monitoring, assessments, research and coastal resource studies. While preserving critical mission activities (see Strategic Actions for 2018 below), the request also includes several proposed terminations and reductions. Activities to be terminated or suspended include:

- Development of the *ShakeAlert* earthquake early warning system for the west coast.
- Maintenance of monitoring networks in Yellowstone and the Commonwealth of the Northern Mariana Islands.
- Implementation of the National Volcano Early Warning System (NVEWS).
- Seismic station upgrades to the Global Seismographic Network (GSN).
- Geomagnetic monitoring, hazard assessment and research in support of the National Space Weather Program.
- Marine habitat mapping, ocean studies to inform resource management, delivery of regional offshore/onshore elevation models, coastal resource vulnerability assessments.
- Support for regional coastal management, restoration, and risk reduction.

Activities to be reduced include: volcano monitoring in the Yellowstone National Park region; volcano hazards assessments (used to inform volcano monitoring and decisions on managing risks from eruptions); and regional earthquake monitoring, hazard assessments, and research in the lower risk regions of Alaska and the Central and Eastern United States. Details for these terminations, suspensions and reductions are provided in the following program sections.

Program Performance

In 2016, 92 percent of the performance measures of the USGS natural hazard programs met or exceeded their targets. Specifically, the Earthquake Hazards Program (EHP) increased work on induced seismicity and analyzed data from new, low-cost seismic instrumentation; the Volcano Hazards Program (VHP) purchased and installed new monitoring equipment; the Landslide Hazards Program (LHP) increased work on post-fire debris flows delivering hazard assessments for 29 wildfires; the Geomagnetism Program improved observatory equipment, which resulted in an increase of reliable data being collected; and the Coastal/Marine Hazards and Resources Program (CMHRP) had continued success in their

research data being cited in a significant number of coastal and ocean studies. This level of performance indicates that critical natural hazard knowledge and tools were being developed and provided to land managers and policymakers to inform decision making.

Strategic Actions Planned through 2018

The **Earthquake Hazards Program** will:

- Monitor the Nation's earthquakes via the Advanced National Seismic System (ANSS) and, through support of several regional seismic networks operated by State and university partners, provide 24x7 reporting on domestic and global earthquakes; deliver rapid earthquake impact and situational awareness products to support emergency response; and develop improved methods for continued improvement in the quality and timeliness of real-time earthquake information.
- Deliver real-time earthquake data to NOAA, supporting tsunami monitoring in the Pacific Rim and disaster alerting in Alaska, Hawaii, Washington, California, and U.S. Territories in the Western Pacific and Caribbean.
- Continue to improve the USGS National Seismic Hazard Model, which describes the likelihood and potential impacts of earthquakes nationwide and serves as the basis of seismic provisions in building codes; deliver a draft model update to the Building Seismic Safety Council, which develops building code updates; and maintain associated databases and tools that are widely used by engineers for site-specific engineering design and seismic risk analysis.
- Conduct applied field, laboratory, and theoretical research on the causes, characteristic, and effects of earthquakes, including investigations of earthquakes related to wastewater disposal and other industrial activities; and will support relevant research by expert partners in academia, State agencies, and the private sector via competitive grants and cooperative agreements.
- Communicate earthquake information to the public and to key stakeholders, including Federal and State emergency response agencies, disaster relief organizations, operators of utilities and lifelines, and communities at risk.

The **Volcano Hazards Program** will:

- Monitor the Nation's volcanoes to issue alerts and information in real-time about eruptive activity to the public and key partners, such as other Federal agencies and state and local emergency management officials to support decisions about evacuation, aircraft diversion for volcanic ash, and other related health and safety impacts.
- Work closely with partners to communicate information about volcano hazards and improve awareness and preparedness activities for the public and other key stakeholders.
- Conduct laboratory-based studies of volcanic processes that will inform volcano monitoring strategies and the generation of updated volcanic hazard assessments.
- Revise the national assessment of volcano threat levels with the availability of new data generated since the 2005 national assessment.

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- Leverage USGS leadership of the 3DEP initiative and partner with other Federal and State agencies to acquire high-resolution light distance and ranging (lidar) data over Very-High-Threat and High-Threat volcanoes.

The **Landslide Hazards Program** will:

- Conduct field, laboratory, and modeling studies of landslide initiation and mobility processes in cooperation with Federal, State, academic, and private sector partners to develop, test, and advance tools and methods for landslide monitoring, hazard assessment, and forecasting.
- Provide post-wildfire debris-flow hazard assessments for major wildfires to post-fire response teams; State geological surveys; Federal, State, and local emergency management; and the public.
- Collect observations, conduct studies, and test methods and models to expand the NOAA-USGS partnership for post-wildfire debris-flow early warning beyond the prototype area in southern California to other parts of the western United States. The LHP will also continue to collect observations and conduct studies to expand debris-flow early warning to non-burned landscapes in select high-risk areas of the Nation.
- Test and deploy a system for near-real-time hazard assessment to support Federal, State, and local response to major landslide crises.

The **Global Seismographic Network** will:

- Focus on its core priority of operating the existing network in its current state to provide seismic data needed for earthquake alerts and situational awareness products, tsunami warnings, national security, hazard assessments, and research.
- Continue to develop the Data Quality Analyzer (DQA) software in order to expand its use in monitoring and improving the data quality from the existing instrumentation. The DQA will refine its automated tracking of data quality metrics and will be combining different metrics to help diagnose station problems.

The **Coastal/Marine Hazards and Resources Program** will:

- Conduct marine geological and geophysical investigations to provide Federal, State, and local users with improved assessments of hazard sources (earthquakes, tsunami, submarine landslides) and their potential impacts on offshore operations, coastal communities and infrastructure.
- Continue field and laboratory studies with other Federal and academic partners to characterize marine methane systems and associated seabed processes to enhance understanding of their energy resource potential, the risk they represent to offshore operations and their role in the global carbon system and marine ecological productivity.
- Contribute analyses and expertise to delineate the U.S. Extended Continental Shelf consistent with international law and will apply unique USGS expertise to understanding the occurrence and potential of deep-sea mineral resources.
- Provide regional real-time forecasts of erosion and inundation due to coastal storms, including

hurricanes, and long-term forecasts of the likelihood of future coastal change and inundation due to storms, erosion, and sea-level rise.

- For priority coastal locations, develop and deliver data and knowledge on physical setting and processes that informs local, State, and Federal coastal management, planning, and public safety efforts to design and assess strategies for regional restoration, risk reduction, and coastal management.

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Natural Hazards Earthquake Hazards Program

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Natural Hazards	\$139,013	\$138,748	\$1,479	\$0	-\$22,116	\$118,111	-\$20,637
<i>FTE</i>	627	627	0	0	-52	575	-52
Earthquake Hazards Program	\$60,503	\$60,388	\$561	\$0	-\$9,561	\$51,388	-\$9,000
<i>FTE</i>	232	232	0	0	-12	220	-12

Summary of Budget Request

The 2018 budget request for the Earthquake Hazards Program is \$51,388,000 and 220 FTE, a program change of -\$9,561,000 and -12 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$561,000.

Overview

The USGS provides the scientific information and knowledge necessary to reduce deaths, injuries, and economic losses from earthquakes and earthquake-induced tsunamis, landslides, and soil liquefaction. The USGS is the only U.S. agency that routinely and continuously reports on current domestic and worldwide earthquake activity. Through the Advanced National Seismic System (ANSS), the USGS and its State and university partners monitor and report on earthquakes nationwide. The USGS National Seismic Hazard Maps form the basis for seismic provisions in the Nation's building codes.

The Earthquake Hazards Program (EHP) is the applied Earth science component of the four-Agency National Earthquake Hazards Reduction Program (NEHRP, reauthorized by the Earthquake Hazards Reduction Authorization Act of 2004, P.L. 108-360). Through NEHRP, the USGS partners with the Federal Emergency Management Agency (FEMA), the National Science Foundation (NSF), and the National Institute of Standards and Technology (NIST) to reduce earthquake losses in the United States.

Nearly half of the U.S. population is at risk from earthquakes, and annualized earthquake losses in the United States are estimated at \$6.1 billion. To effect loss reduction, the EHP supports a highly coordinated set of monitoring, hazards assessment, research, and risk translation and communication activities in at-risk regions nationwide, including the west coast, the Intermountain West, the Central and

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Eastern United States, and Alaska. This work enlists the talents and expertise of the academic community, State governments, and the private sector via competitive grants and cooperative agreements. The 2018 budget request allows the EHP to focus on the core priorities for earthquake loss reduction, which include:

- 24x7 reporting on domestic and global earthquakes.
- Delivery of earthquake impact and situational awareness products to emergency response officials.
- Maintenance of national and regional seismic hazard maps, associated databases and tools.
- Reducing uncertainties in assessments of earthquake occurrence and ground motion.
- Assessing the risks from earthquakes and tsunamis to the Nation's critical infrastructure.
- Communication of earthquake information to the public and to key stakeholders, including Federal and State emergency response agencies and disaster relief organizations.

2018 Program Changes

Eliminate Implementation of Earthquake Early Warning System for the West Coast

(-\$8,200,000/-10 FTE): This elimination would end USGS efforts to implement the *ShakeAlert* earthquake early warning system, suspending internal efforts and eliminating external funding to partners (California Institute of Technology, Central Washington University, University of California at Berkeley, University of Nevada at Reno, University of Oregon, and the University of Washington).

Reduce Support for Regional Earthquake Monitoring, Assessments and Research (-\$800,000/-2 FTE):

This reduces support for regional earthquake monitoring, hazard assessment, and research in areas of moderate seismic risk, specifically Alaska and the Central and Eastern United States. This would also reduce grants supporting targeted research by academic, State, and private sector partners, which may slow the rate of updates to seismic provisions in building codes and provide less science to support risk mitigation actions. The USGS would also suspend its annual forecast of hazard related to both natural and induced seismicity.

Reduce Earthquake Hazards Operations (-\$561,000/0 FTE): This reduction would diminish the EHP's ability to execute its core activities including monitoring and reporting on earthquakes, assessing earthquake hazards, as well as delivery of earthquake products to emergency responders, including equipment, services, and work with partners.

Science Collaboration

Through NEHRP, the USGS partners with FEMA, NSF, and NIST to reduce earthquake losses in the United States. For example, the USGS partners with FEMA in the development and updating of building codes, based on USGS earthquake hazard science. The USGS *ShakeMap* product, which provides rapid situational awareness of earthquake ground motions, is sent directly to numerous businesses, utilities,

lifeline operators, response officials, and State and local government agencies, and is imported directly into FEMA's HAZUS software for detailed estimation of earthquake impacts.

The USGS also participates in FEMA-led national-level earthquake disaster response exercises, in which the USGS contributes directly to two of the Emergency Support Functions within the National Response Framework. Data from USGS-managed seismometers flow directly into the two Tsunami Warning Centers operated by National Oceanic and Atmospheric Administration; the warning centers use those data to quickly estimate the magnitude, location and depth of large earthquakes, and to send rapid tsunami warnings.

The EHP and NSF's Geoscience Directorate jointly fund national and global seismic and geodetic monitoring. The USGS and NSF also jointly support the Southern California Earthquake Center, a highly leveraged research consortium, which is making significant advances in the fields of seismic hazards assessment, seismic-resistant engineering, earthquake forecasting, public risk communication, paleoseismology, and modeling of earthquake ground motions via high-performance computing.

Monitoring data from seismic networks supported by EHP's ANSS, as well as EHP supported geodetic networks, are publically available and used by many NSF-supported research projects. In a complementary way, the NSF supports the ANSS by providing data archiving and distribution through the IRIS Data Management System (see www.iris.edu).

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Natural Hazards Volcano Hazards Program

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Natural Hazards	\$139,013	\$138,748	\$1,479	\$0	-\$22,116	\$118,111	-\$20,637
<i>FTE</i>	<i>627</i>	<i>627</i>	<i>0</i>	<i>0</i>	<i>-52</i>	<i>575</i>	<i>-52</i>
Volcano Hazards Program	\$26,121	\$26,071	\$343	\$0	-\$3,982	\$22,432	-\$3,639
<i>FTE</i>	<i>142</i>	<i>142</i>	<i>0</i>	<i>0</i>	<i>-7</i>	<i>135</i>	<i>-7</i>

Summary of Budget Request

The 2018 budget request for the Volcano Hazards Program is \$22,432,000 and 135 FTE, a program change of -\$3,982,000, and -7 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$343,000.

Overview

Volcanic eruptions are among the most destructive phenomena of nature, and even small events can have a significant social and economic impact. Unlike many other natural disasters, however, volcanic eruptions can be predicted well in advance of their occurrence if adequate in-ground instrumentation is in place that allows earliest detection of unrest providing the time needed to mitigate the worst of their effects.

Despite these successes, the Nation's existing volcano monitoring infrastructure cannot provide warning of eruptions from all volcanos that threaten lives and property. Many volcanoes, including some of the most threatening, lack the instrumentation necessary for effective forecasting and have had only rudimentary geologic study. The VHP has evaluated all of the Nation's volcanoes to determine the monitoring commensurate with the threat they pose. This national threat level assessment was conducted in 2005 and is being updated. The USGS and affiliated partners used this threat assessment to design a national-scale plan, the National Volcano Early Warning System (NVEWS), to detect unrest at the earliest stages using in-ground monitoring instrumentation deployed on the Nation's most threatening volcanoes.

The VHP is built around a structure of five volcano observatories that divide the Nation's volcanoes into distinct areas of responsibility:

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- Hawaiian Volcano Observatory– Hawaii
- Cascades Volcano Observatory – Idaho, Oregon, and Washington
- Alaska Volcano Observatory– Alaska and the Commonwealth of the Northern Mariana Islands
- California Volcano Observatory– California and Nevada
- Yellowstone Volcano Observatory– Arizona, Colorado, Montana, New Mexico, Utah, and Wyoming

Under the NVEWS model, the observatories retain considerable independence, recognizing the importance of local knowledge and close ties with local officials and emergency managers. NVEWS also places great value on the interoperability among the observatories, ensuring that they all use a common set of tools and standards. Each observatory is responsible for volcano monitoring, community preparedness including development and regular practice of volcano hazard emergency response plans, managing volcanic crises, and coordinating research in their areas of responsibility.

The 2018 budget request focuses on core capabilities to provide forecasts and warnings of hazardous volcanic activity at volcanoes in the United States with the current monitoring networks; to provide forecasts and warnings and situational awareness of hazardous volcanic activity at five very-high-threat volcanoes in Alaska and all very-high-threat (VHT) and high-threat (HT) volcanoes in the contiguous United States, and to produce updated volcanic hazard assessments for VHT and HT volcanoes in the contiguous United States.

2018 Program Changes

Suspend Implementation of NVEWS (-\$1,500,000/-2 FTE): This suspends implementation of the National Volcano Early Warning System, including installations to close monitoring gaps on Very-High-Threat volcanoes in the contiguous United States and upgrade analog monitoring stations in Alaska to comply with National Telecommunications and Information Administration spectrum allocation restrictions, and developing a next generation lahar detection system for Mt. Rainier, Washington.

Reduce Volcano Hazard Assessments (-\$1,639,000/-3 FTE): This reduces the pace of hazard assessments at High- and Very-High-Threat volcanoes. The reduction would also reduce efforts to develop volcano hazard assessments used to inform monitoring and decisions on managing risks from eruptions, narrowing the focus of assessments to understanding volcanic systems and technologies for future monitoring and widespread instrument deployment.

Suspend Maintenance of Monitoring Networks and Data Analysis at Yellowstone and Commonwealth of the Northern Mariana Islands (-\$500,000/-2 FTE): This suspends maintenance of USGS monitoring networks which will diminish monitoring of the Yellowstone volcanic region, including real-time temperature monitoring of stream and hydrothermal pools, resulting in significantly reduced awareness of changes within a large caldera system where ground deformation and hydrothermal explosions are commonplace. This reduction would also suspend maintenance of monitoring networks on three active volcanoes in the Commonwealth of the Northern Mariana Islands.

Reduce Volcano Hazards Operations (-\$343,000/0 FTE): This reduction would diminish the VHP's ability to execute its core activities to provide forecasts and warnings of hazardous volcanic activity at volcanoes in the United States with the current monitoring networks; to provide forecasts and warnings and situational awareness of hazardous volcanic activity; and to produce updated volcanic hazard assessments, including equipment, services, and work with partners.

Science Collaboration

Collaboration with National Science Foundation – The USGS is a major participant in the NSF's GeoPRISMS Program, which has targeted studies of the geology and geophysics of continental margins, focusing on the Cascadia and the Alaskan-Aleutian subduction zones. VHP scientists worked closely with their academic partners to obtain NSF funding for a GeoPRISMS project for a "slab-to-surface" geophysical and geochemical imaging effort at Mount St. Helens. The VHP leveraged scientific expertise and logistics experience for GeoPRISMS ship and aircraft resources on three research cruises to the Alaskan subduction margin in the 2015 summer field season, enabling much needed network repair and restoration in the Central and Western Aleutians and gas emission measurements at several Aleutian volcanoes. As a result, AVO can once again reliably track volcanic unrest at these volcanoes and issue warnings of hazardous eruptive activity.

The USGS participated in a NSF-funded workshop in September 2014 that sought to address the upcoming end of the Earthscope initiative in 2018. EarthScope is a program of the National Science Foundation (NSF) that has deployed thousands of seismic, GPS, and other geophysical instruments to study the structure and evolution of the North American continent and the processes that cause earthquakes and volcanic eruptions. The VHP and other parts of the USGS depend on hundreds of instruments deployed as part of Earthscope and their disappearance would represent a major step backward for monitoring capabilities at many U.S. volcanoes. Moreover, some of these instruments are unique (e.g., borehole seismometers at Mount St. Helens) and provide very high quality data that the USGS depends on for comprehensive monitoring. Discussions with NSF and other stakeholders in Earthscope instrumentation continued in 2015, and will likely continue in 2017, with the goal of keeping these instruments functional past a 2018-planned sunset date.

Collaboration with other Federal Agencies – The VHP works closely with other Federal agencies including the National Oceanic and Atmospheric Administration, the NSF, the National Aeronautics and Space Administration, the National Geospatial Intelligence Agency, the Federal Aviation Administration, the Department of Energy, and DOD. In most cases, the information transfer is two way; the VHP provides interpretive products about volcanic activity to these agencies, while also receiving from them an abundance of data useful for volcano monitoring and ash fall forecasts and ash cloud tracking. Interagency cooperation of this sort is critical to success of the VHP mission and the mission of the other agency programs. The VHP emphasizes both external partnerships and the need for data from a wide variety of instrument types.

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Natural Hazards Landslide Hazards Program

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Natural Hazards	\$139,013	\$138,748	\$1,479	\$0	-\$22,116	\$118,111	-\$20,637
<i>FTE</i>	627	627	0	0	-52	575	-52
Landslide Hazards Program	\$3,538	\$3,531	\$53	\$0	-\$53	\$3,531	\$0
<i>FTE</i>	22	22	0	0	0	22	0

Summary of Budget Request

The 2018 budget bequest for the Landslide Hazards Program is \$3,531,000 and 22 FTE, a program change of -\$53,000 and 0 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$53,000.

Overview

Landslides occur in all 50 States and around the world in mountainous and hilly areas. Where landslides impact human activities, lives may be lost and property and infrastructure damaged. A recent, tragic example is the March 2014 landslide near Oso, WA, which killed 43 people, destroyed 40 homes, and buried a mile of State Highway 530. Landslides triggered by earthquakes or heavy rainfall can also impact broad regions. For example, landslides triggered by heavy rainfall over an area of 1,300 square miles in the northern Colorado Front Range in early September 2013, resulted in three fatalities and damaged property and infrastructure throughout the region. The Landslide Hazards Program (LHP) is the only Federal program dedicated to landslide science and conducts targeted studies to understand landslide initiation and mobility processes. This understanding is used to develop methods and models for landslide hazard assessment, develop and deploy systems to monitor threatening landslides, and to develop methods and tools for landslide early warning and situational awareness. Program activities are targeted toward the types of landslides that result in human and economic losses in the United States, such as those with long travel distances, those initiated by heavy rainfall, and those exacerbated by the effects of wildfire.

USGS scientists respond to landslide emergencies and disasters nationwide. Federal, State, and local agencies are assisted through landslide site evaluations and are provided strategies for reducing ongoing

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and future impacts from landslides. USGS expertise is also called upon when landslide disasters occur abroad. The USGS works with the U.S. Agency for International Development's Office of Foreign Disaster Assistance to respond to appeals for technical assistance from affected countries.

The USGS deploys near-real-time monitoring systems at active landslide sites to gather continuous movement, rainfall, soil-moisture, and pore-pressure data needed to understand the mechanisms of landslide occurrence and mobility and forecast future behavior. Such data and understanding form the scientific underpinnings for early warning of conditions that may trigger landslides. For example, the LHP works in conjunction with the National Weather Service (NWS) and the National Oceanic and Atmospheric Administration to issue advisories regarding the potential for debris-flows (potentially deadly and destructive, fast-moving landslides) in areas of southern California recently burned by wildfire. Data needed to extend these methods to other parts of the United States are being collected.

Consistent with the Interior goal to protect lives, resources, and property by providing information to assist communities in managing risks from natural hazards, the LHP provides timely information to the public about current emergency responses and provides data and information to the external user-community through the program Web site, social media, fact sheets, reports, and press releases.

The 2018 budget request allows the LHP to focus on its core priorities for landslide loss reduction. These priorities include: providing debris-flow hazard assessments and early warning for areas recently burned by wildfire to support Interior and U.S. Forest Service's (USFS) post-fire response teams, the NWS, and emergency management; operating systems and conducting investigations to support expansion of landslide alerts to selected non-burned areas; maintaining capability to respond to major landslide crises to support Federal, State, and local emergency management; and continuing to develop and improve methods for landslide hazard assessment and situational awareness in cooperation with state geological surveys, academic partners, and the private sector.

2018 Program Changes

Reduce Landslide Hazards Operations (-\$53,000/0 FTE): This reduction would diminish the LHP's ability to execute its core activities for landslide loss reduction including: providing debris-flow hazard assessments and early warning for areas recently burned by wildfire; supporting expansion of landslide alerts to selected non-burned areas; maintaining capability to respond to major landslide crises; and continuing to develop and improve methods for landslide hazard assessment and situational awareness, including equipment, services, and work with partners.

Science Collaboration

The LHP collaborates with a broad range of international, Federal, State, public, private, and academic partners to understand and address landslide hazards. As the only U.S. Federal agency devoted to landslide science, the LHP often takes the lead in definition of scientific agenda and lines of inquiry.

National Oceanic and Atmospheric Administration – The LHP collaborates with the NWS to operationally deliver debris-flow early warning for recently burned areas in southern California. The LHP also coordinates with the NWS to provide debris-flow information during large storms in other parts of the Nation. The LHP role in the collaboration is to develop criteria and other information that is used by the NWS to provide debris-flow information as part of other (typically flood) NWS products.

Interior and other public land management agencies – The LHP collaborates with public land management agencies to address landslide hazards on public lands. The LHP operationally produces post-wildfire debris-flow hazard assessments for major fires to support Interior, USFS, California Department of Forestry and Fire Protection, and other post-fire response teams. The LHP role in these assessments is data collection, model development, and product delivery. Collaborators provide input and verification data. For specific landslide hazard issues where other agencies have relevant expertise, such as the Yosemite National Park rockfall risk assessment, the LHP cooperates closely with partners on data collection, analysis, and product preparation and publication.

State geological surveys – The LHP collaborates with State geological surveys to address landslide hazards in a number of States. Typically, the LHP provide tools, methods, instrumentation, and data for landslide hazard assessment or study. State geological surveys typically collect data, conduct analyses, and interface with other State agencies and emergency management to implement results. For example, the LHP is working with State surveys in Washington State and California to collect rainfall and geologic data to verify and improve post-fire debris-flow hazard assessments in recently burned areas in those States.

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Natural Hazards Global Seismographic Network

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Natural Hazards	\$139,013	\$138,748	\$1,479	\$0	-\$22,116	\$118,111	-\$20,637
<i>FTE</i>	627	627	0	0	-52	575	-52
Global Seismographic Network	\$6,453	\$6,441	\$29	\$0	-\$1,484	\$4,986	-\$1,455
<i>FTE</i>	12	12	0	0	-2	10	-2

Summary of Budget Request

The 2018 budget request for the Global Seismographic Network Program is \$4,986,000 and 10 FTE, a program change of -\$1,484,000 and -2 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$29,000.

Overview

The Global Seismographic Network (GSN), consisting of more than 150 globally distributed stations, is designed to provide high-quality seismic data needed for earthquake alerts and situational awareness products, tsunami warnings, national security (through nuclear test treaty monitoring and research), seismic hazard assessments and earthquake loss reduction, as well as research on earthquake sources and the structure and dynamics of the Earth.

Because of its real-time data delivery, the GSN is a critical element of USGS hazard alerting activities, as well as supporting activities of other Federal agencies, including the National Oceanic and Atmospheric Administration (NOAA) tsunami warning; National Science Foundation (NSF) basic research; and the Department of Energy (DOE) and the Department of Defense (DOD) nuclear test treaty monitoring and research. GSN stations transmit real-time data continuously to the USGS National Earthquake Information Center in Golden, CO, where they are used to rapidly determine the locations, depths, magnitudes, and other parameters of earthquakes worldwide, in conjunction with data from other networks. GSN data allows for the rapid determination of the location and orientation of the fault that caused the earthquake, and provides an estimate of the length of the fault that ruptured during the earthquake, which are essential for modeling earthquake effects. An additional important aspect of GSN activities is evaluating, developing, and advancing new technologies for seismic instrumentation, sensor installation, and seismic data acquisition and management.

In 2012, Congress provided \$5.7 million to the DOE's National Nuclear Security Agency (NNSA) to purchase replacement equipment for aging and degrading GSN sensors. The NNSA transferred most of those funds to the USGS for the development and purchase of new borehole seismic sensors and delivery of the new sensors began in 2017. The NNSA funds were specified for procurement of new GSN sensors, rather than installation or site improvements. In addition to the nearly one-third of the GSN seismic station sites needing new sensors, one-fourth of the sites also need vault repairs to improve data quality.

2018 Program Changes

Suspend implementation of GSN seismic station upgrades. (-\$1,455,000/-2 FTE): This reduction would suspend the deployment of 15 to 20 sensors procured by the Department of Energy, National Nuclear Security Administration to improve the GSN infrastructure by replacing aged and degraded sensors.

Reduce Global Seismographic Network Operations (-\$29,000/-0 FTE): This reduction would diminish the GSN's ability to execute its core activities including operating the existing network to provide seismic data needed for earthquake alerts and situational awareness products, tsunami warnings, national security, hazard assessments and research, including equipment, services, and work with partners.

Science Collaboration

The GSN is a joint program funded by the USGS and the NSF, and is implemented by the USGS, the Institute for Geophysics and Planetary Physics (IGPP) of the University of California at San Diego, and the Incorporated Research Institutions for Seismology (IRIS, a consortium of universities). The network consists of more than 150 globally distributed seismic stations, installed over two decades by the USGS and the IGPP.

GSN operation is accomplished in cooperation with international partners who, in most cases, provide facilities to shelter the instruments and personnel to oversee the security and operation of each station. USGS responsibilities include station maintenance and upgrades, overseeing telecommunications, troubleshooting problems and providing major repairs, conducting routine service visits, training station operators, providing limited financial aid in support of station operations at sites lacking a host organization, and ensuring data quality and completeness.

Other agency programs will continue to be supported by the GSN. GSN data are available to the public and scientists around the world via the IRIS Data Management Center (DMC). GSN data are a critical element of the tsunami warning system operated by the NOAA National Weather Service, and are transmitted in real time to the NOAA Tsunami Warning Centers in Hawaii and Alaska. The NOAA National Tsunami Hazard Reduction Program is also served. GSN data are used by the U.S. Air Force and DOE nuclear test monitoring research programs. NSF projects use GSN data for basic research on Earth structure and dynamics, seismic wave propagation, earthquake source complexity, and climate.



Natural Hazards Geomagnetism Program

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Enacted
Natural Hazards	\$139,013	\$138,748	\$1,479	\$0	-\$22,116	\$118,111	-\$20,637
<i>FTE</i>	<i>627</i>	<i>627</i>	<i>0</i>	<i>0</i>	<i>-52</i>	<i>575</i>	<i>-52</i>
Geomagnetism Program	\$1,888	\$1,884	\$0	\$0	-\$1,884	\$0	-\$1,884
<i>FTE</i>	<i>15</i>	<i>15</i>	<i>0</i>	<i>0</i>	<i>-15</i>	<i>0</i>	<i>-15</i>

Summary of Budget Request

The 2018 budget request for the USGS Geomagnetism Program is \$0 and 0 FTE, a change of -\$1,884,000 and -15 FTE from the 2017 Annualized Continuing Resolution (CR) level.

Overview

Magnetic storms are caused by the dynamic interaction of the Earth's magnetic field with the Sun. While magnetic storms often produce beautiful aurora lights that can be seen at high latitude, they can also wreak havoc on the infrastructure and activities of our modern, technologically based society. Large storms can induce voltage surges in electric-power grids, causing blackouts and the loss of radio communication, reduce GPS accuracy, damage satellite electronics and affect satellite operations, enhance radiation levels for astronauts and high-altitude pilots, and interfere with directional drilling for oil and gas.

In order to understand and mitigate geomagnetic hazards, the USGS Geomagnetism Program has monitored and analyzed the Earth's dynamic magnetic field. The Program is part of the U.S. National Space Weather Program (NSWP), an interagency collaboration that includes programs in the National Aeronautics and Space Administration (NASA), the Department of Defense (DOD), the National Oceanic and Atmospheric Administration (NOAA), and the National Science Foundation (NSF). The Geomagnetism Program provides data to the NSWP agencies, oil drilling services companies, geophysical surveying companies, and several international agencies. USGS data, products, and services are also used by the electric-power industry to evaluate geomagnetic storm risk.

Domestically, the USGS works cooperatively with NOAA, the Air Force 557th Weather Wing, and other agencies. For example, USGS observatory data are used by NOAA's Space Weather Prediction Center,

Natural Hazards

and by the U.S. Air Force, for issuing geomagnetic warnings and forecasts. The USGS magnetic observatory network is part of the global INTERMAGNET network. USGS research is conducted in collaboration with the Colorado School of Mines, the USGS Crustal Geophysics and Geochemistry Science Center, the NOAA/SWPC, and the NASA Community Coordinated Modeling Center.

The USGS also works with private entities that are affected by space weather and geomagnetic activity, including electric-power grid companies and the oil and gas drilling industries. In the oil and gas industry, for example, drill operators need to know which way their drill bits are going to maximize oil production and avoid collisions with other wells. One way to accomplish this important task is to *install a magnetometer*—a sort of modern-day "compass"—in a drill-string instrument package that follows the drill bit. Simultaneous measurements of the magnetic field in the drill hole are combined with those monitored by the USGS to produce a highly accurate estimate of the drill bit position and direction.

2018 Program Changes

Eliminate the Geomagnetism Program. (-\$1,884,000/-15 FTE): This eliminates the Geomagnetism Program, an element of the U.S. National Space Weather Program. This will reduce the accuracy of NOAA and U.S. Air Force forecasting of the magnitude and impact of geomagnetic storms. In addition to eliminating the data provided to partner Federal agencies, the elimination of the program will also reduce the availability of geomagnetic information to the oil drilling services industry, geophysical surveying industry, several international agencies, and electrical transmission utilities.

Science Collaboration

The USGS is a member of the multiagency NSWP. Domestically, the USGS works cooperatively with NOAA, the Air Force 557th Weather Wing, and other agencies. For example, USGS observatory data are used by NOAA's Space Weather Prediction Center, and by the U.S. Air Force, for issuing geomagnetic warnings and forecasts. Internationally, the USGS magnetic observatory network is itself part of the global INTERMAGNET network. USGS research is conducted in collaboration with the Colorado School of Mines, the USGS Crustal Geophysics and Geochemistry Science Center, the NOAA/SWPC, and the NASA Community Coordinated Modeling Center.

The USGS also works with private entities that are affected by space weather and geomagnetic activity, including electric-power grid companies and the oil and gas drilling industries. In the oil and gas industry, for example, drill operators need to know which way their drill bits are going to maximize oil production and avoid collisions with other wells. One way to accomplish this important task is to install a magnetometer—a sort of modern-day "compass"—in a drill-string instrument package that follows the drill bit. Simultaneous measurements of the magnetic field in the drill hole are combined with those monitored by the USGS to produce a highly accurate estimate of the drill bit position and direction.



Natural Hazards Coastal/Marine Hazards and Resources Program

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Enacted
Natural Hazards	\$139,013	\$138,748	\$1,479	\$0	-\$22,116	\$118,111	-\$20,637
<i>FTE</i>	627	627	0	0	-52	575	-52
Coastal/Marine Hazards and Resources Program	\$40,510	\$40,433	\$493	\$0	-\$5,152	\$35,774	-\$4,659
<i>FTE</i>	204	204	0	0	-16	188	-16

Summary of Budget Request

The 2018 budget bequest for the Coastal/Marine Hazards and Resources Program is \$35,774,000 and 188 FTE, with a program change of -\$5,152,000 and -16 FTE from the 2017 Annualized Continuing Resolution (CR) level. This includes a fixed costs change of \$493,000.

Overview

The Coastal/Marine Hazards and Resources Program (CMHRP) provides surveys, knowledge and tools to characterize the hazard and resource potential of the Nation's offshore and coastal landscapes. CMHRP data, research, and technical expertise provides managers with the information and tools to anticipate and reduce the risk of natural hazards and coastal change, and to assess and manage marine and coastal resources to meet current needs and to respond to changing demands. As the only Federal science program focused on the geology and processes that form, maintain, and alter coastal and marine landscapes CMHRP addresses a wide range of issues in locations from the shallow waters of estuaries to the deep sea. CMHRP responds to immediate local and regional priorities across these environments, while simultaneously addressing the needs of the Nation for comprehensive, long-term coastal and marine science-based products on a national scale. The unique capabilities and expertise of CMHRP are applied in support of the mission objectives of the U.S. Department of the Interior (DOI) and other Federal, state, and local agencies; non-governmental organizations; and, ultimately, the public.

In 2018, prioritized field programs and analyses will provide Federal, State, and local users with improved assessments of hazard sources (earthquakes, tsunamis, submarine landslides) and their potential impacts on offshore operations, coastal communities and infrastructure with an increasing focus on support of bureau-wide investigations of subduction zone processes and hazards. The CMHRP will continue work with other Federal and academic partners to characterize marine methane systems and associated seabed processes to enhance understanding of their substantial energy resource potential, the

risk they represent to offshore operations and their role in the global carbon system and marine ecological productivity. In addition, the CMHRP will contribute analyses and expertise to delineate the U.S. Extended Continental Shelf consistent with international law, expanding U.S. sovereignty over resources on and beneath the sea floor. Modest resources will be directed to efforts to provide unique USGS expertise on the occurrence and potential of deep-sea mineral resources.

For the majority of contiguous U.S. ocean beaches and barrier islands CMHRP provides real-time forecasts of erosion and inundation due to coastal storms, including hurricanes; and long-term forecasts of the likelihood of future coastal change due to storms, erosion and sea-level rise. The CMHRP is the recognized Federal provider of tools to anticipate and respond to physical change along our Nation's coast. Within the proposed 2018 budget, CMHRP will prioritize development of the data and knowledge of physical setting and processes that enables continued, expanded and improved delivery of these tools to local, State, and Federal coastal managers, planners, and public safety officials throughout the Nation. Planning and implementation of this portfolio of activities is the result of cooperative partnerships with many Federal and State agencies and local stakeholders who expect timely project completion and delivery of products.

The 2018 Budget Request allows the CMHRP to focus on provision of science-based products in response to the priorities of the Administration, Interior and other Federal agencies, and critical needs of State and local stakeholders. Activities supported within this budget will apply the unique and proven capabilities of CMHRP to address issues of national consequence where they have the greatest potential to impact public safety; coastal and marine policy, planning, and management; and where partner priorities are demonstrated through collaboration and cost-sharing in planning, execution, and delivery.

2018 Program Changes

Eliminate Marine Habitat/Resource Mapping and Ocean and Glacier Studies to Inform Resource Management. (-\$1,600,000/-6 FTE): The reduction would eliminate monitoring, research, and model development to forecast the impacts on coastal waters, ecosystems and fisheries due to ocean acidification and changing fluxes of nutrients, freshwater, and sediment from retreating glaciers. This will reduce the information and tools available to resource managers to anticipate and respond to stresses on commercial, recreational, and subsistence fisheries in the Gulf of Mexico and Gulf of Alaska. Additionally, it reduces application of USGS mapping expertise to characterize marine habitats and sand resources required for beach nourishment in areas where operational costs are not provided by external partners.

Eliminate Elevation Model Development and Regional Coastal Resource Assessments (-\$2,500,000/-7 FTE): This reduces the development of “user ready” regional onshore/offshore elevation models for regional restoration of San Francisco Bay, the Pacific Northwest, the Northern Gulf of Mexico and Florida. These models are also used for State and Federal coastal management and planning. It also reduces development and delivery of large-scale assessments of coral reef and associated community vulnerability including impacts of changing reef structure on tourism, recreational and commercial fisheries, and hazard exposure of military and other infrastructure in Florida, Hawaii, and the Pacific and Caribbean territories.

Reduce Support for Regional Coastal Management, Restoration, and Risk Reduction

(-\$559,000/-3 FTE): This would result in a reduction of activities in the Gulf of Mexico, Pacific and Atlantic regions resulting in fewer and delayed products to support planning and implementation of regional coastal management, restoration, and risk reduction strategies by Interior, other Federal and State agencies. For example, activities in the Fire Island National Seashore, New York, to inform State and Federal management and planning to reduce coastal hazards and manage protected resources and studies supporting the Puget Sound Partnership goals for regional restoration will be concluded. Regional studies supporting restoration in the Northern Gulf of Mexico and San Francisco Bay will be reduced, decreasing the scope and extending the timeline for delivery of products to inform regional restoration efforts locally and in similar coastal settings nationwide.

Reduce Coastal/Marine Hazards and Resources Operations (-\$493,000/0 FTE): This reduction would diminish the CMHRP's ability to execute its core activities, including addressing coastal and marine issues of national consequence that have the greatest potential to impact public safety as well as coastal and marine policy, planning, and management, including equipment, services, and work with partners.

Science Collaboration

The USGS collaborated with Oregon State University to map the seafloor in an area off Coos Bay, OR, under consideration for construction of a floating wind-energy facility. Using funds from BOEM and the USGS research vessel *Parke Snavely*, researchers collected data that were used to develop a digital elevation model (DEM), habitat maps, and geologic maps needed by the BOEM for marine spatial planning, ecosystem assessment, environmental reviews, and offshore infrastructure analysis. BOEM will use this information for decisions about the proposed WindFloat Pacific 30-megawatt floating wind farm, the first wind farm proposed offshore of the U.S. west coast. The USGS continues to collaborate with BOEM on development of science-based tools to assess the vulnerability of offshore infrastructure and operations due to geologic processes at and beneath the sea floor.

The CMHRP has worked with the U.S. Army Corps of Engineers (USACE) to leverage USGS expertise about beach processes and responsibilities for forecasting beach change and USACE role in coordinating beach nourishment projects. Beginning in 2015, the USGS and USACE are working with the American Shore and Beach Preservation Association (ASBPA) to plan for development of a new Coastal Resiliency Network and to support collaborative research on coastal risk and vulnerability. The goal is to use the wealth of data that already exists in the Corps, the USGS, and other Federal agencies to quantify coastal resiliency and predict changes through time. Additionally the USGS and USACE are collaborating on identifying ways to streamline and improve procedures for transforming raw lidar data into useful data products.

For U.S. Fish and Wildlife Service and National Park Service coastal units in the Northeast, CMHRP delivered the iPlover, a smartphone application. This new tool helps Interior and local scientists

Natural Hazards

understand how piping plovers use coastal habitat. The USGS analyzed datasets documenting piping plover habitat and developed a plover behavior model that is quantitatively tied to variables including elevation, slope, frequency of inundation and overwash, and amount of vegetation. The USGS also developed a habitat evolution model by relating the datasets documenting changes in the habitat (e.g., topography, shoreline position, vegetation) to changes in sea level and storminess. Coupling these two models (plover behavior and habitat evolution) allows scientists to evaluate historical observations and then model future scenarios to analyze alternative conservation and coastal protection strategies against plausible sea level and other future climate variables. CMHRP is engaging State, local, other Federal and NGO partners to evaluate expansion of this approach to development of management tools for additional species and habitats of concern, including beach-nesting habitat for sea turtles.

USGS scientists served as subject matter experts in an Inter-Agency Sea Level Rise Panel Discussion hosted by the Federal Emergency Management Agency (FEMA). During the past 20 years, multiple hurricanes have caused billions of dollars in damage and much human suffering. These storms have received much attention as the Nation strives for improved resiliency. FEMA Risk Mapping, Assessment, and Planning (Risk MAP) Federal Coastal Partners are analyzing potential impacts of more severe storms and sea-level rise, and supporting disaster planning for coastal States and communities. USGS expertise greatly enhances discussions with FEMA, the Environmental Protection Agency, the National Oceanic and Atmospheric Administration, and USACE about how to incorporate geologic changes into projections of future conditions for America's shorelines.

Water Resources

Water Resources



USGS Water Science data and information
improves our safety, economy,
and quality of life.

Headwaters of the Big
Thompson River, Rocky
Mountain National Park, CO

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Water Resources	\$210,687	\$210,287	\$2,661	\$0	-\$39,906	\$173,042	-\$37,245
<i>FTE</i>	<i>1,407</i>	<i>1,407</i>	<i>0</i>	<i>0</i>	<i>-179</i>	<i>1,228</i>	<i>-179</i>
Water Availability and Use Science Program	\$42,052	\$41,972	\$642	\$0	-\$12,201	\$30,413	-\$11,559
<i>FTE</i>	<i>340</i>	<i>340</i>	<i>0</i>	<i>0</i>	<i>-60</i>	<i>280</i>	<i>-60</i>
Groundwater and Streamflow Information Program	\$71,535	\$71,399	\$742	\$0	-\$3,982	\$68,159	-\$3,240
<i>FTE</i>	<i>392</i>	<i>392</i>	<i>0</i>	<i>0</i>	<i>-10</i>	<i>382</i>	<i>-10</i>
National Water Quality Program	\$90,600	\$90,428	\$1,277	\$0	-\$17,235	\$74,470	-\$15,958
<i>FTE</i>	<i>674</i>	<i>674</i>	<i>0</i>	<i>0</i>	<i>-108</i>	<i>566</i>	<i>-108</i>
Water Resources Research Act Program	\$6,500	\$6,488	\$0	\$0	-\$6,488	\$0	-\$6,488
<i>FTE</i>	<i>1</i>	<i>1</i>	<i>0</i>	<i>0</i>	<i>-1</i>	<i>0</i>	<i>-1</i>

Summary of Program Changes

Request Component	(\$000's)	FTE	Fixed Costs	Page
Water Availability and Use Science Program	-12,201	-60	+642	J--7
Reduce National Research Program	-4,325	-28		J--8
Eliminate Water Use Data and Research	-1,500	-1		J--9
Eliminate Mississippi Alluvial Plan Aquifer Assessment Project	-1,000	-7		J--9
Eliminate U.S.-Mexico Transboundary Aquifer Assessment Project	-1,000	-4		J--9
Eliminate Water-Use Unconventional Oil and Gas	-250	-1		J--9
Eliminate Focus Area Studies	-1,600	-8		J--9
Eliminate Two Regional Groundwater Evaluations	-789	-4		J--9
Eliminate Groundwater Model Development, Maintenance and Sustainability	-1,095	-7		J--9
Reduce Water Availability and Use Science Program Operations	-642	0		J--9
Groundwater and Streamflow Information Program	-3,982	-10	+742	J--11
Reduce National Research Program	-1,540	-10		J--12
Reduce National Groundwater Monitoring Network	-1,700	0		J--12
Reduce Support to Groundwater and Streamflow Information Operations	-742	0		J--12
National Water Quality Program	-17,235	-108	+1,277	J--13
Reduce National Research Program	-6,011	-40		J--15
Eliminate National Park Service Cooperative Water Partnership	-1,743	-12		J--15
Eliminate National Atmospheric Deposition Program	-1,576	-10		J--15
Reduce National Water-Quality Assessment Project Lower Mississippi Stream Quality Assessment	-4,000	-28		J--16
Reduce National Water-Quality Assessment Project Trends Assessments	-2,628	-18		J--16
Reduce National Water Quality Program Operations	-1,277	0		J--16
Water Resources Research Act Program	-6,488	-1	0	J--17
Eliminate Water Resources Research Act Program	-6,488	-1		J--17
Total Program Change	-39,906	-179	+2,661	

Summary of Budget Request

The 2018 budget request for the Water Resources Mission Area is \$173,042,000 and 1,228 FTE, a net program change of -\$39,906,000 and -179 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$2,661,000.

Overview

The Water Resources Mission Area is comprised of four Programs—

- Water Availability and Use Science Program (WAUSP)
<https://www.usgs.gov/science/mission-areas/water/water-availability-and-use-science-program>
- Groundwater and Streamflow Information Program (GWSIP)
<https://www.usgs.gov/science/mission-areas/water/groundwater-and-streamflow-information>
- National Water Quality Program (NWQP)
<https://www.usgs.gov/science/mission-areas/water/national-water-quality-program>
- Water Resources Research Act Program (WRRRA)
<https://www.usgs.gov/science/mission-areas/water/water-resources-research-institute>

Since 1879, the USGS has addressed issues of water availability and quality, drought, and flood hazards. Today, covering all 50 States and Puerto Rico, hydrologic professionals and support staff continue this legacy of providing the Nation with critical water information. As the primary Federal science agency for water information, the USGS monitors and assesses the amount and characteristics of the Nation's water resources, assesses sources and behavior of contaminants in the water environment, and develops tools to improve management and understanding of water resources. The USGS provides critical information during times of drought and floods. USGS information and tools allow first responders, the public, water managers and planners, policymakers and other decision makers to:

- Manage freshwater, both above and below the land surface, for domestic, public, agricultural, commercial, industrial, recreational, and ecological uses.
- Protect and enhance water resources for human health, aquatic health, and environmental quality.
- Contribute to wise use, development, and conservation of the Nation's water resources for the benefit of present and future generations.
- Minimize loss of life and property as a result of water-related natural hazards, such as floods, droughts, landslides, and chemical spills.

The USGS Water Science Strategy (Strategy), outlined in its Circular 1383-G *Observing, Understanding, Predicting, and Delivering Water Science to the Nation* (<http://pubs.usgs.gov/circ/1383g/circ1383-G.pdf>), identifies water science goals and objectives that serve the Nation and addresses the risks of water challenges for future water supplies. The Strategy outlines areas where hydrologic science can make substantial contributions to the Nation and identifies opportunities for the USGS to better use its hydrologic science capabilities to address Administration priorities to ensure healthy watersheds and sustainable, secure water supplies. In doing so, the Strategy informs long-term approaches to USGS program planning, technology investment, partnership development, and workforce and human capital strategies. The choice of strategic water science priority-actions, goals and objectives is based on the guiding principles to observe, understand, predict and deliver water information that allows society to meet the water challenges of the Nation, current and future. While the Strategy does not cover all facets

Water Resources

of USGS work in hydrology, it builds on a hierarchy of planning documents and provides a science-based response to the overarching issues of water availability, water quality, and hydrologic hazards.

The USGS provides information and tools to decision makers that help minimize loss of life and property as a result of water-related natural hazards, such as floods, droughts, and land movement; effectively manage groundwater and surface water resources for domestic, agricultural, commercial, industrial, recreational, and ecological uses; and protect and enhance water resources for human health, aquatic health, and environmental quality, all of which contribute to the wise physical and economic development of the Nation's resources for the benefit of present and future generations.

The Water Resources Mission Area carries out its programs through 32 USGS Water Science Centers covering all 50 States and Puerto Rico, as well as 3 major research installations located in Reston, VA, Denver, CO, and Menlo Park, CA.

Cooperative Matching Funds

The cooperative matching funds program provides funding to partner with nearly 1,600 local, State regional and Tribal agencies to monitor and assess water in every State, protectorate, and territory.

The 2018 request includes \$57,710,000 across the three sub-activities of the mission area, unchanged from the 2017 level. This includes \$11,397,000 in WAUSP, \$29,799,000 in GWSIP, and \$16,514,000 in NWQP.

Program Performance

Performance in the monitoring and assessing of the Nation's water availability and quality shows steady improvement from 2013 through 2016, toward long term, cumulative targets associated with the increase in scope of the National Water Quality Assessment (NAWQA) Project coverage as specified in the Cycle 3 Science Plan (<http://pubs.er.usgs.gov/publication/ofr20131160>). This level of performance indicates programs are effectively applying funding toward needed research, monitoring, and assessments to inform decision makers about water availability and quality. The 2018 budget request maintains core goals and priorities for the Water Resources programs.

Strategic Actions Planned through 2018

The Water Availability and Use Science Program (WAUSP) will:

- Measure and analyze water use information in cooperation with other Federal agencies, States, localities, and Tribes to determine the amount of water used, where it is used, and how it is used to allow management of water resources.
- Publish the 2015 National Water Use compilation report. The USGS has published this report every five years since 1950.
- Continue work on regional groundwater availability studies that will provide managers more information and new tools to understand groundwater resources in their area.
- Work with other partners, to conduct national water-budget component studies that will provide quantitative information about the amount of water that resides in or is moving through individual components of the water budget as part of the National Water Census.
- Expand work related to water availability issues on tribal lands and enhance cooperative activities related to energy and water, drought, and data collection related to tribal water issues.
- Synthesize and report information at regional and national scales, with an emphasis on compiling and reporting the information in a way that is useful to States and others responsible for water management and natural resource issues, especially for areas affected by drought.
- Focus on drought research, including determining the changing importance of snowmelt in the hydrologic cycle, that can provide a regional and national picture of how water availability and use changes during drought. This would include effects of human water use, including withdrawals, diversions, and return flows.

The Groundwater and Streamflow Information Program (GWSIP) will:

- Collect, manage, and disseminate consistently high quality and reliable hydrologic information in real time and over the long term. This includes maintaining a unified national streamgauge network of more than 8,200 real-time streamgages, more than 1,600 real-time groundwater wells, as well as, a growing network of interdisciplinary “Super Gages.”
- Continue research, development, and application of innovative techniques and technical oversight for cost-effective monitoring.
- Support development and application of hazard information and tools to minimize loss of life and property, such as Rapid Deployment Gages (RDG’s), Storm Tide Sensors, and Wave Height Sensors. Maintain data collection during hydrologic hazards and deploy information tools for water resource managers to minimize loss of life and property.

The National Water Quality Program (NWQP) will:

- Support long-term, nationally consistent monitoring of sediment, nutrients, and pesticides at 116 stream monitoring sites and collect and analyze water-quality samples from about 625 groundwater wells in some of the most important aquifers used as a source of water supply.

Water Resources

- Develop regional-scale modeling of current and projected surface-water and groundwater quality in selected major river basins and important principal aquifers will continue as planned.
- Conduct research on the interactions among water-mediated processes in a warming arctic, assess system feedbacks (e.g., effects of warming on hydrology and biogeochemical cycling, which subsequently affects climate and hydrology), and better anticipate future system changes, expand monitoring of hydrologic (groundwater, surface water, thermos-karst features) cycles.
- Continue long-term monitoring and modeling studies of nutrients, pesticides, sediments, and other important water-quality constituents to provide critical information for water managers, policymakers, and the public about current water-quality conditions, how they are changing through time, and the major factors that influence observed conditions and trends.

Science to Support Collaboration

The USGS Water Resources Programs work with States, municipalities, regional organizations, Tribes, and non-governmental organizations, including private industries, involving contributions for cooperative water efforts. These entities, in turn, collaborate with more than 1600 Federal, State, Tribal and local agencies and private sector organizations. Cooperators choose to work with the USGS because of its broad, interdisciplinary expertise; high-quality, nationally consistent procedures and quality-assurance; innovative monitoring technology, models, and research tools; and robust data management and delivery systems that provide readily available public access to national data. In addition, other partners include Interior bureaus (Bureau of Reclamation, National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management, Bureau of Indian Affairs); Department of Defense (U.S. Army Corps of Engineers, Air Force, Army, Navy); Environmental Protection Agency; National Aeronautics and Space Administration; National Oceanic and Atmospheric Administration; Department of State; Federal Emergency Management Agency; Department of Transportation; Department of Agriculture; and Department of Energy.



Water Resources

Water Availability and Use Science Program

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Water Resources	\$210,687	\$210,287	\$2,661	\$0	-\$39,906	\$173,042	-\$37,245
<i>FTE</i>	<i>1,407</i>	<i>1,407</i>	<i>0</i>	<i>0</i>	<i>-179</i>	<i>1,228</i>	<i>-179</i>
Water Availability and Use Science Program	\$42,052	\$41,972	\$642	\$0	-\$12,201	\$30,413	-\$11,559
<i>FTE</i>	<i>340</i>	<i>340</i>	<i>0</i>	<i>0</i>	<i>-60</i>	<i>280</i>	<i>-60</i>

Summary of Budget Request

The 2018 budget request for the Water Availability and Use Science Program is \$30,413,000 and 280 FTE, a net change of -\$12,201,000 and -60 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$642,000.

Overview

The Water Availability and Use Science Program (WAUSP) directly supports the USGS Science Strategy focus on the National Water Census; providing scientific information on water availability and use nationally to inform the public and decision makers about the status of water resources and how they are changing. This program also fulfills the goal stated in the SECURE Water Act (P.L. 111-11), Section 9508, to establish a “national water availability and use assessment program.” The WAUSP will synthesize and report information at regional and national scales, with an emphasis on compiling and reporting information in a way that is useful to States and others responsible for water management and natural resource issues.

The WAUSP supports the USGS National Water Census through work to develop and deliver water budget estimates across the Nation, aggregate and analyze water use information, and assess regional groundwater availability. In addition, the WAUSP supports, maintains, and enhances USGS data delivery systems to process and disseminate study results beyond the immediate needs of funding agencies or programs. The WAUSP supports development of innovative tools, setting standards of practice for hydrologic activities, training staff for fieldwork as well as complex modeling studies. Finally, activities

in the WAUSP also include cooperative science activities with States, localities, and Tribes, as well as the USGS National Research Program's hydrologic sciences.

In support of the National Census of water resources, the USGS completed the National Brackish Groundwater Assessment to provide updated information about brackish groundwater as a potential resource to augment or replace freshwater supplies. This study, the first of its kind in more than 50 years, found that the amount of brackish groundwater underlying the country is more than 800 times the amount currently used each year. With issues like drought, groundwater depletion, dwindling freshwater supplies, and demand for groundwater expected to continue to rise, understanding brackish groundwater supplies can help determine whether they can supplement or replace taxed freshwater sources in water-stressed areas.

The USGS also supports activities of the Advisory Committee on Water Information (ACWI, a Presidential Federal Advisory Committee) and its subcommittees. The ACWI represents the interests of water-information users and professionals in advising the Federal Government on Federal water-information programs and their effectiveness in meeting the Nation's needs. Member organizations help to foster communications between the Federal and non-Federal sectors on collecting, standardizing, and sharing water information, ultimately resulting in reduced Federal costs for operating resource management and environmental protection programs.

The 2018 budget request focuses on the core priorities for water availability and use:

- Providing daily water budget components nationally at the basin scale.
- Assessing and quantifying the availability of groundwater resources.
- Implementing nationwide methods to estimate streamflow at locations without streamgages.
- Improving assessment of the status and trends of the water resources of the United States.
- Developing the basis for improved forecasting for the availability of water for future consumption.
- Advancing water use science through models that link water use to drivers that predict human uses, including the water, energy and food nexus.

2018 Program Changes

Reduce National Research Program (-\$4,325,000/-28 FTE): This reduces research in the San Francisco Bay Delta, Klamath Lake, the Florida Everglades, and Chesapeake Bay to improve operational forecasting of water availability and ecological health. In addition, geomorphic and sediment research will be eliminated. This also reduces research at the 32 USGS Water Science Centers across the United States that address existing and emerging water availability and use issues. This reduces localized, regional, and national studies examining how changes in water budget components (including precipitation, evapotranspiration, streamflow, and groundwater) impact water availability. The ability to extrapolate current conditions, both spatially and temporally, and forecast future changes using surface and groundwater models would be reduced, limiting information for resource managers.

Eliminate Water Use Data and Research (-\$1,500,000/-1 FTE): This eliminates cooperative agreements with States to improve the availability, quality, compatibility, and delivery of water-use data that is collected or estimated by States in order to manage long-term water supplies.

Eliminate Mississippi Alluvial Plan Aquifer Assessment Project (-\$1,000,000/-7 FTE): This would eliminate the Mississippi Alluvial Plan Aquifer Assessment, including the collection of detailed information about the interaction of groundwater and streamflow that would support sustainable agriculture in Mississippi, Louisiana, Arkansas, Alabama and Tennessee.

Eliminate U.S.-Mexico Transboundary Aquifer Assessment Project (-\$1,000,000/-4 FTE): This eliminates the U.S.-Mexico Transboundary Aquifer Assessment, a collaboration with the USGS, the States of Arizona, New Mexico, and Texas through their Water Resources Research Institutes and the International Boundary and Water Commission, stakeholders, and Mexican counterparts to provide new information and a scientific foundation for State and local officials to address water-resource challenges along the U.S. – Mexico border.

Eliminate Water-Use Unconventional Oil and Gas (-\$250,000/-1 FTE): This eliminates a pilot study in the Williston Basin (Western Dakotas and eastern Montana) to provide tools and information to determine the quantities of water necessary to develop and recover unconventional oil and gas resources.

Eliminate Focus Area Studies (-\$1,600,000/-8 FTE): This eliminates collaborative studies in the Upper Rio Grande, the Red River, and the Coastal Carolina Basins with State and local partners to provide data, models and decision-support tools, such as water availability estimates, snow melt information, and groundwater and surface water models to improve water resource management.

Eliminate Two Regional Groundwater Evaluations (-\$789,000/-4 FTE): This eliminates two of 14 studies of regional groundwater, the Coastal Lowlands Aquifer System (CLAS), which extends from Texas to the Panhandle of Florida, and the California Coastal Basin Aquifers. The CLAS study focuses on land subsidence issues in Houston and developing tools to assist in managing the entire groundwater system from Texas to northern Florida. The California Coastal Basins study applies new modeling techniques to enable local agencies to identify groundwater issues, such as chronic lowering of groundwater levels, reduction of storage, seawater intrusion, degraded water quality, land subsidence, and depletion of interconnected surface waters.

Eliminate Groundwater Model Development, Maintenance and Sustainability (-\$1,095,000/-7 FTE): This eliminates maintenance and improvements on existing groundwater software tools, MODFLOW and GSFLOW. MODFLOW is the de facto international standard code for aquifer simulation and GSFLOW is a linked surface water and groundwater modeling code. Both tools provide valuable information used in resource management.

Reduce Water Availability and Use Science Program Operations (-\$642,000/0 FTE): This reduction would diminish the ability to execute its core activities including assessing and quantifying the availability of groundwater resources, providing a more accurate assessment of the status and trends of the water resources of the United States, as well as developing the basis for an improved ability to forecast the availability of water for future economic, energy production, and environmental uses. In addition, equipment, services and work with partners will be impacted.

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Water Resources

Groundwater and Streamflow Information Program

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Water Resources	\$210,687	\$210,287	\$2,661	\$0	-\$39,906	\$173,042	-\$37,245
<i>FTE</i>	<i>1,407</i>	<i>1,407</i>	<i>0</i>	<i>0</i>	<i>-179</i>	<i>1,228</i>	<i>-179</i>
Groundwater and Streamflow Information Program	\$71,535	\$71,399	\$742	\$0	-\$3,982	\$68,159	-\$3,240
<i>FTE</i>	<i>392</i>	<i>392</i>	<i>0</i>	<i>0</i>	<i>-10</i>	<i>382</i>	<i>-10</i>

Summary of Budget Request

The 2018 budget request for the Groundwater and Streamflow Information Program is \$68,159,000 and 382 FTE, a net change of -\$3,982,000 and -10 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$742,000.

Overview

Monitoring networks that generate hydrologic data are the foundation of situational awareness and understanding of the Nation's water resources. The Groundwater and Streamflow Information Program (GWSIP) encompasses the Water Resources Mission Area's objectives to collect, manage, and disseminate consistently high-quality and reliable hydrologic information in real-time and over the long-term, which are critical for managing our Nation's water resources and for anticipating and responding to water hazards that can result in loss of life and property.

The GWSIP serves as the national source of impartial, timely, rigorous, and relevant data for short- and long-term water decisions by local, State, Tribal, regional, and national stakeholders. The continuous real-time water data supplied by the program are used for decisions such as emergency response, flood forecasting, reservoir releases, water-use restrictions, drinking-water deliveries, permit compliance, water-quality studies, and recreational safety. The long-term data supplied by the program are used for decisions such as water-supply planning, aquifer storage and recovery, infrastructure design, floodplain and ecosystem management, energy development, and resolution of water disputes. Access to water information is increasingly critical as climate patterns, land use, and population change, increasing the challenges of managing competing water priorities.

The 2018 budget request focuses on the core priorities for Groundwater and Streamflow:

- Sustaining the National streamgauge (more than 8,200 real-time gages) and groundwater (more than 1,600 wells) monitoring networks.
- Maintaining the USGS network of interdisciplinary “Super Gages.”
- Developing and implementing hazard-data collection, information presentation, and new tools to minimize loss of life and property.
- Supporting research, development, and application of cost-effective monitoring, record maintenance, and data delivery.
- Managing and developing cutting-edge instrumentation through the Hydrologic Instrumentation Facility.

2018 Program Changes

Reduce National Research Program (NRP) (-\$1,540,000/-10 FTE): This reduces research on water quality and the development of effective remediation strategies, which may extend hazardous waste cleanup in many States by several years. It will also end the collection and provision of water-quality data and trend analysis on nutrients and sediments to Federal and State partners in the Gulf of Mexico and Chesapeake Bay, as well as affect local and State efforts to lower nutrient levels affecting drinking water intakes and local rivers and lakes.

Reduce National Groundwater Monitoring Network (NGWMN) (-\$1,700,000/0 FTE): This reduces cooperative agreements with States that support national and local groundwater databases that are shared through the NGWMN Data Portal. In addition, it will reduce support for a network of groundwater wells that monitor the effects of droughts and other factors on groundwater levels. The network consists of about 130 groundwater wells in 20 states. This may increase difficulties for States, regional authorities, and local agencies coordinating management activities related to drought, water resource planning and permitting on shared groundwater resources. It also reduces well maintenance and replacement, creating information gaps.

Reduce Groundwater and Streamflow Information Program Operations (- \$742,000/0 FTE): This reduction would diminish the ability to execute its core activities including strengthening the National streamgauge and groundwater monitoring networks, developing and implementing hazard data collection, information presentation and new tools to minimize loss of life and property, research, development, as well as application of cost-effective monitoring, record maintenance, and data delivery. In addition, equipment, services and work with partners will be impacted.



Water Resources National Water Quality Program

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Water Resources	\$210,687	\$210,287	\$2,661	\$0	-\$39,906	\$173,042	-\$37,245
<i>FTE</i>	1,407	1,407	0	0	-179	1,228	-179
National Water Quality Program	\$90,600	\$90,428	\$1,277	\$0	-\$17,235	\$74,470	-\$15,958
<i>FTE</i>	674	674	0	0	-108	566	-108

Summary of Budget Request

The 2018 budget request for the National Water Quality Program is \$74,470,000 and 566 FTE, a net change of -\$17,235,000 and -108 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$1,277,000.

Overview

Water-quality challenges are increasing in number and complexity, and solutions are becoming more challenging and costly. The U.S. Census Bureau projects that the U.S. population in 2017 is now over 325 million people. Increased population accompanied by increased development and use of fertilizers and pesticides for food production, will increase pressure on existing resources for to supply water of suitable quality for irrigation, drinking water, energy development, and healthy ecosystems. The NWQP investments in monitoring, assessment, and research provide the data and scientific information needed to address current and future water-quality challenges.

The National Water Quality Program (NWQP) includes water-quality monitoring, assessment, and research activities done by the Water Mission Area that

- Assess the current quality of the Nation's freshwater resources and how it is changing over time.
- Explain how human activities and natural factors (e.g., land use, water use and climate variability) are affecting the quality of surface water and groundwater resources.
- Determine the relative effects of important sources of impairment including contaminants, excess nutrients and sediment, and altered streamflow on aquatic ecosystems.
- Predict the effects of human activities, climate change, and management strategies on future water-quality and ecosystem conditions.

The NAWQA Project is the largest component of the NWQP. In 1991, Congress established NAWQA within the USGS to address a fundamental question: “What is the status of the Nation’s water quality and is it getting better or worse?” Since then, the NAWQA Project has been a primary source of objective and nationally consistent water-quality data and information on the quality of the Nation’s streams and groundwater. NAWQA Project data and models provide answers to where, when, and why the Nation’s water quality is degraded, and what can be done to improve and protect it for human and ecosystem needs (<http://water.usgs.gov/nawqa/xrel.pdf>).

Over 25 years of the NAWQA Project monitoring and modeling have resulted in a solid foundation of data and scientific understanding that resource manager and policy makers within the water community have used to address current and future water-quality issues. During its first decade, (1991-2001 or Cycle 1), the NAWQA Project completed interdisciplinary baseline assessments of the quality of streams, groundwater, and aquatic ecosystems in 51 of the Nation’s largest and most important river basins and aquifers. The assessments were based on sampling at 505 stream sites and more than 5,000 wells. During its second decade, (2001-2012 or Cycle 2), the NAWQA Project built upon the baseline assessments by reporting on how water-quality conditions were changing over time and by developing regional-scale water-quality models to extrapolate findings to unmonitored areas.

The NAWQA Project’s third decade (2013-2023 or Cycle 3) science plan (<http://pubs.er.usgs.gov/publication/ofr20131160>) continues strategies that have been central to the NAWQA Project’s long-term success, but adjusts approaches, monitoring intensity, and study design to address data and science information needs identified by the NAWQA Project stakeholders and the National Research Council (NRC), which reviewed the Cycle 3 plan in 2012 (http://www.nap.edu/openbook.php?record_id=13464&page=R1). The current plan addresses stakeholder needs for timely reporting of water-quality information, science, and tools, through: (1) annual Web-based reporting of concentrations, loads, and trends of nutrients, sediment, and other contaminants in rivers draining into important coastal estuaries; (2) preparation of maps showing the distribution of nitrate, arsenic, and other contaminants in important water-supply aquifers at the depth tapped by domestic and public-supply wells; and (3) model-based decision support tools that allow managers to evaluate how water quality or stream ecosystems may change in response to different scenarios of population growth.

The 2018 budget request focuses on the following core priorities for Water Quality:

- Assessing the current quality of the Nation’s streams and aquifers and how water quality is changing over time.
- Evaluating how human and natural factors affect the surface water and groundwater.
- Determining the relative effects of multiple stressors on aquatic ecosystems to guide stream and ecosystem restoration efforts.
- Predicting the effects of human activities, climate variability, and different management strategies on water quality and ecosystem conditions.

- Conducting monitoring and modeling studies to develop tools that water resource managers and drinking-water suppliers can use to forecast toxic harmful algal bloom events and protect human and ecosystem health.

2018 Program Changes

Reduce National Research Program (NRP) (-\$6,011,000/-40 FTE): This would suspend studies in Arizona, California, Colorado, and Minnesota that focus on how contaminants move through the environment, their degradation or, if they persist, whether or not they pose a risk to human or aquatic ecosystem health. It would suspend studies that examine how nutrients, carbon and sediment are transported and delivered to small streams in the agricultural Midwest and to large estuaries such as the Chesapeake Bay or in the Gulf of Mexico. Studies examining the post-wildfire impacts on water quality and ecosystems in the Western United States and the effects of climate variability on the condition of permafrost in Alaska would also be suspended. The ability to forecast which legacy or emerging contaminants pose a threat to drinking water supplies in Arizona and Colorado or the health of aquatic ecosystems in California, the upper Midwest, and the Gulf of Mexico would be sharply curtailed. The ability to extrapolate current conditions and forecast future changes in water quality in important watersheds, such as the Mississippi River Basin or critical aquifers like the Central Valley of California, would be delayed 5-10 years, suspending the production of critical information water resource managers use to evaluate water resources for agricultural irrigation and safe drinking water supplies across the United States.

Eliminate National Park Service Cooperative Water Partnership (NPS-CWP) (-\$1,743,000/-12 FTE): This funding decrease would eliminate the NWQP's NPS-CWP, which provides water-quality science support to the National Park Service. For over 20 years, the NPS-CWP has supported data collection and interpretative studies of priority water-quality issues in the Nation's national parks including the occurrence of emerging contaminants, harmful algal blooms, endocrine disrupting compounds, harmful algal blooms, and mercury and other metals in park waters. Collectively or individually, these sources of water-quality impairment threaten human and aquatic ecosystem health and have the potential to decrease the number of visitors and reduce revenue in affected parks. Twenty-one existing projects will be stopped that include studies examining threats to water quality in Crater Lake National Park (OR), Golden Gate National Recreational Area and Yosemite National Park (CA), Chattahoochee National Recreational Area (GA), Voyageurs National Park (MN), Fire Island National Seashore (NY), Saguaro National Park (AZ), Lake Mead (AZ, NV) Delaware River Gap (NJ, PA), Jamestown Island Colonial National Historic Park (VA), and New River Gorge (WV). Without these projects, and any future planned projects, the NPS will have less information with which to make decisions about water quality, which would impact the public water supply at the parks and potentially affect the health of park visitors and wildlife.

Eliminate National Atmospheric Deposition Program (NADP) (-\$1,576,000/-10 FTE): This decrease will eliminate USGS participation in the NADP a collaborative effort that involves about 250 Federal, State, tribal, academic, and local organizations who operate five national monitoring networks that measure atmospheric inputs of nutrients, acidic compounds, mercury, ammonia, and other chemicals to aquatic and terrestrial ecosystems. The decrease would eliminate monitoring at 82 sites in 38 States and

Puerto Rico, which is about 30 percent of the program's network. NADP data, which go back 40 years at some sites, are used to produce the Environmental Protection Agency and the International Joint Commission air quality reports, to establish mercury fish consumption advisories and provide surveillance data for biological, chemical, or radiological agents derived from natural or manmade disasters, such as radioactive fallout from the 2011 Fukushima reactor meltdown.

Reduce National Water-Quality Assessment Project Lower Mississippi Stream Quality Assessment (-\$4,000,000/-28 FTE): This eliminates the planned NAWQA Project stream-quality assessment study of the Lower Mississippi River Basin (LMRB). The collaborative study would have characterized sources of water-quality and aquatic ecosystem impairment—contaminants, nutrients, sediment, and streamflow—and ecological conditions in streams in Arkansas, Louisiana, Mississippi, Missouri, Tennessee and Kentucky to determine the relative effects of these stressors on the health of aquatic communities and to identify which human and natural factors are most critical in controlling stream quality.

Reduce National Water-Quality Assessment Project Trends Assessments (-\$2,628,000/-18 FTE): This decrease will delay implementation of planned studies that will determine and explain which natural and human factors are most important in influencing long-term trends in surface water and groundwater quality. The decrease also eliminates planned sampling of groundwater-quality networks in seven States (AZ, IL, MN, NJ, SC, TX, and WA), and eliminates water-quality sampling at four percent of the long-term monitoring sites operated as part of the USGS National Water Quality Network for Streams and Rivers. This decrease would also delay or suspend a study of long-term water quality trends in the Nation's rivers and streams. The decrease will delay data analysis and reporting by four years and delay work at the regional and national scale to assess the effectiveness of investments in wastewater treatment plant upgrades and best management practices, particularly in agricultural areas.

Reduce National Water Quality Program Operations (-\$1,277,000/0 FTE): This decrease would reduce NAWQA Project activities assessing the current and future quality of the Nation's freshwater resources, evaluating which human and natural factors are driving observed geographic patterns and trends, and developing tools and models water resource managers and drinking-water suppliers can use to forecast short and long-term changes to water quality, such as forecasting harmful algal blooms or decadal-scale changes in groundwater quality. In addition, maintenance of monitoring equipment, data services and work with partners will be impacted.



Water Resources Water Resources Research Act

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Water Resources	\$210,687	\$210,287	\$2,661	\$0	-\$39,906	\$173,042	-\$37,245
<i>FTE</i>	<i>1,407</i>	<i>1,407</i>	<i>0</i>	<i>0</i>	<i>-179</i>	<i>1,228</i>	<i>-179</i>
Water Resources Research Act Program	\$6,500	\$6,488	\$0	\$0	-\$6,488	\$0	-\$6,488
<i>FTE</i>	<i>1</i>	<i>1</i>	<i>0</i>	<i>0</i>	<i>-1</i>	<i>0</i>	<i>-1</i>

Summary of Budget Request

The 2018 budget request for the Water Resources Research Act Program is \$0 and 0 FTE, a net change of -\$6,488,000 and -1 FTE from the 2017 Annualized Continuing Resolution (CR) level.

Overview

The Water Resources Research Act, authorized by section 104 of the Water Resources Research Act (WRRRA) of 1984, is a Federal–State partnership that plans, facilitates, and coordinates water resources research, education, and information transfer through a matching grant program. The WRRRA authorized the establishment of State Water Resources Research Institutes (National Institutes for Water Resources) at land grant universities across the Nation. There are currently 54 Institutes: one in each State, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam. The Institute in Guam serves the Federated States of Micronesia and the Commonwealth of the Northern Mariana Islands. The WRRRA Program provides an institutional mechanism for promoting State, regional, and national coordination of water resources research, promotes student education and training, and is a focal point for research coordination and information and technology transfer. The WRRRA expired in 2011.

2018 Program Changes

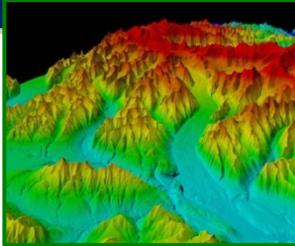
Eliminate Water Resources Research Act Program (-\$6,488,000/-1 FTE): This eliminates a grant and cooperative agreement program for land grant universities. This would end USGS involvement in coordination and administrative support for all grants to Water Resource Research Institutes. Applied research projects that address a wide variety of water resource topics and problems at the State level would no longer receive funding through this expired program.

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Core Science Systems



Core Science Systems



3D Elevation Program (3DEP) lidar image shows elevation changes over an Alaskan mountain range.

The USGS offers foundational geospatial data, maps, and analytical tools that support smart decision making benefitting America's economy.

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Core Science Systems	\$111,550	\$111,339	\$1,021	\$0	-\$19,391	\$92,969	-\$18,370
<i>FTE</i>	<i>456</i>	<i>456</i>	<i>0</i>	<i>0</i>	<i>-58</i>	<i>398</i>	<i>-58</i>
National Geospatial Program	\$62,854	\$62,735	\$575	\$0	-\$11,375	\$51,935	-\$10,800
<i>FTE</i>	<i>257</i>	<i>257</i>	<i>0</i>	<i>0</i>	<i>-26</i>	<i>231</i>	<i>-26</i>
National Cooperative Geologic Mapping Program	\$24,397	\$24,351	\$244	\$0	-\$2,314	\$22,281	-\$2,070
<i>FTE</i>	<i>109</i>	<i>109</i>	<i>0</i>	<i>0</i>	<i>-5</i>	<i>104</i>	<i>-5</i>
Science Synthesis, Analysis and Research Program	\$24,299	\$24,253	\$202	\$0	-\$5,702	\$18,753	-\$5,500
<i>FTE</i>	<i>90</i>	<i>90</i>	<i>0</i>	<i>0</i>	<i>-27</i>	<i>63</i>	<i>-27</i>

Summary Changes

Request Component	(\$000's)	FTE	Fixed Costs	Page
National Geospatial Program	-11,375	-26	+575	K--9
Reduce Federal Geographic Data Committee Functions	-2,700	-7		K--11
Eliminate Geospatial Research and Reduce 3DEP Technical Support	-5,100	-19		K--11
Reduce 3D Elevation Program (3DEP) Functions	-3,000	0		K--11
Reduce National Geospatial Program Operations	-575	0		K--11
National Cooperative Geologic Mapping Program	-2,314	-5	+244	K--13
Reduce National Cooperative Geologic Mapping Program Functions	-2,070	-5		K--15
Reduce National Cooperative Geologic Mapping Program Operations	-244	0		K--15
Science Synthesis, Analysis and Research Program	-5,702	-27	+202	K--17
Reduce USGS Library Functions	-3,000	-20		K--19
Reduce Biogeographic Science Functions	-2,500	-7		K--19
Reduce Science Synthesis, Analysis and Research Program Operations	-202	0		K--19
Total Program Change	-19,391	-58	+1,021	

Summary of Budget Request

The 2018 budget request for the Core Science Systems Mission Area is \$92,969,000 and 398 FTE, and includes a program change of -\$19,391,000 and -58 FTE from the 2017 Annualized Continuing Resolution (CR). This funding level includes a fixed costs change of \$1,021,000.

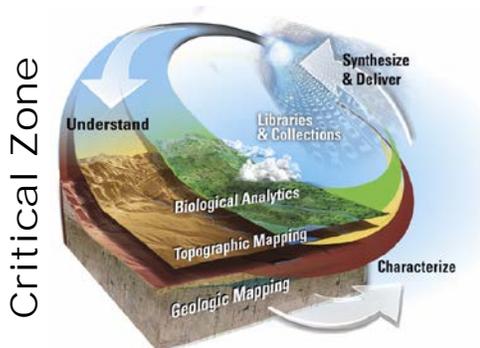
Overview

Core Science Systems (CSS) leads the USGS's mission as the civilian mapping agency for the Nation and supports the conduct of detailed surveys and the resulting distribution of high-quality and highly-accurate topographic, geologic, hydrographic, and biogeographic maps and data. Mapping accuracy through cutting-edge technology allows for precise planning for energy development, transportation and pipeline infrastructure projects, urban planning, flood prediction, emergency response, and hazard mitigation.

CSS builds on the core strengths of the USGS in characterizing and understanding complex Earth and natural systems. CSS products provide foundational geospatial data for the Nation; underpin the work of all USGS mission areas; and are essential enablers for meeting the USGS's priorities in addressing America's growing energy, mineral resource, water, and infrastructure improvement needs.

The CSS Mission Area:

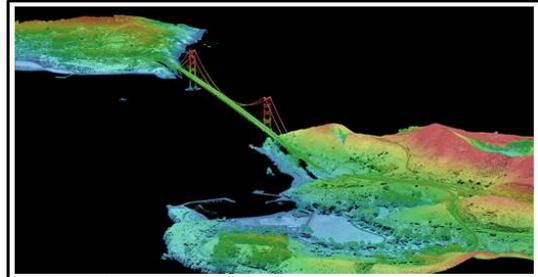
- Provides foundational geospatial, geological, hydrological, and biogeographical maps and data for the Nation's topography, natural landscape, and built environment.
- Conducts science, surveys, and research on the Nation's geological and biological resources and offers geospatial data, map services, and decision-support tools for the American public to easily discover and use for local, regional, national, or continental analyses.
- Coordinates the effective and economical use and management of geospatial data assets for the government and the Nation.
- Enhances data synthesis and analysis across science disciplines for infrastructure modernization, natural hazards mitigation, energy and mineral exploration and assessments, emergency response, and ground and surface water resource assessments to enable data-driven science.
- Preserves and promotes geological and geophysical data collections to provide a framework for geoscience data and information sharing.
- Improves Federal-State cooperation and collaboration by effectively leveraging partnerships.



CSS continuously strives to better understand, characterize, synthesize, and apply context to the complex processes and interactions taking place in the Earth's Critical Zone.

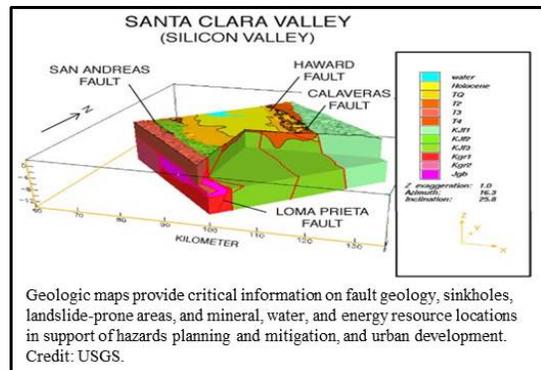
CSS Programs

The National Geospatial Program (NGP) – The NGP organizes, updates, and publishes the geospatial baseline of the Nation’s topography, natural landscape and built environment through The National Map. The NGP also conducts geospatial research to discover new approaches for updating and using geospatial data and for reducing costs of these activities. The National Map is a compilation of the foundational data layers for the entire Nation, maintained in the public domain. (<https://go.usa.gov/xXATR>)



High-resolution elevation and hydrography data supports decision-making by providing highly-accurate data for transportation, construction, and civil engineering projects and identifying potential natural hazards. Credit: USGS.

The National Cooperative Geologic Mapping Program (NCGMP) – The NCGMP characterizes, interprets, and distributes the geologic framework model (i.e., a three-dimensional visualization of surface and subsurface rock, soil, and sediment layers) of the Nation through geologic mapping and research in support of the responsible use of land, water, energy, and minerals resources. These products also help to mitigate the impact of geologic hazards on society and facilitate economic growth and national security through informed natural resource management. (<https://go.usa.gov/xXATd>)



Geologic maps provide critical information on fault geology, sinkholes, landslide-prone areas, and mineral, water, and energy resource locations in support of hazards planning and mitigation, and urban development. Credit: USGS.



The Science Synthesis, Analysis and Research Program (SSAR) – The SSAR Program provides analysis and synthesis of scientific data and information, long-term preservation of scientific data, and library collections. This program accelerates research and decision making through data science, information delivery, advanced computing, biodiversity analytics, and preserved geoscientific assets (e.g., drilling cores, rock, soil, and sediment samples). (<https://go.usa.gov/xXATg> and <https://go.usa.gov/xXATw>)

The CSS Mission Area will continue valuable and highly cost-effective collaborations with our Federal, State, tribal, local, and private sector partners to deliver nationally-consistent, high-quality maps and data products and computational needs that meet the growing demand for accurate and precise representations of natural and man-made features. In 2018, the CSS Mission Area would:

- Support America’s energy future through identifying energy, mineral, and oil and gas resources through targeted and detailed geologic mapping.

- Plan for America’s future infrastructure, engineering, and transportation projects (e.g., roads, bridges, and highways; pipelines and power lines; dams and hydropower plants; county and urban sectors; and railroads and airports).
- Guide natural hazards and flood-risk assessments essential for the public safety of millions of Americans through detailed geologic mapping and three-dimensional modeling.
- Spur the creation of new jobs and businesses based on location analytics and geo-enabled mobile applications mining USGS data.
- Enable cost-efficient and rapid processing of the complex computational models and analyses associated with the high-resolution elevation, hydrographic, three-dimensional geologic, and biogeographic datasets through high-performance computing.
- Support public safety and disaster recovery, wildfire management, hunting, and outdoor recreation by providing accurate and up-to-date digital topographic maps and map-on-demand services.
- Support assessments of surface water and ground water sources for America’s water stewardship by providing high-resolution hydrography data and detailed geologic maps.
- Create efficiencies by providing USGS high-performance computing capacity and expertise and facilitating rapid data analysis to support large-scale computational research for the USGS and Interior on land management questions.
- Promote a shared conservation ethic by providing biogeographic data (e.g., species distributions), maps, and decision support tools to inform recreation and sporting, land and water stewardship, infrastructure, fire and energy policy decisions.
- Evaluate the effects of Earth processes (e.g., storm surge, landslides, earthquakes, volcanic eruptions, coastal erosion, flooding, and drought) on economic security, public safety and tribal resources.
- Provide foundational geospatial data for America’s national security and emergency preparedness.

The 2018 President's budget request continues to support CSS programs that provide critical topographic, geologic, hydrologic, and biogeographic data, maps, and services for America including:

- High-resolution, three-dimensional elevation mapping and accurate and up-to-date topographic mapping support for the Nation's infrastructure and public safety.
- High-resolution interferometric synthetic aperture radar (IfSAR) and topographic mapping for Alaska supporting transportation, hydrology, infrastructure modernization, and aviation safety.
- High-resolution hydrographic mapping for the National Hydrography Dataset (NHD) for public safety, water stewardship, and hazard mitigation.
- Surface and subsurface three-dimensional geologic mapping for energy, mineral, and oil and gas assessments, seismic analyses, and natural hazard mitigation.

- High-performance computing and data science enabling all aspects of USGS research and modeling in support of public safety, energy, minerals, infrastructure and science.
- Data and tools from the Protected Areas Database of the United States (PAD-US), which is a National Geospatial Data Asset used in land stewardship, effective siting for renewable energy facilities and other infrastructure, and fuel and fire management studies.
- Preservation of geoscientific physical samples (rocks and core samples) and data to aid in future energy and mineral exploration and geologic assessments.

The USGS's external partners rely on the consistent, high-quality geospatial data and a wide range of other three-dimensional representations of the Nation's natural and constructed features produced by the CSS Mission Area. CSS foundational data, tools, and mapping technologies provide valuable productivity, safety, and cost-saving benefits to the public by facilitating infrastructure improvement, construction and engineering projects, energy-siting evaluations, aviation safety, flood risk management, and natural hazard evaluations.

Program Performance

Dramatically new, state-of-the-art technology (e.g., airborne remote sensing) and methods for observing and mapping of America's land, water, and resources have the capability of measuring and monitoring the Earth's surface, sub-surface, and biota with unprecedented accuracy. The USGS, with its partners, is realizing significant enhancements and efficiencies in the acquisition, production, and delivery of elevation, hydrographic, geologic, and biogeographic maps and data nationwide by operationalizing these new technologies and techniques. As a result, production and delivery rates continue to improve—which translates to more data products and tools available to the Nation to support smart decisions.

Strategic Actions Planned through 2018

National Geospatial Program

- Continue acquisition of high-resolution lidar elevation data to achieve the first-ever cycle of nationwide lidar coverage in 2033 to support topographic map production.
- Continue acquisition of high-resolution interferometric synthetic aperture radar (IfSAR) elevation data for the State of Alaska; develop more efficient means of updating hydrography data; and continue to produce topographic maps.
- Continue acquisition of high-resolution hydrography data (NHD+HR) for the Nation to support flood risk management; infrastructure improvements; and energy resource management.
- Continue to strengthen the outreach and communication strategy for Federal, State, local, and tribal partners and private sector users that receive matching funds to acquire new elevation data.
- Continue to support emergency operations that support major disasters such as hurricanes, tornados, flood response, and public safety (e.g., Hurricane Matthew recovery, Oroville, CA, Dam emergency).
- Implement a cloud-based system capable of topographic map production and distribution.

Core Science Systems

- Initiate quarterly updates to national foundational mapping databases in dynamic Web services, substantially improving user access to current information.
- Lead the development of the Federal Geographic Data Committee's (FGDC) strategic action framework, which provides a federal and non-federal collaborative approach to the advancement of the Nation's geospatial infrastructure. These efforts lay the foundation for the next National Spatial Data Infrastructure Strategic Plan.
- Support—via the FGDC Secretariat—the FGDC's 32-Federal agency committee, Interior, and the Office of Management and Budget's (OMB) Chair and Vice-Chair leadership responsibilities, Interior's National Geospatial Advisory Committee of non-Federal partners; and limit implementation of OMB's Circular A-16 for the coordination of Federal geospatial and mapping activities and the Nation's Spatial Data Infrastructure.

National Cooperative Geological Mapping Program

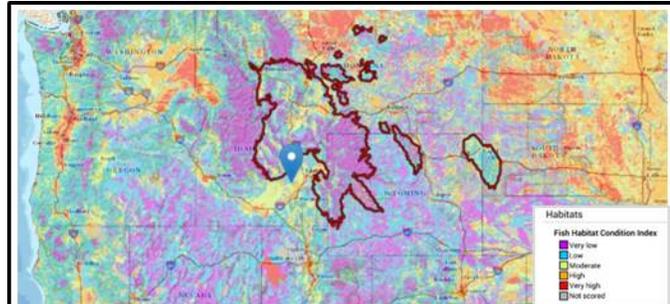
- Improve beneficial partnering between the National Cooperative Geologic Mapping Program's (NCGMP) FEDMAP, STATEMAP and EDMAP components to maximize return on program investment and facilitate intellectual exchange and data sharing.
- Enhance the performance and relevance of the NCGMP's components (FEDMAP, STATEMAP, EDMAP) to maximize efficiency in program function, funding allocation, prioritization of need, and program accountability.
- Optimize the use of remote sensing, geophysical surveys, and national digital geospatial datasets to expand opportunities for the development of subsurface geologic interpretations, increase the interpretive resolution of surface mapping and to boost geologic mapping productivity.
- Provide guidance and education for the National Cooperative Geologic Mapping Program 09 (NCGMP09) data schema and assist State geological surveys and USGS scientists in their adoption of this data standard.
- Work with partners at the American Geosciences Institute, Geological Society of America, and universities to improve youth outreach and develop more opportunities to train geologic mappers in all facets of the science, including emerging mapping technologies.
- Strengthen and expand the National Geologic Map Database (NGMDB) by establishing geologic map standards, creating, interpreting and building a seamless geologic map database for the Nation based on new geologic mapping at regional-to-local scales, and utilizing new and existing tools to extrapolate surface geologic mapping to subsurface interpretation and temporal geologic evolution of the Earth.

Science, Synthesis, Analysis, and Research Program

- Support the use and development of field-based technology and related standards for purposes of expediting and expanding digital field data capture and real-time interpretation, data preservation and dissemination.

- Enhance the USGS's High-Performance Computing capabilities to support USGS and Interior computational and management challenges, and enable more timely data analysis, reduce wait time for available central processing units (CPU), and assist in the public release of research results.

- Continue development of the USGS's National Biogeographic Map to provide analytical tools for the examination of selected species, habitats, protections, and habitat conditions.



This National Biogeographic Map shows the risk of fish habitat degradation in the Middle Rockies. Overall, fish habitat in the mountain states are of higher quality, particularly in recreational fishing areas within U.S. National Parks.
Credit: USGS.

- Continue to increase access, discovery, understanding and reuse of USGS science data and information by providing USGS researchers the tools and expertise to release and preserve science data.

- Continue to support States to preserve, and promote for reuse, valuable geoscientific documents, samples, and data to inform geologic studies for resource and energy development, and infrastructure projects.

- Continue to work with private sector, State, and Federal government researchers to promote preservation of geoscientific artifacts and data by promoting best practices, shared repositories, and standardized data sharing techniques to expose and enable investigation of existing collections and associated data.

- Improve discovery and access to valuable fossils, rock cores, and associated data to industry, academic, and government researchers to promote geoscientific investigation of natural resources (e.g., oil, gas, and minerals) and infrastructure development.

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Core Science Systems National Geospatial Program

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Core Science Systems	\$111,550	\$111,339	\$1,021	\$0	-\$19,391	\$92,969	-\$18,370
<i>FTE</i>	456	456	0	0	-58	398	-58
National Geospatial Program	\$62,854	\$62,735	\$575	\$0	-\$11,375	\$51,935	-\$10,800
<i>FTE</i>	257	257	0	0	-26	231	-26

Summary of Budget Request

The 2018 budget request for the National Geospatial Program is \$51,935,000 and 231 FTE, and includes a program change of -\$11,375,000 and -26 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$575,000.

Overview

The National Geospatial Program (NGP) organizes, updates, and publishes the geospatial baseline of the Nation's topography, natural landscape and built environment through The National Map, and conducts geospatial research to discover new approaches for updating and using geospatial data and for reducing costs of these activities. The National Map is a compilation of the foundational data layers for the entire Nation, maintained in the public domain.

The American public relies on the NGP's modern enhanced data and mapping to remain informed and stay healthy and safe. Modern surveying methods (such as airborne sensors), evolving technologies, and high-quality geospatial data and services help to create private sector jobs, fuel American economic opportunities, and support a wide array of uses. The NGP supports the Department of the Interior's responsibilities for national geospatial coordination, and carries out the USGS's government-wide leadership responsibilities for elevation, hydrography and watershed boundaries, and geographic names.

The NGP's 3D Elevation Program (3DEP) acquires high-resolution elevation data to protect infrastructure and natural resources and improve public safety. Collaboration efforts, supported by geospatial liaisons from across the United States are critical for coordinating with Federal, State, local, and tribal governments and private industry users to obtain matching funds (approximately four partner dollars for each USGS dollar invested). This strategy effectively leverages Federal dollars through partnerships to support land and water stewardship and security, and enable job creation.

The economic benefit of high-resolution elevation data is tremendous to these partners across all sectors. Estimates by the National Enhanced Elevation Assessment (Dewberry, 2012), indicate a complete national 3D Elevation collection would result in an estimated annual economic benefit of \$690 million. In addition, nationwide topographic maps produced by the USGS remain a critical part of many business processes and applications across the Country, particularly for hunting and outdoor recreation; wildfire management and suppression; aerial navigation and safety; and natural hazards mitigation and recovery.

Stakeholders and Federal, State, tribal, and local partners use USGS hydrography data and hydrographic mapping products to perform water quantity and quality mapping; reference hydrologic features and observations for more accurate flood risk management; and report on surface water conditions. The combined National Hydrography and Watershed Datasets (NHD and WBD)—an intelligent network map of surface water—results in an estimated annual economic benefit of nearly \$538 million.

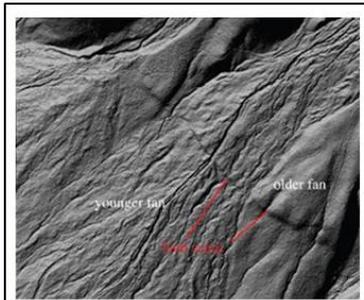
The Federal Geographic Data Committee (FGDC) Secretariat supports Interior and OMB's leadership and coordination responsibilities in achieving efficiencies across the Federal government. The FGDC also achieves management efficiencies in partnership with State, local, and tribal governments and non-Federal partners in the wide-spread use of geospatial data and technologies and helps civil and defense agencies achieve situational awareness of the natural and built infrastructure.

The 2018 budget request supports:

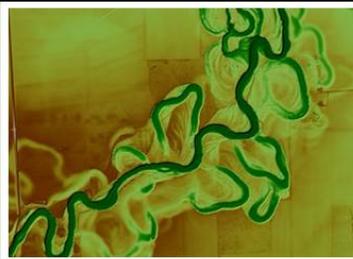
- High-resolution, three-dimensional elevation mapping support for the Nation's infrastructure and public safety.
- High-resolution interferometric synthetic aperture radar (IfSAR) and topographic mapping for Alaska supporting transportation, hydrology, infrastructure modernization, and aviation safety.
- High-resolution hydrographic mapping for the National Hydrography Dataset (NHD) for public safety, water stewardship, and hazard mitigation.

The 2018 budget request also supports The National Map, but delays acquisition of light detection and ranging (lidar) data for nationwide coverage and eliminates geospatial research that drives technological innovation and efficiency. In 2016, The National Map distributed approximately 13.6 million files of elevation, hydrography, orthoimagery, and other related topographic information. These widely used geospatial data and related Web services help the public and private sectors to implement a wide range of activities, including public safety, utilities management, precision agriculture, road and bridge construction, aviation and national security.

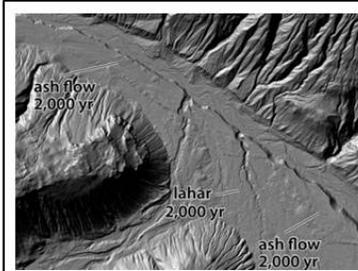
Examples of Mission Critical Applications:



Energy and Minerals:
3DEP data provide information on the geologic framework in the southwestern U.S. aiding mineral and energy resource assessments.



Flood Risk Management:
3DEP data provide critical information on changing river morphology especially in low-relief areas.



Natural Hazards:
3DEP data provide information on identifying features in heavily forested and snow-covered Glacier Peak, WA.

2018 Program Changes

Reduce Federal Geographic Data Committee Functions (-\$2,700,000/-7 FTE): This eliminates Interior sponsorship of several Federal Geographic Data Committee (FGDC) subcommittees and projects, but retains core FGDC committee support, stakeholder engagement, and strategic planning support. Reductions and eliminations include activities supporting the Federal Geospatial Platform; the National Geospatial Advisory Committee; collaborating with Federal and non-Federal partners on geospatial standards; and supporting the development of the National Spatial Data Infrastructure.

Eliminate Geospatial Research and Reduce 3DEP Technical Support (-\$5,100,000/-19 FTE): This reduces support for technical operations and delivery functions within the 3D Elevation Program (3DEP), National Hydrography and Watershed Boundary Datasets, and US Topo Programs, including Alaska mapping. The reduction would eliminate the Center of Excellence for Geospatial Information Science and its associated research grants.

Reduce 3D Elevation Program (3DEP) Functions (-\$3,000,000/0 FTE): This defers completion of 3DEP national coverage by five years, delaying until 2033 the complete acquisition of light detection and ranging (lidar) data to enhance landscape-scale, three-dimensional maps for the Nation. The reduction results in a significant loss of leveraged partner funds

Reduce National Geospatial Program Operations (-\$575,000/0 FTE): This reduction would diminish the NGP's ability to execute its core activities including delaying major mapping efforts to produce and make available highly-accurate topographic, hydrographic, and geologic data and maps for the American public through the National Map and Federal Geospatial Platform. This reduces equipment, services, and work with Federal, State, and industry partners.

Science Collaboration

Users throughout the Federal Government, including those in the U.S. Department of the Interior, the U.S. Departments of Agriculture, Commerce, and Defense; the Federal Emergency Management Agency, the National Guard Bureau; States, Tribes, the private sector, and other organizations collaborate on, produce, and use NGP geospatial data, derived topographic map products, and web services to support their decision-making and operational activities.

The 3DEP Executive Forum facilitates executive dialog and collaboration on strategies to implement and sustain 3DEP for the benefit of its Federal stakeholders and the broader community. The Forum is comprised of representatives from 14 Federal agencies that support 3DEP goals for nationwide data coverage.

The Alaska Mapping Executive Committee meets regularly to coordinate on critical Alaska topographic mapping activities. Executives from 15 Federal agencies and the State of Alaska are combining efforts to acquire new digital elevation, hydrography, transportation, shoreline and geospatial data for Alaska, and create a new digital topographic map series for the State.

The USGS offers world-class science capabilities to support the Department of Defense (DOD). Since 2003, the USGS has partnered with the U.S. Northern Command (USNORTHCOM) to facilitate science support in the event of a major natural disaster. One key product that now supports USNORTHCOM and other DOD partners during a natural disaster is the USGS topographic map or US Topo, which the USGS provides to DOD through a partnership with the Defense Logistics Agency. This new capability enables immediate requests and delivery of this USGS resource to the impacted area.

The NGP and the U.S. Forest Service share data for mapping purposes to create more consistent and current products. This collaboration reduces costs for map production and results in more consistent products.



Core Science Systems National Cooperative Geologic Mapping Program

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Core Science Systems	\$111,550	\$111,339	\$1,021	\$0	-\$19,391	\$92,969	-\$18,370
<i>FTE</i>	<i>456</i>	<i>456</i>	<i>0</i>	<i>0</i>	<i>-58</i>	<i>398</i>	<i>-58</i>
National Cooperative Geologic Mapping Program	\$24,397	\$24,351	\$244	\$0	-\$2,314	\$22,281	-\$2,070
<i>FTE</i>	<i>109</i>	<i>109</i>	<i>0</i>	<i>0</i>	<i>-5</i>	<i>104</i>	<i>-5</i>

Summary of Budget Request

The 2018 budget request for the National Cooperative Geologic Mapping Program is \$22,281,000 and 104 FTE, and includes a program change of -\$2,314,000 and -5 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$244,000.

Overview

The vision of the USGS's National Cooperative Geologic Mapping Program (NCGMP) is to create an integrated, three-dimensional, digital geologic framework of the United States and its territories to address the Nation's changing resource needs. The NCGMP's mission is to characterize, interpret, and disseminate the geologic framework model of the Nation through geologic mapping and derivative research, in order to support the responsible use of land, water, energy, and minerals, and to mitigate the impact of geologic hazards on society thereby facilitating national security and economic growth through informed Earth resource management.

The NCGMP advances the understanding of the nature of the materials—rocks, energy resources, water—and processes such as characterization, containment, and flow. This nationwide program of geologic research produces abundant, high-impact peer-reviewed journal articles annually on surficial and bedrock geology, mapping, and multidimensional models that provide fundamental research and data for assessing energy, mineral and water resources.

Physical infrastructure (e.g., transportation, energy, and telecommunications networks) requires raw materials for new construction and maintenance of existing projects as well as understanding of ground stability and subsurface rock competency for siting infrastructure, urban development and land-use projects such as power or waste disposal facilities. In addition, improvements to infrastructure would

require current, accurate geologic maps to locate water, oil and gas, and aggregate and mineral resources, many of which are found within or near the margins of sedimentary basins. These maps aid the Nation in locating and developing necessary resources; assessing and protecting groundwater quality; and safely siting infrastructure projects such as solid and hazardous waste disposal facilities.

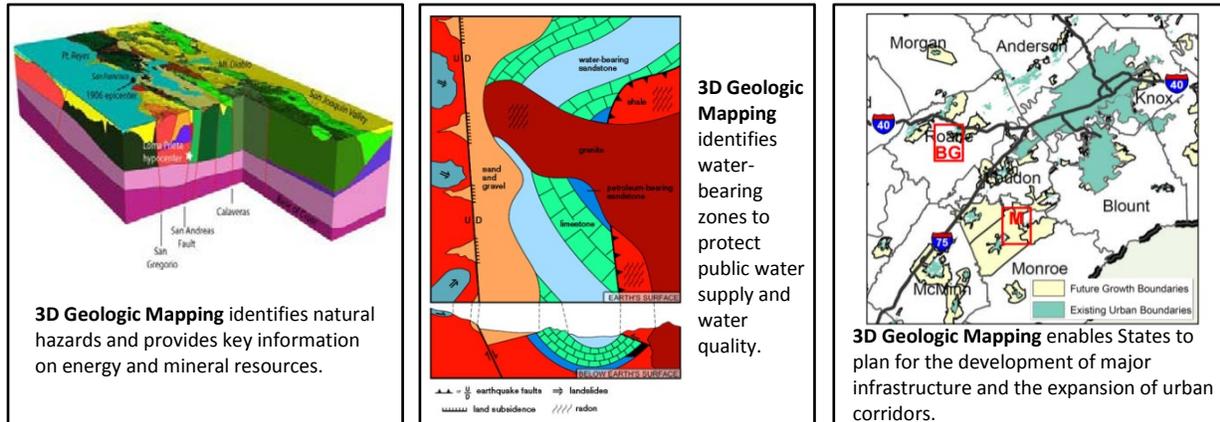
Geologic maps and frameworks define the location and subsurface shape of aquifers, how much water aquifers can store, and parameters for water movement through the ground. Geologic mapping products also provide critical information for predicting and mitigating natural hazards, such as landslides, sinkholes, floods, earthquakes, and volcanoes. In 2014, geologic maps were critical tools used in emergency response situations such as major landslides that had human casualties in Washington State and western Colorado. Three-dimensional geologic maps are the basis for estimating ground-shaking hazards from future earthquakes as well, and are thus critical for safely siting homes, buildings, and physical infrastructure.

The American public relies on geologic mapping methods and data to remain informed, healthy, and safe. Three-dimensional geologic mapping and frameworks (models) help to create private sector jobs, fuel American economic opportunities, and support a 21st century economy based on energy, minerals, and oil and gas resource assessments. Understanding the Earth's composition, structure, and history derived from geologic maps lies at the forefront of basic and applied geologic research that responds directly to economic and societal needs. Geologic maps are widely recognized as an essential source of foundational knowledge for economic prosperity, national security, and environmental quality. Accurate geologic maps and three-dimensional geologic framework models are essential for identifying mineral, oil, and gas resources, finding and protecting groundwater, guiding earthquake and flood hazard mitigation, identifying landslide and post-wildfire hazards, and guiding transportation and other infrastructure planning. One report estimated that geologic maps return up to 39 times their cost to the American public (see "Economic benefits of detailed geologic mapping to Kentucky," Bhagwat and Ipe, 2000).

The 2018 budget request supports:

- NCGMP programs (Federal: FEDMAP; State: STATEMAP; and universities: EDMAP) would continue to produce, at a reduced rate, the geologic maps, three-dimensional geologic models, interpretive studies, and scientific publications that support energy, mineral, and oil and gas assessments, seismic analyses, and natural hazard mitigation.
- Surface and subsurface three-dimensional geologic mapping for energy, mineral, and oil and gas assessments, seismic analyses, and natural hazard mitigation.

Examples of Mission Critical Applications:



2018 Program Changes

Reduce National Cooperative Geologic Mapping Program Functions (-\$2,070,000/-5 FTE): This reduces FEDMAP, STATEMAP, and EDMAP funds proportionately based on the algorithm defined by the National Geologic Mapping Act of 1992 and subsequent reauthorizations. This would eliminate earthquake seismic hazard assessments in central Virginia impacting the USGS's ability to construct seismic hazard maps based upon the latest geologic maps for the central Virginia area. The USGS would reduce the number of geologic maps produced for the Nation; the loss of matching (1:1 match) partner funds from the State Geological Surveys through the STATEMAP grants program doubles this loss. This reduction would also affect EDMAP grants to colleges and universities.

Reduce National Cooperative Geologic Mapping Program Operations (-\$244,000/-0 FTE): This reduction would diminish the NCGMP's ability to execute its core activities including significantly delaying the number of geologic maps produced to current standards for the Nation. This reduces equipment, services, and work with Federal, State, and university partners.

Science Collaboration

In 1992, the 102nd United States Congress declared, “geologic maps are the primary database for virtually all applied and basic earth-science applications.” Consequently, all three components of the NCGMP—FEDMAP, STATEMAP and EDMAP—share the common responsibility identified in the National Geologic Mapping Act of 1992, to collaborate and expedite the production of a geologic map database for the Nation applicable to land-use management, assessment, and utilization and (or) conservation of natural resources, groundwater management, and environmental protection. The NCGMP has over 20 years of successful cooperation among Federal (FEDMAP), State (STATEMAP), and university (EDMAP) partners to deliver digital geologic maps to the public. Each of these three components has a unique role, yet all work cooperatively to select and map high-priority areas for new geologic maps.

Core Science Systems

Annually, the NCGMP works cooperatively with approximately 45 different State Geological Surveys and 20-25 different universities throughout the Country.

Additionally, the NCGMP shares responsibility with other USGS programs for identification and mitigation of natural or human-induced geologic hazards to minimize property loss, providing for the health and safety of the general public and facilitating the security and economic growth of the Nation. Collaboratively produced geologic maps and models aid America in locating and developing aggregate, mineral, energy and water resources; assessing and protecting groundwater quality; and safely siting solid and hazardous waste disposal facilities.



Core Science Systems

Science Synthesis, Analysis, and Research Program

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Core Science Systems	\$111,550	\$111,339	\$1,021	\$0	-\$19,391	\$92,969	-\$18,370
<i>FTE</i>	<i>456</i>	<i>456</i>	<i>0</i>	<i>0</i>	<i>-58</i>	<i>398</i>	<i>-58</i>
Science Synthesis, Analysis and Research Program	\$24,299	\$24,253	\$202	\$0	-\$5,702	\$18,753	-\$5,500
<i>FTE</i>	<i>90</i>	<i>90</i>	<i>0</i>	<i>0</i>	<i>-27</i>	<i>63</i>	<i>-27</i>

Summary of Budget Request

The 2018 budget request for the Science Synthesis, Analysis, and Research Program is \$18,753,000 and 63 FTE, and includes a program change of -\$5,702,000 and -27 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$202,000.

Overview

The Science Synthesis, Analysis, and Research Program (SSAR) provides analysis and synthesis of scientific data and information, and long-term preservation of scientific data and library collections. This program strives to accelerate research and decision making through data science, information delivery, advanced computing, biodiversity analytics, and preserved geoscientific assets. SSAR ensures that data are strategically managed, integrated, and available to decision makers and others as they focus on issues associated with Earth and life science processes.

The SSAR Program includes the Core Science Analytics, Synthesis and Libraries program (CSAS&L); the National Geological and Geophysical Data Preservation Program (NGGDPP); the Core Research Center; and the J.W. Powell Center for Analysis and Synthesis (Powell Center). These activities provide an integrated suite of critical data, services and applications to empower USGS and its collaborators to effectively manage, steward and analyze key scientific priorities.

To meet the needs of supporting improvements to the Nation's infrastructure, the USGS must also focus on reinvesting in its infrastructure—specifically developing an Advanced Research Computing Framework. The USGS and the Core Science Systems Mission Area would maintain its high performance computing (HPC) efforts to execute complex computational models required to quickly and efficiently process the high-resolution elevation datasets. High-performance computing is also necessary for computational efficiency when integrating the National Geospatial Program's elevation and

hydrography data, and the National Cooperative Geologic Program's three-dimensional geologic datasets—all of which inform resource availability (building materials), engineering requirements, and safety for the pursuit of improving and developing the Nation's infrastructure.

America's tremendous asset base of public land and other protected open areas is critical for conservation, recreation, and public health applications. These include national parks, forests, wildlife refuges, monuments and wilderness; State parks and wildlife management areas; county open space and city parks; land trust preserves, conservation easements, marine protected areas and many other lands. Together, these include more than 150,000 places covering three billion acres, managed by thousands of public agencies and non-profit organizations that serve current and future generations. A complete and current Geographic Information System (GIS) database of these assets is a critical tool to achieve organizational missions across jurisdictions. The Protected Areas Database of the United States (PAD-US) geodatabase is one of the essential data collections to organize and assess the long-term protection of biodiversity in the United States, and required to assess the conservation status of native vertebrate species and natural land cover types, while facilitating the application of this information to land management activities.

Federal, State, and local governments work together to provide public and protected lands for the benefit of all Americans, which are critical for conservation, recreation, and public health and safety. Making wise decisions about the management of these open spaces and the natural resources they provide requires timely and accurate data and information. The USGS provides integrated and synthesized biogeographic data and information on protected lands and waters, species and habitats, and the dynamics that impact those trust resources over time. Through data science, high-performance computing and technologies, and open scientific data requirements, USGS develops new methods and tools that help inform and engage citizens, launch and empower business, and help governments manage and conserve America's public land assets.

Standards-based practices for preserving and sharing data and collections inform geoscientific interpretation and directly benefit discovery of new natural resources, hazard mitigation, infrastructure development, and public safety. Across the Nation, vast collections of valuable geologic materials and data, collected over many decades, are managed by State geological surveys, the USGS, and other Interior bureaus. The USGS provides technical and financial assistance to advance preservation, exposure, and reuse of these valuable geoscientific artifacts. Prior to these collaborative preservation efforts, countless geological samples and data were rarely used because their existence was unknown, resulting in potentially limited interpretations or expensive re-collection costs of equivalent materials and data.

The 2018 budget request supports:

- High performance computing capabilities that enable more timely data analysis; reduce wait time for available central processing units (CPU); and assist in the public release of USGS science data and research results.
- Data and tools from the Protected Areas Database of the United States (PAD-US) used in land stewardship; effective siting for renewable energy facilities and other infrastructure; and fuel and fire management studies. The USGS would also prioritize providing actionable intelligence to

decision makers on the most prevalent and severe threats to America's important habitats through the National Biogeographic Map.

- Critical biogeographic data and systems needed to conduct scientific analyses of issues involving land management and conservation practice for government, academic, and commercial sectors.
- Virtual access to unique collections; improvement of discovery and access tools; organization of remaining collections; and maintenance of some online access to subscription research journals.
- Geoscientific physical samples (rocks and core samples) and data preserved to aid in future energy and mineral exploration, and geologic assessments.

Examples of Mission Critical Applications:

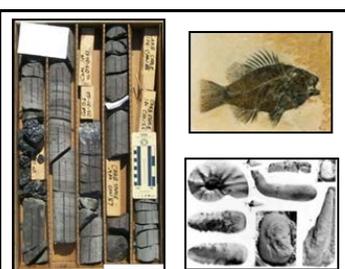


High-Performance Computing (HPC):

HPC has a tremendous return-on-investment by dramatically reducing research data processing, enabling study area expansion through incorporation of additional high-resolution data, and helping to provide analyses of critical issues facing our Nation.



Protected Areas Database of the United States (PAD-US): An inventory that lets any user – from the public to professional land managers – know exactly what lands are protected anywhere in the U.S. They can easily use this information in conservation, land management, planning, recreation and other uses.



Data Preservation:

The preservation, digitization, and public exposure of irreplaceable geoscience collections, samples and promotes their discovery and further research, and avoids re-collection efforts. Credit: USGS

2018 Program Changes

Reduce USGS Library Functions (-\$3,000,000/-20 FTE): This eliminates public access to USGS Library locations. The USGS would place all collections into a dark archive; reduce online journal subscriptions by at least fifty percent; and close libraries in three, or possibly all four locations (Menlo Park, CA; Flagstaff, AZ; Lakewood, CO; and Reston, VA).

Reduce Biogeographic Science Functions (-\$2,500,000/-7 FTE): This reduction would eliminate all national species occurrence data (e.g., species distributions) and systems, which impacts the USGS's ability to produce and maintain these data. The USGS would also eliminate contracts and partnership agreements with USGS Science Centers, universities, and other Federal agencies for assembling and integrating data on species distribution across the Nation. This would result in other Federal agencies, State, and local governments spending additional funding to individually assemble and integrate non-standard species data. This reduction also eliminates the biodiversity hub of EcoINFORMA (Ecoinformatics-based Open Resources and Machine Accessibility).

Reduce Science Synthesis, Analysis, and Research Program Operations (-\$202,000/0 FTE): This reduction would diminish the SSAR Program's ability to execute its core activities including the production and maintenance of species occurrence data; decreasing bibliographic research services; and

limiting access to online journals—services essential to all of the USGS's mission areas and Interior science. This reduction would also reduce the ability to maintain and invest in information technologies that are essential to the core mission work of the program.

Science Collaboration

The USGS's High-Performance Computing has supported more than two million computing jobs and 12.5 million CPU hours to advance USGS and Interior science, land management, and big data challenges. Research related to increasing sturgeon larval gene pools, automatic detection of burned areas, improvements in the processing of airborne electromagnetic surveys, aiding in data visualization and processing for multi-scenario volcanic ash plume modeling, and several large-scale species population viability assessments have all been supported. The USGS will continue to establish interagency partnerships with leading supercomputing organizations such as the National Science Foundation (NSF) and the U.S. Department of Energy (DOE) for HPC. These partnerships allow the USGS to establish on-demand, specialized computing capability that can be expanded through these collaborations when demands outpace in-house capacity. In addition to DOE and NSF, partners include many Interior bureaus and universities.

The PAD-US informs critical decisions in habitat management, recreation, public health, and wildfire planning and response by groups such as the National Park Service, U.S. Forest Service, U.S. Fish & Wildlife Service, and National Wildfire Coordinating Group. PAD-US is the cornerstone data asset of the North American Intergovernmental Committee on Cooperation for Wilderness and Protected Area Conservation, forming a basis for informing conservation policies at the international level. The accuracy and accessibility of PAD-US make it one of the vital engines behind scientific analysis of issues involving land management and conservation practice for government, academic, commercial, and non-profit science.

The Core Research Center (CRC), located in the Denver Federal Center, houses rock cores and samples from 63,000 wells representing over 242 million linear feet of subsurface rock strata from 36 States. The CRC



is heavily used by both the private and public sector. In 2016, 57 percent of the CRC users represented industry. The CRC's geologic samples provide an invaluable archive for oil, gas, and mineral exploration; infrastructure development; and water resource management. As new technologies become available (e.g., hydrofracturing), industry researchers are able to revisit reservoirs that were once considered “tight” or depleted and reevaluate the potential for further oil and gas production by re-analyzing archived rock cores. Mining professionals analyze existing, ore rich rock cores to determine the value of pursuing extraction. Construction of buildings, bridges, and dams across the United States

requires a comprehensive understanding of the rocks that lie below the surface to ensure these structures will remain stable, steady, and functional for years to come. Researchers from the USGS, State water resources departments, water conservation boards, water districts, and water consulting businesses use cores and cuttings to obtain detailed geologic and hydrologic data for aquifers and subsurface structures. The CRC provides a wealth of resources to support natural resource exploration, infrastructure development and water resource management by both the public and private sectors.

The NGGDPP supports the preservation, modernization, and exposure of physical geoscience samples and data managed by State geological surveys and Interior bureaus. Many geoscientific assets, collected over decades, remain in analog format, including paper records and reports, data logs, photographs, field notebooks and maps. The preservation, digitization, and public exposure of these unique and irreplaceable materials via the Internet promotes their discovery and further research, and saves resources by precluding the need for recollection efforts in remote and potentially, no longer accessible areas. The financial and technical assistance provided by the NGGDPP enables States to engage in preservation activities that they otherwise may not be able to complete, and can result in significant economic benefits to the States (e.g., hazard prevention, natural resource development, etc.).

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Science Support



Science Support



U.S. Capitol Building, front-west view

USGS science support enables our employees to be successful and serve the American people.

	2016	2017	2018				
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	Change from 2017 Annualized CR
Science Support	\$105,611	\$105,410	\$1,082	\$0	-\$17,124	\$89,368	-\$16,042
<i>FTE</i>	<i>509</i>	<i>509</i>	<i>0</i>	<i>0</i>	<i>-145</i>	<i>364</i>	<i>-145</i>
Administration and Management	\$81,981	\$81,825	\$944	\$0	-\$13,390	\$69,379	-\$12,446
<i>FTE</i>	<i>451</i>	<i>451</i>	<i>0</i>	<i>0</i>	<i>-140</i>	<i>311</i>	<i>-140</i>
Information Services	\$23,630	\$23,585	\$138	\$0	-\$3,734	\$19,989	-\$3,596
<i>FTE</i>	<i>58</i>	<i>58</i>	<i>0</i>	<i>0</i>	<i>-5</i>	<i>53</i>	<i>-5</i>

Summary of Program Changes

Request Component	(\$000's)	FTE	Fixed Costs	Page
Administration and Management	-13,390	-140	+944	L--7
Reduce Administration and Management Services	-12,446	-140		L--9
Reduce Administration and Management Operations	-944	0		L--9
Information Services	-3,734	-5	+138	L--11
Reduce Information Services Program	-3,596	-5		L--11
Reduce Information Services Operations	-138	0		L--12
Total Program Change	-17,124	-145	+1,082	

Summary of Budget Request

The 2018 budget request for Science Support is \$89,368,000 and 364 FTE, and includes a program change of-\$17,124,000 and -145 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$1,082,000.

Overview

The Science Support Activity provides the functions that make it possible to conduct USGS science. The Science Support Activity provides business and information services and systems including acquisitions and grants; finance; internal controls; communications; budget; monitoring and evaluation of science quality and integrity; education; information assurance; Information Management and Technology (IMT) services; and human capital, each of which are crucial to conducting quality science. Science Support also includes the executive leadership and management that provide guidance, direction, and oversight for all USGS science activities.

For 2018, the Science Support Activity seeks to sustain the USGS science mission by providing the essential foundation and structure to conduct world-class science and allow implementation of support activities that would advance the USGS science mission. The essential support functions and services provided by the Administration and Management and Information Services subactivities form the foundation for the USGS science mission. The breadth of responsibilities funded include purchasing scientific equipment and field supplies; developing science agreements with partners; contracting for support scientists and researchers; safety training; hazardous waste management; strategic planning; succession planning; hiring and staffing; protecting science data assets; providing reliable and robust Information Management Technology (IMT) infrastructure, collaboration and connectivity; developing applications; and employee development and training.

Program Performance

Communications and Public Outreach – The Office of Communication and Publishing (OCAP) coordinated 41 congressional briefings during 2016 on key issues including harmful algal bloom, induced seismicity, natural disaster preparedness, climate and land use change, ecosystem impacts, and water quality and availability. The OCAP prepared witnesses for six hearings and conducted more than 80 courtesy visits to congressional offices. The USGS social media efforts in 2016 resulted in more than 547,000 Twitter followers and 437,724 Facebook followers. The OCAP also responded to more than 14,400 ASK USGS phone calls and 16,500 email inquiries ranging from a variety of topics including hazards, water, biology, and mapping.

Energy Efficiency – In 2016, the USGS reached its Fleet Green House Gas (GHG) reduction goal and continued to improve utilization data collection and reporting. The Office of Management Services (OMS) provides ongoing guidance and training to field staff regarding utilization, work orders, and reallocation of vehicle expense funds to improve overall fleet data collection. The USGS Eco Action Plan identified areas where improvement in fleet GHG reduction is needed, and promotes the use of alternative fuel. The USGS will continue its efforts in reduction of 2017 GHG emissions with timely disposal of less fuel efficient vehicles, declared as excess or unserviceable, while maintaining a 95 percent alternative fuel vehicle rate for new acquisitions.

Employee Safety – The USGS continues to lead Interior with the lowest accident rates of bureaus of equal size or larger, attributable to a focus on establishing organizational accountability through adoption of formal performance metrics and customer surveys that ensure success in achieving Department of the Interior (Interior) Occupational Safety and Health (OSH) strategic plan and outcomes. The USGS metrics are supplemented with initiatives to increase supervisor and employee awareness and implementation of safety and health requirements, such as through Physical Hazard Analysis (PHA) that allows all employees to identify hazards and mitigation measures and required OSH training associated with their job activities and tasks. Educational efforts will also continue in 2017, by conducting over 25 classroom courses for more than 100 Collateral Duty Safety Program Coordinators to increase their knowledge, skills, and abilities in support of supervisors and employees.

Science Education – The Youth and Education in Science (YES) Program helped to train nearly 1,100 young scientists through internships, partnerships, and hires. These young scientists contributed to all mission areas while developing workforce skills. The USGS scientists worked directly with over 400,000 students and teachers, in addition to 273,000 educators that utilized the USGS website as an educational resource. The USGS is also working in partnership with the National Science Foundation (NSF) Graduate Internship Program to expand opportunities for NSF Graduate Fellows to enhance their professional development by engaging in mission-related research experiences with the USGS.

Strategic Planning and Change Management Role – The USGS Organizational Development (OD) program office serves as experts in effective and efficient strategic planning processes and change management. In 2016, at least 75 percent of OD program work consisted of leading and facilitating change and strategic science planning, as well as tactical and operational planning for organizations in each mission area and regional office. The OD expert guidance and process ensures that management and science teams maximize their time and efforts using appropriate planning methods and tools, while generating a thorough and quality product that ensures support and ownership in execution.

In 2017, the USGS is examining organizational alignment and structures to maximize efficiencies and best use of resources. The Organizational Development program will provide a key role in leading and facilitating complex decision-making meetings, setting priorities, and ensuring management teams effectively navigate consensus on realignment, reorganizing, and maximizing resources. The OD office can provide a systematic and efficient planning and reorganization process for USGS.

Technology Transfer – The Federal Technology Transfer Act, 15 USC 3710 as amended, requires each Federal laboratory having 200 or more full-time scientific, engineering and related technical positions to establish a research and technology application function. Within the USGS, this function is housed in the Office of Policy and Analysis where staff service USGS Science Centers and offices throughout the Country. USGS science and research contributes to a broad range of valuable collaborative projects in the private and academic sector.

During 2016, the USGS increased its technology transfer activity both in terms of number of collaborations and projects and reimbursable funding. The USGS executed 8 new Cooperative Research and Development Agreements (CRADA) and 498 new Technical Assistance Agreements (TAA), making for 29 active CRADAs and 829 active TAAs. The USGS had 28 specialty analytical laboratory services

Science Support

providing unique capabilities to the United States, private sector partners, and academia. New facility use agreements executed during 2016 totaled more than 180. The USGS has an active patent portfolio that has more than 40 patents on inventions ranging from sensors to biotechnology improvements.

Workforce Planning – The USGS recently released and implemented the USGS Workforce Plan 2015 – 2020 to help provide supervisors, managers, and leaders with strategies and tools to attract, develop, retain, and manage a workforce with the right skillset and characteristics to accomplish the bureau’s mission within a complex and changing operational environment.

Enhancing Science Collaboration through Information Management and Technology – The USGS continues to advance its use of cloud technology through its Cloud Hosting Solutions (CHS) program. CHS provided the USGS science with a platform that supports on-demand delivery of IT resources and enabled data driven science. During 2016, CHS migrated 20 applications into operation/production and test/development cloud environments as well as deployed a sandbox environment that provides a safe environment for customers to test cloud services. In 2017, CHS is migrating additional science applications to the cloud environment and deploying tools that will enhance USGS science data. Training in virtualization and alternative application tools was also provided to numerous USGS Science Centers during 2016, along with the establishment of the USGS Strategic Laboratory Committee, highlighting the bond between science and science support. Connectivity is key to sharing scientific data and, during 2016, Information Services collaborated on a cost-efficient network connection between the USGS Science Centers in Rolla, MO, and Denver, CO, enabling the successful transmission of high volume lidar data. Working collaboratively with the science communities, the USGS also processed 200 Freedom of Information Act requests that shared important scientific information with the public.

Managing Information Management and Technology Resources – In 2016, Information Services worked jointly with the USGS Science Centers to develop a draft Federal Information Technology Acquisition Reform Act (FITARA) plan. The plan’s success was recognized by Interior as a model and has provided the platform for the development of implementation processes in 2017. Improvements include capturing planned IMT acquisition, regardless of amount, through a bureau-wide operating plan and testing tracking of IMT expenditures with flags and codes in the financial system. Information Services formed a bureau-wide collaboration team to develop the plans and ensure stakeholder buy-in. The plan improves IMT portfolio alignment with the current management structure, tracks IMT acquisitions and staff, formalizes delegated responsibilities and provides for the certification of IMT accountability by Bureau leadership, which strengthens executive governance of IMT policies and investments.

Protecting USGS Data Assets – In 2016, Information Services continued to provide enterprise-wide services, which protect the integrity of systems, applications and data as well as ensure reliable and continual access to resources. The USGS implemented controls across mission areas to secure IT systems from misuse, unauthorized access, and unofficial data modification. During this period, Information Services assessed 100 security controls associated with 165 assessment objectives for all USGS IT systems in support of the Annual Assurance Statement. Information Services also coordinated and

tracked the remediation of over 560,000 vulnerabilities and deployed security software to over 13,500 USGS systems.

Strategic Actions Planned through 2018

The essential support functions and services provided by the Science Support activity form the foundation for the USGS science mission. Achieving high-quality science research depends on having the required resources, including scientific equipment and supplies, facilities and laboratories, scientists, technicians and researchers; information technology security, infrastructure and information management; partnership agreements and contracts in place; and the management processes to control and best utilize these resources. The organizations funded by the Science Support Activity will contribute to a robust national scientific community.

In 2017, the Science Support Activity will conduct assessments and implement succession planning to align strategic goals and human resources to achieve the USGS mission; develop distance learning courses for training all staff on technology transfers to enable USGS researchers to partner with the private sector, leverage resources, and share ideas in a protected environment; increase partnerships with the Public Land Corps groups as a pathway to intern hiring to offer the Nation's youth unparalleled experiences to conserve the nature of America; implement a cybersecurity assessment and authorization restructuring plan to increase efficiencies in compliance reporting, data categorization granularity, and increase protection of scientific data; execute the DHS cybersecurity continuous monitoring and diagnostics program elements to enhance the protection of the USGS science data and assets; and develop processes and guidance for the full bureau-wide implementation of FITARA.

In 2018, the Science Support Activity will decrease its level of support to science centers. The 2018 budget request will delay timeliness of awarding stand-alone acquisition and financial assistance transactions and result in the USGS not being able to adapt solutions to emerging priorities and requirements; delay the validation and review of cybersecurity requirements and efforts to move to the cloud; eliminate or diminish automation initiatives that may increase the risks for internal controls, improper payments, and delinquent debts; and could impact scientific integrity principals. In addition, the Office of Human Capital would continue to experience longer processing times, and even further miss the 80-day mandated hiring model by the Office of Personnel Management. The 2018 budget request may reduce USGS's ability to keep up with changes in the workforce, which now requires more high-tech skillsets and tools, and deliver science information and data to policy and decision makers.

A significant portion of Science Support funds are required departmental costs for program activities and enterprise-wide systems. The costs for activities in the Department's Working Capital Fund central and direct billings to the bureaus are not estimated to decrease, which will result further reduction to Science Support program dollars.



Science Support Administration and Management

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Science Support	\$105,611	\$105,410	\$1,082	\$0	-\$17,124	\$89,368	-\$16,042
<i>FTE</i>	<i>509</i>	<i>509</i>	<i>0</i>	<i>0</i>	<i>-145</i>	<i>364</i>	<i>-145</i>
Administration and Management	\$81,981	\$81,825	\$944	\$0	-\$13,390	\$69,379	-\$12,446
<i>FTE</i>	<i>451</i>	<i>451</i>	<i>0</i>	<i>0</i>	<i>-140</i>	<i>311</i>	<i>-140</i>

The 2018 budget request for the Administration and Management is \$69,379,000 and 311 FTE, a program change of -\$13,390,000 and -140 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$944,000.

Overview

The Administration and Management Subactivity provides bureau-wide leadership and direction; establishes organizational vision, mission, goals and scientific priorities; develops and enforces standards for scientific rigor and integrity; plans, obtains and manages necessary resources, including people, budget authority, facilities and equipment; provides resource management systems; implements statutory and regulatory requirements and monitors and enforces compliance; and communicates the USGS mission and science to Congress and the public. Administration and Management is comprised of the following areas:

The USGS **Office of the Director** performs chief executive officer and chief operating officer responsibilities.

The science mission area **Associate Directors** establish program direction and goals, and serve as science advisors to the Director in their respective program areas.

The **Regional Directors** exercise line management responsibility for the science centers and implement science projects on the landscape.

The **Office of Budget, Planning, and Integration (BPI)** secures funding resources needed for the USGS to perform its mission goals, facilitates information sharing internally and externally, provides oversight of the internal controls process and the USGS Working Capital Fund, and provides in-depth

Science Support

analysis of USGS goals, strategies, performance and budget data for the USGS to understand, anticipate, and respond to the changing demands resulting from public policy decisions and science needs.

The **Office of Communications and Publishing (OCAP)** guides and conducts public affairs, legislative relations, customer service, external stakeholder, and internal communications and provides publishing and Web development services. The Science Publishing Network (SPN) provides services including technical writing, editing, design, and illustration to prepare scientific reports and maps for publication. This information is widely used across the Nation by members of Congress and their staff, other natural resource planners and managers, recreational hunters and hikers, emergency response officials, and the media.

The **Office of Science Quality and Integrity (OSQI)** establishes and implements bureau-wide standards for scientific integrity and quality and administers offices and programs for ethics; fundamental science practices; research evaluation, review, and recognition; and tribal relations, including the USGS Office of Ethics, the Youth and Education in Science program, the Mendenhall Postdoctoral Fellowships, the Research Grade Evaluation (RGE) and Equipment Development Grade Evaluation (EDGE) program, the Scientist Emeritus program, and the Office of Tribal Relations.

The **Office of International Programs (OIP)** enhances the USGS scientific mission by providing opportunities for USGS scientists to interact with scientific partners abroad and extend research and investigations to other countries. The OIP supports the development and conduct of a broad spectrum of international activities involving scientific cooperation and assistance in geological, hydrological, biological, and geospatial research and scientific investigations. The OIP provides guidance and representation to domestic and international agencies and organizations in matters pertaining to international scientific activities of the USGS.

The **Office of Diversity and Equal Opportunity (DEO)** develops policies and procedures, administers the federally mandated EEO and Diversity related programs, facilitates early resolution of discrimination complaints, and develops guidelines to ensure proper implementation of Equal Opportunity laws and regulations. DEO staff chair the USGS Diversity Council, coordinate outreach and recruitment events focused on minorities with the various mission areas, and develop and submit required/mandatory reporting on EEO Complaints and Diversity. The office is also responsible for ensuring the USGS provides reasonable accommodations to employees/applicants with disabilities.

The **Office of Administration (OA)** establishes policies, manages, coordinates, provides oversight and conducts operations in the areas of accounting and fiscal services, general services, security, safety and occupational health, acquisitions and grants, internal controls, technology transfer, facilities and property, environmental protection, human capital programs, including human resources and employee development. The Associate Director is the Chief Financial Officer (CFO) and Designated Agency Safety and Health Official (DASHO).

The Administration and Management Subactivity contributes to a robust national scientific community and trains future scientists through youth work experiences in the USGS scientific mission areas; maintains the Mendenhall Research Fellowship Program to a consistent high standard for projects and researchers; manages the Publications Warehouse, which provides a comprehensive program to make USGS publications, research results and datasets more accessible; implements Web Reengineering in order to streamline USGS internal and external Web sites; leads workforce planning and leadership succession planning; and implements process improvement principles to evaluate human capital and acquisitions to increase operational efficiency and improve science mission support.

2018 Program Changes

Reduce Administration and Management (-\$12,446,000/-140 FTE): A reduction to the A&M workforce would further delay hiring, which impacts mission areas research and prohibits us from meeting the OPM mandated 80-day hiring process. These reductions also limit strategic sourcing initiatives and decrease the timeliness of awards by our acquisition and contract staff, directly impacting the science, along with impacting States and universities that receive grants. In addition, these decreases will also reduce publications of scientific reports that are widely used by decision makers, natural resource planners, and Congress; eliminate youth outreach activities contributing directly to STEM capabilities for the Nation; impact cooperative work with international counterparts; and reduce technology transfers and patent programs resources, impacting our scientific inventions.

Reduce Administration and Management Operations (-\$944,000/0 FTE). This reduction would diminish A&M's ability to execute its core activities including hiring, contracting, accounting functions, and other activities that support the science mission of the bureau. This proposed reduction will reduce staff training and travel, procurement of needed equipment and services, and the ability to maintain and invest in information technology that are essential to the core mission work of the program.

Science Collaboration

The Office of Communications and Publishing developed a Water Data Dashboard in collaboration with the Water Resources mission area to enable users to explore real-time State-based streamflow, groundwater, and water-quality conditions and access data via a new interactive map application.

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Science Support Information Services

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Science Support	\$105,611	\$105,410	\$1,082	\$0	-\$17,124	\$89,368	-\$16,042
<i>FTE</i>	<i>509</i>	<i>509</i>	<i>0</i>	<i>0</i>	<i>-145</i>	<i>364</i>	<i>-145</i>
Information Services	\$23,630	\$23,585	\$138	\$0	-\$3,734	\$19,989	-\$3,596
<i>FTE</i>	<i>58</i>	<i>58</i>	<i>0</i>	<i>0</i>	<i>-5</i>	<i>53</i>	<i>-5</i>

The 2018 budget request for the Information Services is \$19,989,000 and 53 FTE, a program change of -\$3,734,000 and -5 FTE from the 2017 Annualized Continuing Resolution (CR) level. This funding level includes a fixed costs change of \$138,000.

Overview

The Information Services subactivity provides the critical IMT foundation for the USGS science mission by implementing advances in IMT and using them to facilitate research, data gathering, analysis and modeling, scientific collaboration, knowledge management and work processes. This subactivity funds numerous IMT services such as the USGS information assurance program, infrastructure and computing services, applications and customer support, and information and investment management programs. In addition to IMT services, this subactivity also supports the Interior IMT bureau activities. Although Information Services has been confronted with competing mission challenges resulting from cyber security incidents and the implementation of the Federal Information and Technology Acquisition Reform Act (FITARA), the subactivity continues to provide critical bureau-wide IMT services necessary to support a successful and respected science organization.

2018 Program Changes

Reduce Information Services Program (-\$3,596,000/-5 FTE): The 2018 budget request would limit resources to fund cybersecurity efforts in the cloud and increases response times to requests for cybersecurity reporting. It would also reduce collaborative and automation activities that support the science mission and eliminates this program's support for Open Data Initiative, Data.gov and Open Science Initiatives, and reduces resources supporting the Federal IT Acquisition Reform Act (FITARA) compliance. It would reduce investment in the information infrastructure, increasing risk of system failures and loss of science data.

Science Support

Reduce Information Services Operations (-\$138,000/0 FTE): This reduction would diminish Information Services' ability to execute its core activities including cybersecurity efforts in the cloud and elongated response times to requests for cybersecurity reporting, collaborative activities and automation activities that support the science mission of the bureau. This proposed reduction will reduce staff training and travel, procurement of needed equipment and services, and the ability to maintain and invest in information technology.

Science Collaboration

Information Services provides shared services with Interior, and its bureaus, by consolidating numerous software purchases that deliver economies of scale. Information Services also functions as the service provider of fiber optic cabling for offices within Interior and its bureaus, as well as for agencies within the U.S. Forest Service, the Department of Labor, the General Services Administration and other Federal agencies.

Facilities



Facilities



**USGS facilities enable our employees
To conduct the science required to fulfill the
USGS mission.**

The Vincent E. McKelvey at
the USGS Menlo Park campus.

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Facilities	\$100,421	\$100,230	\$11,963	\$0	\$0	\$112,193	\$11,963
<i>FTE</i>	60	60	0	0	0	60	0
Rental Payments and Operations & Maintenance	\$93,141	\$92,964	\$11,963	\$0	\$0	\$104,927	\$11,963
<i>FTE</i>	60	60	0	0	0	60	0
Deferred Maintenance and Capital Improvement	\$7,280	\$7,266	\$0	\$0	\$0	\$7,266	\$0
<i>FTE</i>	0	0	0	0	0	0	0

Summary of Changes

Request Component	(\$000's)	FTE	Fixed Costs	Page
Rental Payments and Operations & Maintenance	0	0	+11,963	M--5
Rent Increase	0	0		
Deferred Maintenance and Capital Improvement	0	0	0	M--9
Total Program Change	0	0	+11,963	

Summary of Budget Request

The 2018 Budget Request for Facilities is \$112,193,000 and 60 FTE, level with the 2017 Annualized Continuing Resolution (CR) level. This includes a fixed costs change of +\$11,963,000.

Overview

The USGS Facilities Activity provides safe, functional workspace to accomplish the bureau's scientific mission with an emphasis on the mission driving facility needs. Funds support basic facility operations;

Facilities

security; facility maintenance in compliance with Federal, State, and local standards; and provide a safe working environment for USGS employees, visiting partners, and customers.

Assets include property consisting of land, buildings, or other improvements permanently attached to the land or a structure on it. Facilities typically provide space for offices, laboratories, storage, parking, shared support for cafeterias, conference rooms, and other common space uses. The USGS classifies eight large research vessels as laboratory facilities. Owned assets are usually part of a campus, for example, the Leetown Science Center includes all associated land, buildings, and other structures.



USGS Research Vessel (R/V) Kiyi, based in Bayfield, WI, currently operates on Lake Superior.

The Facilities Activity is comprised of two subactivities: Rental Payments and Operations and Maintenance (RP and O&M), and Deferred Maintenance and Capital Improvements (DMCI).

This Activity supports Interior's goal of facilities improvement by tracking outcomes, such as overall condition of buildings and structures; reduction of energy intensity by 2.5 percent annually and cost savings initiatives through space consolidations.

The Facilities program goal is to meet bureau science needs while optimizing facility locations, distributions, use, and to control or reduce costs. Objectives for meeting this goal are to:

- Coordinate facility planning with science planning to provide safe, high-quality workspace aligned with science needs.
- Develop Asset Business Plans to meet asset management goals, continue annual surveys, and cyclic condition assessments.
- Meet performance targets for improving space utilization, controlling rent and operating costs, and releasing unneeded space.
- Reduce deferred maintenance by renovating and constructing buildings and other facilities to replace assets otherwise no longer cost effective to operate.
- Establish an effective maintenance program at each owned facility to meet industry best practices.
- Increase co-location consistent with science program objectives.
- Achieve sustainability, energy and water reduction goals.

Facility Planning – The USGS owns 281 buildings situated on 2,157 acres. These buildings total over 130 million square feet and have a replacement value of more than \$405 million. Approximately 60 percent of USGS owned buildings are over 40-years old.

Additionally, the USGS owns 354 structures with a replacement value of \$129.5 million. The owned inventory includes 10 ecological science centers; 5 ecological field and research stations; 1 land resources

science center—the National Center for Earth Resources Observation Science (EROS); and 15 geomagnetic, seismic and volcano observatories.

The USGS also owns eight large research vessels that have operations and maintenance costs that are comparable to those of a USGS building. These vessels exceed 45 feet in length and perform overnight research to support biological, water resources, and marine geology research. Five of the vessels operate on the Great Lakes; two operate in California; and one operates in Alaska

The USGS utilizes site-specific Asset Business Plans (ABPs) that support the USGS Asset Management Plan (AMP). The ABPs provide a framework, strategic vision, and plan of action for effective bureau management of General Services Administration (GSA) provided space, USGS direct leases, and owned property. These five to 10-year strategies are developed by Science Center Directors addressing specific needs of a field unit, campus, or region including all assets reported in the Federal Real Property Profile (FRPP). The USGS ABPs effectively address the life cycle issues and characteristics of a site's real property assets. ABPs implement bureau space management goals, including consolidation, co-location, and disposal.

The USGS relies on GSA-owned and -leased buildings for nearly 63 percent of the space it occupies. The USGS cannot influence the market-based rental rates at these sites. To reduce costs, the USGS emphasizes improving space utilization, disposing of underutilized assets, and consolidating operations to relinquish space to GSA. This space includes offices, laboratories, data centers, and warehouses at major USGS centers in Reston, VA, Denver, CO, and Menlo Park, CA.

As part of the USGS Strategic Facilities Master Plan, USGS ranked facilities in terms of their mission dependency using a tool called the Asset Priority Index. Although the largest concentrations of employees are in GSA-controlled space in Reston, VA, Denver, CO, and Menlo Park, CA, 15 of the top 20 mission-critical assets are owned assets in other locations. These owned assets have specialized capabilities positioned on the landscape to address specific science issues. One example of this is the EROS Data Center (EROS), located in Sioux Falls, SD. When EROS was conceived, it was decided that it needed to be centrally located for receiving data as Landsat satellites passed over the United States. The EROS location eliminates the need for locating a ground station on both the west coast and the east coast to ensure coverage of the conterminous United States.

Another example of specialized capability is the National Wildlife Health Center (NWHC), in Madison, WI. The USGS maintains the only Federal high-biocontainment facility dedicated to wildlife disease surveillance and research. Without this facility, the Nation would lose its ability to investigate the causes of wildlife diseases and to develop management options to mitigate the devastating impacts of epidemics such as those caused by white-nose syndrome in bats. The NWHC, a high-security infectious disease facility that operates at Biological Safety Level 3, benefits public health because over 70 percent of emerging human zoonotic diseases circulate in wildlife (e.g., plague, monkeypox) and benefits the economy because nearly 80 percent of livestock diseases are shared with wildlife (e.g., avian influenza). The USGS supports the U.S. Department of Agriculture (USDA) as the lead under the Department of Homeland Security's Federal Emergency Management Agency's National Response Plan, Emergency Support Function #11 (Agriculture and Natural Resources Annex). Built in approximately 1960, the NWHC is reaching the end of its usable life.

Reduce the Footprint (RTF) – Space reductions and cost savings are integral to rent and operations management. The USGS realizes space savings with space consolidations or relocations to spaces with lower costs. The USGS participates actively in Interior’s Reduce the Footprint (RTF) targets and proceeding with a Real Property Efficiency Plan. The USGS’s goals under the plan are to reduce its footprint and costs, and move toward a 180 SF per person utilization standard. To focus on meeting these goals, the USGS has a centralized space-action approval process and a five-year planning process for Cost Savings and Innovation Plan (CSIP) projects. The processes include a ranking, scoring, and approval process as well as identifying funding for CSIP/RTF projects. The USGS is prioritizing RTF projects that have the shortest payback period and significantly reduce the Bureau’s footprint.

Maintaining America’s Heritage (MAH) is Interior’s commitment as a steward of priceless and natural resources to preserve and maintain operational facilities and major equipment. The 2018 budget includes \$41.7 million for this effort. Of this, \$7.3 million is for Deferred Maintenance and Capital Improvements (DMCI), including facility projects, equipment maintenance, maintenance management, condition assessment, and project planning. Operations and maintenance for USGS facilities is \$34.4 million.

Strategic Actions Planned Through 2018

In 2018, the USGS will begin relocating non-lab personnel and functions from the GSA-owned Menlo Park campus to the National Aeronautics and Space Administration’s Ames Research Center (NASA-Ames) located at Moffett Field in Mountain View, CA, in order to achieve long-term space reductions and cost savings.

In 2017 and 2018, the USGS will continue making efforts to ensure that energy reporting and Greenhouse Gas (GHG) emissions reporting for fully serviced building leases over 10,000 rentable square feet are included as requirements for lessors. This is a requirement of E.O. 13693 *Planning for Federal Sustainability in the Next Decade*.

The USGS will continue to focus on meeting the sustainable building and energy efficiency goals as outlined in E.O. 13693 *Planning for Federal Sustainability in the Next Decade*.

The USGS will also:

- Continue to reduce space and improve sustainability, including improving the space utilization at the USGS National Center in Reston, VA, and, continue consolidation efforts related to the Denver Federal Center and the Menlo Park campus.
- Renovate 15 additional cableways and remove 10 for public safety through DMCI funds.
- Replace obsolete observation systems and backup power capabilities at communication hubs that provide centralized data flow through the Northern California Seismic Network and the National Strong Motion Program.



Facilities

Rental Payments and Operations and Maintenance

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Facilities	\$100,421	\$100,230	\$11,963	\$0	\$0	\$112,193	\$11,963
<i>FTE</i>	<i>60</i>	<i>60</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>60</i>	<i>0</i>
Rental Payments and Operations & Maintenance	\$93,141	\$92,964	\$11,963	\$0	\$0	\$104,927	\$11,963
<i>FTE</i>	<i>60</i>	<i>60</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>60</i>	<i>0</i>

Justification of Program Change

The 2018 budget request for Rental Payments and Operations and Maintenance is \$104,927,000 and 60 FTE, level with the 2017 Annualized Continuing Resolution (CR) level. This includes a fixed costs change of +\$11,963,000.

Overview

The Rental Payments (RP) and Operations and Maintenance (O&M) Subactivity provides the USGS with funding needed to meet asset management goals and carry out Executive Orders (E.O.) related to Federal space.

In 2018, the USGS projects rent and operations and maintenance costs will be \$143 million, with rent costs estimated to be \$102 million and approximately \$41 million to be spent on operations and maintenance of USGS owned properties that are mission critical. Of these projected costs, 73 percent (\$104.9 million) are funded through this subactivity with the remainder funded by mission areas and reimbursable partners.

Rental payments are to GSA, other Federal sources, private lessors, and cooperators for space occupied by the USGS. The USGS has unique facility requirements for supporting science functions and relies heavily on GSA to meet those needs, including modern laboratory space. The USGS occupies approximately four million square feet of rentable space in about 172 GSA buildings nationwide, making the USGS one of the largest users of GSA space within Interior. Nearly 20 percent of USGS space is owned; the remaining 80 percent of the USGS space is provided through GSA, direct leases with the

Facilities

private sector, and cooperative and interagency agreements with State and local governments, universities, and other Federal agencies.

The Operations and Maintenance cost component provides funding for basic facility operations and security and facility maintenance, providing a safe working environment for USGS employees, visiting partners, and customers. Maintenance involves the upkeep of USGS owned facilities, structures and capitalized equipment, necessary to maintain the useful life of the asset. To protect its important resources, ongoing investments in annual and cyclic maintenance, repair, revitalization, and disposal of assets must be considered as a part of a long-term operations and maintenance program. Operational costs at USGS owned facilities include costs such as utilities, janitorial services, waste management, and salaries for staff responsible for the day-to-day operations of the facility. The USGS also funds the operations and maintenance of its research vessels from this subactivity.

The full cost of USGS rent, operations, and maintenance are only partially covered by this subactivity. The balance is covered by science programs. In 2016, the science programs funded \$12.5 million of rent and O&M. The USGS estimates that science programs will fund \$5.1 million in rent and O&M in 2017 and \$5.7 in rent and O&M in 2018.

The USGS relies on GSA-owned and -leased buildings for nearly 63 percent of the space it occupies. The USGS cannot influence the market-based rental rates at these sites. To reduce costs, the USGS emphasizes improving space utilization, disposing of underutilized assets, and consolidating operations to relinquish space to GSA. This space includes offices, laboratories, data centers, and warehouses at major USGS centers in Reston, VA, Denver, CO, and Menlo Park, CA. The USGS is also working with GSA to explore options for relocating labs located in Building 20 on Denver Federal Center (DFC), Denver, CO.

The USGS has leveraged its Deferred Maintenance and Capital Improvement funding to support its Cost Savings and Innovation Plan (CSIP) footprint reduction projects allowing the USGS to reduce its footprint by more than 765,000 RSF from 2012 through 2017. These efforts focused on three major centers in Reston, VA, Denver, CO, and Menlo Park, CA. Each of these centers have successfully completed major consolidation projects, reduced space requirements, actively sought co-location opportunities and vacated more expensive space.

Menlo Park – In 2018, the USGS will relocate non-lab personnel and functions from the GSA-owned Menlo Park campus to the National Aeronautics and Space Administration’s Ames Research Center (NASA-Ames) located at Moffett Field in Mountain View, CA, approximately 12 miles away. This involves moving approximately 200 non-lab personnel in early 2018. The USGS is working with NASA to identify if cost-saving opportunities exist to move the remaining personnel, labs, special technology capabilities, and warehouse space to Moffett Field.

Denver Federal Center Building 20 –Built in 1941, and partially renovated in 1988, Building 20 is well past its designed lifespan and the building does not meet the needs for USGS lab space. Deteriorating conditions jeopardize the USGS science mission. These include frequent roof leaks, inadequate building mechanical equipment, inefficient energy usage, and disruptions to building services. The conditions

have a direct impact on the ability of the USGS to conduct research. The USGS is working with GSA for a solution.

The Denver Federal center consolidation efforts included moving out of older GSA-owned building into newer buildings more suitable for USGS functions, such as Building 25, Building 95, and Building 810. Consolidations in 2018 will further reduce the USGS space requirement by an additional 2,700 SF.

National Center in Reston, VA – At the USGS National Center in Reston, VA, the USGS performs building operations and maintenance under GSA delegated authority and has day-to-day control of most space assignments. Of the approximate 1.1 million square foot (SF) facility at the National Center, the USGS supports Interior and other agencies by providing nearly 280,000 SF (approximately 25 percent) of released space to other Federal partners. In 2017, that will decrease to about 230,000 SF (23 percent) as one Interior group relocates. The USGS continues to seek opportunities to consolidate functions to improve space utilization at the National Center, including actively seeking additional Federal partners to occupy the space.

The USGS will continue a co-location project with the Bureau of Reclamation, in Boulder City, NV. This project, with the target completion in 2017, will reduce the rent costs by \$450,000 and reduce Interior's footprint by 3,000 SF.

Energy Sustainability Efforts – The USGS has made great strides in reducing the energy intensity of its owned and leased buildings. The recent E.O. 13693 *Planning for Federal Sustainability in the Next Decade* requires an additional 25 percent decrease from 2015 to 2025. The USGS has accomplished a 3.6 percent decrease in 2016. The USGS has completed a bureau-wide Energy Savings Performance Contract (ESPC) study and implemented ESPCs five of its owned facilities and one at its leased and largest energy consuming facility in Reston, VA.

Ongoing Program Activities – Section 106 of the National Historic Preservation Act (NHPA) requires all Federal agencies to consider how their projects will have an effect on historic property. Simultaneously, Section 110 of the NHPA requires Federal agencies to inventory and evaluate properties under their control to determine if they are indeed historic. Projects under facilities management usually take the form of repair or replacement. The USGS meets these lawful requirements by evaluating its real property portfolio through the Comprehensive Condition Assessment Program (CCAP). Condition assessment results are then made available so project managers can determine if proposed projects will have any impact on historical properties. As part of E.O. 13327 *Federal Real Property Asset Management*, the results of the historic evaluations are transferred to Federal Real Property Reporting through the Federal Maintenance Management System (FMMS). To date, 222 real property assets have been evaluated to determine if they are historic. The USGS will continue to evaluate all of its properties, which is anticipated to continue through 2021.

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Facilities

Deferred Maintenance and Capital Improvements

	2016	2017	2018				Change from 2017 Annualized CR
	Base	CR Annualized	Fixed Costs	Internal Transfer Costs	Program Changes	Request	
Facilities	\$100,421	\$100,230	\$11,963	\$0	\$0	\$112,193	\$11,963
<i>FTE</i>	<i>60</i>	<i>60</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>60</i>	<i>0</i>
Deferred Maintenance and Capital Improvement	\$7,280	\$7,266	\$0	\$0	\$0	\$7,266	\$0
<i>FTE</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>

Justification of Program Changes

The 2018 budget request for Deferred Maintenance and Capital Improvements is \$7,266,000 and 0 FTE, level with the 2017 Annualized Continuing Resolution (CR).

Overview

Deferred maintenance is maintenance and repair activity that was not performed on owned assets (buildings, structures, and equipment) in the year it was scheduled.

The Deferred Maintenance and Capital Improvements (DMCI) program funds the highest priority USGS facility and equipment requirements. Unfunded maintenance results in a backlog of deferred maintenance needs, which was \$95 million at the end of fiscal year 2016. Those deferred maintenance needs are broken out as \$80 million for USGS owned facilities and \$850,000 for USGS large vessels. When USGS is located at facilities owned by other DOI bureaus or Federal agencies, USGS will at times pay deferred maintenance cost in lieu of rent. In 2016, these deferred maintenance cost included: \$9.6 million for U.S. Fish and Wildlife Services owned facilities, \$4.5 million for National Park Service, and \$240,000 for other Federal agencies. Besides increasing the deferred maintenance backlog, deferring maintenance can accelerate the rate of facilities deterioration, causing costlier future repairs and in some cases, necessitating unplanned repairs for health, safety, or asset protection.

Annually, the USGS develops a DMCI five-year plan. The plan provides the projects of greatest need in priority order that best support bureau missions, with focus first on critical health and safety and energy efficiency. The bureau has undertaken an extensive effort in developing this plan, identifying projects where the urgency of remediation and science program impact are most viable. The 2018 USGS DMCI five-year plan includes DMCI projects and other programs and stewardship responsibilities for unique

Facilities

mission equipment that are funded annually through the DMCI Program, such as hazard warning networks, river cableways, and stream gaging stations, all of which require maintenance and capital investments to preserve their functionality.

The USGS prioritizes DMCI according to Interior-wide guidelines. The USGS five-year plans are updated annually to focus limited resources on projects that are both mission critical and in the most need of repair or replacement. The process emphasizes projects that involve mission critical assets in unacceptable condition with less emphasis on non-mission critical assets. Facility Condition Index (FCI) is an industry accepted metric used to measure the condition of buildings and structures in the USGS real property portfolio.

The condition assessment process identifies deferred maintenance needs and determines the current replacement value of constructed assets. The condition assessment program includes annual surveys and a cyclic process for comprehensive onsite inspections to document deferred maintenance. Interior's Asset Management Plan specifies that bureaus update condition assessments annually and perform comprehensive condition assessments every five years for properties valued over \$50,000. Facilities projects reflect comprehensive evaluations conducted by independent architectural and engineering firms. These installation-wide assessments help establish core data on the condition of USGS constructed assets. Additionally, knowing the estimated cost of deferred maintenance and the replacement value of constructed assets allows the USGS to use the industry standard FCI as a method of measuring facility condition and condition changes. The condition assessment process also identifies, reports, and tracks asbestos, environmental, and disposal liabilities of USGS. Through the asset management planning process, the USGS identifies real property assets that are candidates for disposition. Any asset that is no longer critical to the mission, in poor condition, or no longer cost effective to maintain is a candidate for possible disposal.

Natural Hazards – The Northern California Seismic Network (NCSN) and National Strong Motion Program (NSMP) have significant inventories of obsolete and failing seismic instrumentation. The aging infrastructure stresses the ability of these networks to ensure the reliable recording of earthquake data critical for emergency response, earthquake engineering, and Earth science research.

In 2016, the NSMP completed the deployment of the “Networms,” which has allowed the USGS to extend the life of obsolete systems while reducing operational costs and extending the capabilities of the older instrumentation. The USGS purchased new equipment for both the NSMP and the NCSN and deployment of the new instrumentation is taking place in 2017, focused on the San Francisco Bay Area for the NCSN.

In 2018, the USGS will replace obsolete science instruments in structures such as buildings, bridges, dams, pipelines, and geotechnical arrays. Instrumented structures are a unique role of the USGS, and the data from these locations plays a critical role in influencing the development of building codes.

Water Resources – Cableways have been used for many decades by the USGS for the measurement of streamflow and collection of water-quality samples. The DMCI program supports the USGS streamgaging network by restoring vital cableways to safe operation, and removing unnecessary

cableways that present a potential hazard to employees and to the public. These cableways reduce the need for USGS personnel to work from dangerous highway bridges and allow the selection of sites that offer optimum hydraulic characteristics for measuring stream discharge. Cableways consisting of a main cable, anchors, support structures, backstays, cablecars, and other equipment are damaged and deteriorate from weather, vandalism, or erosion. There are 792 active cableways with 39 in need of inspections or repairs.

In 2017, the USGS plans to repair 26 cableways. In 2018, the USGS plans to repair 15 cableways and remove ten that are unserviceable. The USGS has 60 inactive cableways awaiting removal, 81 inactive cableways that will remain in place for possible future use, and 30 cableways are dismantled and awaiting remediation. The estimated backlog for cableway remediation is \$7.9 million.

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USGS Working Capital Fund



Working Capital Fund

The U.S. Geological Survey (USGS) Working Capital Fund (WCF) was established to allow for the efficient financial management of the components listed below. The WCF was made available for expenses necessary for furnishing materials, supplies, equipment, work, and services in support of USGS programs, and as authorized by law (authorization information begins on page 3 of this section), to agencies of the Federal Government and others. The WCF consists of four components:

1. The WCF **Investment** Component provides a mechanism to assist USGS managers in planning for and acquiring goods and services that are too costly to acquire in a single fiscal year or that, due to the nature of services provided must operate in a multi- as opposed to a single-year basis of funding. Investments are supported by documented investment plans that include estimated acquisition/replacement costs, a schedule of deposits, and approval of the plans, deposits and expenditures by designated USGS officials.
 - **Telecommunications Investments** are used for telecommunication hardware, software, facilities, and services. Examples include replacement or expansion of automatic exchange systems and computerized network equipment such as switches, routers, and monitoring systems.
 - **Equipment Investments** are used for the acquisition, replacement, and expansion of equipment for USGS programs. Equipment may include, but is not limited to, hydrologic, geologic, and cartographic instruments, laboratory equipment, and computer hardware and software.
 - **Facilities Investments** support facility and space management investment expenses for USGS real property, including owned and leased space. Authorized investment expenses include nonrecurring and emergency repair, relocation of a facility, and facility modernization. The component does not include annual expenses such as rent, day-to-day operating expenses, recurring maintenance, or utilities.
 - **Publications Investments** are used for the preparation and production of technical publications reporting on the results of scientific data and research. Research projects typically are three to five years in duration, and planning the medium in which to report results occurs over the life of the project. The Publications Investment Component provides a mechanism for establishing an efficient, effective, and economical means of funding publications costs over the duration of the research.
2. The WCF **Fee-for-Service** Component provides a continuous cycle of client services for fees established in a rate-setting process. Fees are predicated upon both direct and indirect costs associated with providing the services, including amortization of equipment required to provide the services.

- **The National Water Quality Laboratory (NWQL)** conducts chemical and biological analyses of water, sediments, and aquatic tissue for all USGS science centers and other customers, including other USGS mission areas, other Interior bureaus, and non-USGS customers. The NWQL also does biological classification for these customers. NWQL analysis services are provided on a reimbursable basis, with the price of services calculated to cover direct and indirect costs.
 - **The USGS Hydrologic Instrumentation Facility (HIF)** provides hydrologic instrumentation on a fee-for-service basis. The facility provides its customers with hydrologic instruments that can be rented or purchased, maintains a technical expertise on instrumentation, and tests and evaluates new technologies as they become available in the marketplace.
 - **Bureau Laboratories** – There are currently five laboratories within the Water Resources Mission Area that perform gaseous dissolved chlorofluorocarbon measurements, environmental microbiology analyses and isotope-ratio measurements of water, sediments, rocks, and gases for all USGS mission areas, and for USGS customers.
 - **The National Training Center** conducts USGS training programs. Examples include specialized training for USGS employees, cooperators, and international participants in many facets of Earth science, as well as computer applications, management and leadership seminars, and various workshops.
 - **Research Drilling Program** – The Drilling Program is operated out of two locations, Lakewood, CO, and Las Vegas, NV. The Drilling Program provides drilling and drilling related services to research projects across the United States. These services include conducting exploratory drilling and obtaining geologic samples and cores in difficult hydrogeologic environments, installation of sampling devices, monitoring wells and other sub-surface sensors, borehole geophysical logging, and well and aquifer hydraulic testing support.
3. The **GSA Buildings Delegation** Component is used to manage funds received under the delegated authority for the J.W. Powell Building and Advanced Systems Center in Reston, VA, as provided by 40 U.S.C. 121 (d) and (e) (formerly subsections 205 (d) and (e) of the Federal Property and Administrative Services Act of 1949, as amended, and 40 U.S.C. 486 (d) and (e), respectively). Delegated functions include building operations, maintenance, cleaning, overseeing fire and life safety, maintaining high voltage switchgear and fire alarms, recurring repairs, minor alterations, historic preservation, concessions, and energy management. Because of the size of the Reston buildings and the need to expend the facility funds in a manner corresponding to GSA's no-year funding (Federal Buildings Fund) mechanisms and the GSA National Capital Region long-range capital improvement plan, no-year funding is a prerequisite to administering the delegation. Public Law 104–208, Section 611, provides that, for the fiscal year ending September 30, 1997, and thereafter, any department or agency that has delegated authority shall retain that portion of the GSA rental payment available for operation, maintenance, and repair of the building and the funds shall remain available until expended. This WCF component was established in 2004 to provide USGS with this no-year flexibility.

Appropriation Language and Citations

Permanent authority:

1. Provided further, That, in fiscal year 1986, and thereafter, all amortization fees resulting from the Geological Survey providing telecommunications services shall be deposited in a special fund to be established on the books of the Treasury and be immediately available for payment of replacement or expansion of telecommunications services, to remain available until expended.
 - **43 U.S.C.50a** established the Telecommunications Amortization Fund, which was displayed as part of the Surveys, Investigations and Research appropriation from 1986 through 1990. Beginning in 1991, the Telecommunications Amortization Fund was merged into the WCF described in the next citation.

2. There is hereby established in the Treasury of the United States a working capital fund to assist in the management of certain support activities of the United States Geological Survey (hereafter referred to as the "Survey"), Department of the Interior. The fund shall be available on and after November 5, 1990, without fiscal year limitation for expenses necessary for furnishing materials, supplies, equipment, work, facilities, and services in support of Survey programs, and, as authorized by law, to agencies of the Federal Government and others. Such expenses may include laboratory modernization and equipment replacement, computer operations, maintenance, and telecommunications services; requirements definition, systems analysis, and design services; acquisition or development of software; systems support services such as implementation assistance, training, and maintenance; acquisition and replacement of computer, publications and scientific instrumentation, telecommunications, and related automatic data processing equipment; and, such other activities as may be approved by the Secretary of the Interior.

There are authorized to be transferred to the fund, at fair and reasonable values at the time of transfer, inventories, equipment, receivables, and other assets, less liabilities, related to the functions to be financed by the fund as determined by the Secretary of the Interior. Provided, That the fund shall be credited with appropriations and other funds of the Survey, and other agencies of the Department of the Interior, other Federal agencies, and other sources, for providing materials, supplies, equipment, work, and other services as authorized by law and such payments may be made in advance or upon performance: Provided further, That charges to users will be at rates approximately equal to the costs of furnishing the materials, supplies, equipment, facilities, and services, including such items as depreciation of equipment and facilities, and accrued annual leave: Provided further, That all existing balances as of November 5, 1990, from amortization fees resulting from the Survey providing telecommunications services and deposited in a special fund established on the books of the Treasury and available for payment of replacement or expansion of telecommunications services as authorized by Public Law 99-190, are hereby transferred to and merged with the working capital fund, to be used for the same purposes as originally authorized. Provided further, That funds that are not necessary to carry out the activities to be financed by the fund, as determined by the Secretary, shall be covered into miscellaneous receipts of the Treasury.

P.L. 101-512 Department of the Interior and Related Agencies Appropriations Act, 1991 This authority established a Working Capital Fund account in 1991. The Telecommunications Amortization Fund was included as part of the WCF and all balances of the Telecommunications Amortization Fund existing at the end of 1990 were transferred to the WCF. These balances were to be used for the same purposes as originally authorized.

P.L. 103-332 Department of the Interior and Related Agencies Appropriations Act, 1995 The amendments that were made in this appropriations act are shown in underline in the second citation shown above. This authority expanded the use of the Working Capital Fund to partially fund laboratory operations and facilities improvements and to acquire and replace publication and scientific instrumentation and laboratory equipment.

United States Geological Survey
Federal Funds

General and special funds:

WORKING CAPITAL FUND

Program and Financing

(In millions of dollars)

Identification Code		2016 Actual	2017 CR Annualized	2018 Request
14-4556-0-4-306				
	Obligations by program activity:			
08.01	Working Capital Fund	77	112	85
	Budgetary resources:			
	Unobligated balance:			
10.00	Unobligated balance carried forward, start of year	90	96	68
10.21	Recoveries of prior year unpaid obligations	2	0	0
10.50	Unobligated balance total	92	96	68
	Budget Authority:			
	Spending Authority from offsetting collections, disc			
17.00	Collected	81	84	76
19.30	Total budgetary resources available	173	180	144
	Memorandum (non-add) entries:			
19.41	Unexpired unobligated balance, end of year	96	68	59
	Change in obligated balances:			
	Obligated balance, start of year:			
30.00	Unpaid obligations, brought forward, Oct 1	28	27	58
30.10	Obligations incurred, unexpired accounts	77	112	85
30.20	Outlays, Gross	-76	-81	-78
30.40	Recoveries of prior year obligations	-2	0	0
	Obligated balance, end of year:			
30.50	Unpaid Obligations, end of year (gross)	27	58	65
	Budget authority and outlays, net:			
	Discretionary			
40.00	Budget authority, gross	81	84	76
	Outlays, gross:			
40.10	Outlays from new discretionary authority	35	38	34
40.11	Outlays from discretionary balances	41	43	44
40.20	Outlays, gross	76	81	78
	Offsets against gross budget authority and outlays:			
	Offsetting collections (collected) from:			
40.30	Federal Sources	-80	-83	-75
40.70	Budget authority, net (discretionary)			
40.80	Outlays, net (discretionary)	-5	-3	2
41.80	Budget authority, net (total)			
41.90	Outlays, net (total)	-5	-3	2

WORKING CAPITAL FUND

Balance Sheet

(In millions of dollars)

Identification Code		2015	2016
14-4556-0-4-306		Actual	Actual
	ASSETS:		
	Federal assets:		
1101	Fund balances with Treasury	111	111
	Investments in U.S. securities:		
1106	Receivables, net		
1803	Other Federal assets: Property, plant and equipment, net	34	34
1999	Total assets	145	145
	LIABILITIES:		
2101	Federal liabilities: Accounts payable		
2201	Non-Federal liabilities: Accounts payable	4	4
2999	Total liabilities	4	4
	NET POSITION:		
3300	Cumulative results of operations	141	141
3999	Total net position	141	141
4999	Total liabilities and net position	145	145

WORKING CAPITAL FUND

Object Classification

(In millions of dollars)

Identification Code 14-4556-0-4-306	2016 Actual	2017 Enacted	2018 Request
Reimbursable obligations:			
Personnel compensation:			
11.1 Full-time permanent	11	10	9
11.3 Other than full-time permanent	0	0	0
11.5 Other personnel compensation	1	1	1
11.9 Total personnel compensation	12	11	10
12.1 Civilian personnel benefits	4	4	3
21.0 Travel and transportation of persons	1	1	0
23.1 Rental payments to GSA	2	2	1
23.3 Communications, utilities, and miscellaneous charges	0	0	0
24.0 Printing and reproduction	0	1	0
25.2 Other services	10	19	10
25.3 Other purchases of goods and services from Government Accounts	7	17	15
25.4 Operation and maintenance of facilities	6	3	7
25.7 Operation and maintenance of equipment	3	4	3
26.0 Supplies and materials	5	5	5
31.0 Equipment	26	42	29
32.0 Land and structures	1	3	2
99.9 Total new obligations	77	112	85

WORKING CAPITAL FUND

Employment Summary

Identification Code 14-4556-0-4-306	2016 Actual	2017 Enacted	2018 Request
Reimbursable:			
2001 Civilian full-time equivalent employment	152	152	152

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USGS Exhibits

United States Geological Survey

Federal Funds

General and special funds:

SURVEYS, INVESTIGATIONS, AND RESEARCH

For expenses necessary for the United States Geological Survey to perform surveys, investigations, and research covering topography, geology, hydrology, biology, and the mineral and water resources of the United States, its territories and possessions, and other areas as authorized by 43 U.S.C. 31, 1332, and 1340; classify lands as to their mineral and water resources; give engineering supervision to power permittees and Federal Energy Regulatory Commission licensees; administer the minerals exploration program (30 U.S.C. 641); conduct inquiries into the economic conditions affecting mining and materials processing industries (30 U.S.C. 3, 21a, and 1603; 50 U.S.C. 98g(1)) and related purposes as authorized by law; and to publish and disseminate data relative to the foregoing activities; \$922,168,000, to remain available until September 30, 2019; of which \$70,933,913 shall remain available until expended for satellite operations; and of which \$7,266,000 shall be available until expended for deferred maintenance and capital improvement projects that exceed \$100,000 in cost: Provided, That none of the funds provided for the ecosystem research activity shall be used to conduct new surveys on private property, unless specifically authorized in writing by the property owner: Provided further, That no part of this appropriation shall be used to pay more than one-half the cost of topographic mapping or water resources data collection and investigations carried on in cooperation with States and municipalities.

Note.—A full-year 2017 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Further Continuing Appropriations Act, 2017 (P.L. 114–254). The amounts included for 2017 reflect the annualized level provided by the continuing resolution.

Appropriation Language and Citations

For expenses necessary for the United States Geological Survey to perform surveys, investigations, and research covering topography, geology, hydrology, biology, and the mineral and water resources of the United States,

- **43 U.S.C. 31(a)** provides for establishment of the Office of the Director of the Geological Survey, under the Interior Department, and that this officer shall have direction of the Geological Survey, and the classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain.

A full listing of USGS appropriation language and citations is available at the USGS Office of Budget, Planning, and Integration Web site, under Resources and Tools.

Web site: https://www2.usgs.gov/budget/resources_tools.asp

Expiring Authorizations

The USGS has no expiring authorizations in 2018.

Administrative Provisions

From within the amount appropriated for activities of the United States Geological Survey such sums as are necessary shall be available for contracting for the furnishing of topographic maps and for the making of geophysical or other specialized surveys when it is administratively determined that such procedures are in the public interest; construction and maintenance of necessary buildings and appurtenant facilities; acquisition of lands for Water Resources and Natural Hazards activities through permits and licenses; expenses of the United States National Committee for Geological Sciences; and payment of compensation and expenses of persons employed by the Survey duly appointed to represent the United States in the negotiation and administration of interstate compacts: Provided, That activities funded by appropriations herein made may be accomplished through the use of contracts, grants, or cooperative agreements as defined in section 6302 of title 31, United States Code: Provided further, That the United States Geological Survey may enter into contracts or cooperative agreements directly with individuals or indirectly with institutions or nonprofit organizations, without regard to 41 U.S.C. 6101, for the temporary or intermittent services of students or recent graduates, who shall be considered employees for the purpose of chapters 57 and 81 of title 5, United States Code, relating to compensation for travel and work injuries, and chapter 171 of title 28, United States Code, relating to tort claims, but shall not be considered to be Federal employees for any other purposes.

Administrative Provisions Language and Citations

A full listing of USGS appropriation language and citations is available at the USGS Office of Budget, Planning, and Integration Web site, under Resources and Tools.

Web site: https://www2.usgs.gov/budget/resources_tools.asp

USGS Exhibits

Activity/Subactivity/ Program Element	2016 Actual	FY 2017 CR Annualized		Fixed Costs (+/-)	Internal Transfers (+/-)	Program Changes (+/-)		2018 Budget Request		Change from 2017 (+/-)	
	Amount	FTE	Amount			FTE	Amount	FTE	Amount	FTE	Amount
Surveys, Investigations, and Research											
Ecosystems											
Status and Trends Program	20,473	109	20,434	206	0	-24	-3,806	85	16,834	-24	-3,600
Fisheries Program	20,886	134	20,846	253	0	-34	-5,253	100	15,846	-34	-5,000
Wildlife Program	45,757	269	45,670	508	0	-63	-10,707	206	35,471	-63	-10,199
Environments Program	38,415	208	38,342	392	0	-59	-9,392	149	29,342	-59	-9,000
Invasive Species Program	17,330	67	17,297	127	0	0	-127	67	17,297	0	0
Cooperative Research Units	17,371	139	17,338	262	0	0	-262	139	17,338	0	0
Ecosystems Total	160,232	926	159,927	1,748	0	-180	-29,547	746	132,128	-180	-27,799
Land Resources – new structure¹											
National Land Imaging Program	72,194	146	72,057	340	0	-52	3,730	94	76,127	-52	4,070
Land Change Science Program	41,346	208	41,267	122	-1,477	-95	-20,627	113	19,285	-95	-21,292
National and Regional Climate Adaptation Science Centers	26,435	60	26,385	140	0	-24	-9,090	36	17,435	-24	-8,950
Land Resources Total	139,975	414	139,709	602	-1,477	-171	-25,987	243	112,847	-171	-26,862
Energy and Mineral Resources, and Environmental Health											
Energy and Minerals Resources											
Mineral Resources Program	48,371	277	48,279	644	0	0	-644	277	48,279	0	0
Energy Resources Program	24,695	130	24,648	290	1,477	7	-290	137	26,125	7	1,477
Subtotal	73,066	407	72,927	934	1,477	7	-934	414	74,404	7	1,477
Environmental Health											
Contaminant Biology Program	10,197	57	10,178	139	0	-16	-2,087	41	8,230	-16	-1,948
Toxic Substance Hydrology Program	11,248	60	11,226	148	0	-15	-2,498	45	8,876	-15	-2,350
Subtotal	21,445	117	21,404	287	0	-31	-4,585	86	17,106	-31	-4,298
Energy and Mineral Resources, and Environmental Health Total	94,511	524	94,331	1,221	1,477	-24	-5,519	500	91,510	-24	-2,821

¹ Land Resources (formerly Climate and Land Use Change) is shown in the proposed structure.

Activity/Subactivity/ Program Element	2016 Actual	FY 2017 CR Annualized		Fixed Costs (+/-)	Internal Transfers (+/-)	Program Changes (+/-)		2018 Budget Request		Change from 2017 (+/-)	
	Amount	FTE	Amount			FTE	Amount	FTE	Amount	FTE	Amount
Natural Hazards											
Earthquake Hazards Program	60,503	232	60,388	561	0	-12	-9,561	220	51,388	-12	-9,000
Volcano Hazards Program	26,121	142	26,071	343	0	-7	-3,982	135	22,432	-7	-3,639
Landslide Hazards Program	3,538	22	3,531	53	0	0	-53	22	3,531	0	0
Global Seismographic Network	6,453	12	6,441	29	0	-2	-1,484	10	4,986	-2	-1,455
Geomagnetism Program	1,888	15	1,884	0	0	-15	-1,884	0	0	-15	-1,884
Coastal-Marine Hazards and Resources Program	40,510	204	40,433	493	0	-16	-5,152	188	35,774	-16	-4,659
Natural Hazards Total	139,013	627	138,748	1,479	0	-52	-22,116	575	118,111	-52	-20,637
Water Resources											
Water Availability and Use Science Program	42,052	340	41,972	642	0	-60	-12,201	280	30,413	-60	-11,559
Groundwater and Streamflow Information Program	71,535	392	71,399	742	0	-10	-3,982	382	68,159	-10	-3,240
National Water Quality Program	90,600	674	90,428	1,277	0	-108	-17,235	566	74,470	-108	-15,958
Water Resources Research Act Program	6,500	1	6,488	0	0	-1	-6,488	0	0	-1	-6,488
Water Resources Total	210,687	1,407	210,287	2,661	0	-179	-39,906	1,228	173,042	-179	-37,245
Core Science Systems											
National Geospatial Program	62,854	257	62,735	575	0	-26	-11,375	231	51,935	-26	-10,800
National Cooperative Geologic Mapping Program	24,397	109	24,351	244	0	-5	-2,314	104	22,281	-5	-2,070
Science Synthesis, Analysis and Research Program	24,299	90	24,253	202	0	-27	-5,702	63	18,753	-27	-5,500
Core Science Systems Total	111,550	456	111,339	1,021	0	-58	-19,391	398	92,969	-58	-18,370
Science Support											
Administration and Management	81,981	451	81,825	944	0	-140	-13,390	311	69,379	-140	-12,446
Information Services	23,630	58	23,585	138	0	-5	-3,734	53	19,989	-5	-3,596
Science Support Total	105,611	509	105,410	1,082	0	-145	-17,124	364	89,368	-145	-16,042
Facilities											
Rental Payments and Operations & Maintenance	93,141	60	92,964	11,963	0	0	0	60	104,927	0	11,963
Deferred Maintenance and Capital Improvement	7,280	0	7,266	0	0	0	0	0	7,266	0	0
Facilities Total	100,421	60	100,230	11,963	0	0	0	60	112,193	0	11,963
Total, USGS	1,062,000	4,923	1,059,981	21,777	0	-809	-159,590	4,114	922,168	-809	-137,813

U.S. Geological Survey

United States Geological Survey
Justification of Fixed Costs and Internal Realignment
(Dollars In Thousands)

Fixed Cost Changes and Projections	2017 Change	2017 to 2018 Change
Change in Number of Paid Days This column reflects changes in pay associated with the change in the number of paid days between the CY and BY.	-4,704	+0
Pay Raise The change reflects the salary impact of the 2.1% pay raise for 2017 as signed by the President in December 2016, and the estimated 1.9% pay raise for 2018.	+11,952	+10,102
Departmental Working Capital Fund The change reflects expected changes in the charges for centrally billed Department services and other services through the Working Capital Fund. These charges are detailed in the Budget Justification for Departmental Management.	-1,265	-59
Worker's Compensation Payments The amounts reflect projected changes in the costs of compensating injured employees and dependents of employees who suffer accidental deaths while on duty. Costs will reimburse the Department of Labor, Federal Employees Compensation Fund, pursuant to 5 U.S.C. 8147(b) as amended by Public Law 94-273.	+145	-75
Unemployment Compensation Payments The amounts reflect projected changes in the costs of unemployment compensation claims to be paid to the Department of Labor, Federal Employees Compensation Account, in the Unemployment Trust Fund, pursuant to Public Law 96-499.	-121	+9
Rental Payments The amounts reflect changes in the costs payable to the General Services Administration (GSA) and others for office and non-office space as estimated by GSA, as well as the rental costs of other currently occupied space. These costs include building security; in the case of GSA space, these are paid to the Department of Homeland Security (DHS). Costs of mandatory office relocations, i.e. relocations in cases where due to external events there is no alternative but to vacate the currently occupied space, are also included.	-2,077	+11,800
Baseline Adjustments for O&M Increases In accordance with space maximization efforts across the Federal Government, this adjustment captures the associated increase to baseline operations and maintenance (O&M) requirements resulting from movement out of GSA or direct-leased (commercial) space and into Bureau-owned space. While the GSA portion of fixed costs will go down as a result of these moves, Bureaus often encounter an increase to baseline O&M costs not otherwise captured in fixed costs. This category of funding properly adjusts the baseline fixed cost amount to maintain steady-state funding for these requirements.	+3,260	+0

Account Exhibits

SURVEYS, INVESTIGATIONS, AND RESEARCH

Summary of Requirements by Object Class

(Millions of Dollars)

Appropriation: Surveys, Investigations, and Research		2017 Estimate		Fixed Costs		Program Changes		2018 Request	
		FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Object Class									
Personnel compensation									
11.1	Full-time permanent		409		7		-66		350
11.3	Other than full-time permanent		41		0		-7		34
11.5	Other personnel compensation		8		0		-1		7
Total personnel compensation		4,923	458	0	7	-809	-74	4,114	391
12.1	Civilian personnel benefits		149		3		-25		127
13.0	Benefits for former personnel		1		0		0		1
21.0	Travel and transportation of persons		23		0		-4		19
22.0	Transportation of things		1		0		0		1
23.1	Rental payment to GSA		58		12		0		70
23.2	Rental payments to others		2		0		0		2
23.3	Communications, utilities, and miscellaneous charges		18		0		-3		15
24.0	Printing and reproduction		1		0		0		1
25.1	Advisory and assistance services		15		0		-2		13
25.2	Other services from non-Fed sources		77		0		-8		69
25.3	Other goods and services from Fed sources		60		0		-3		57
25.4	Operation and maintenance of facilities		15		0		0		15
25.5	Research and development contracts		3		0		0		3
25.7	Operation and maintenance of equipment		26		0		0		26
26.0	Supplies and materials		24		0		0		24
31.0	Equipment		46		0		-9		37
32.0	Land and structures		1		0		0		1
41.0	Grants, subsidies, and contributions		82		0		-32		50
Total requirements			1,060		22		-160		922

This information is displayed in budget authority (not obligations) by object class.

SURVEYS, INVESTIGATIONS, AND RESEARCH

Summary of Requirements by Object Class

(Millions of Dollars)

Appropriation: Surveys, Investigations, and Research							
Reimbursable Obligations		2017 Estimate		2018 Request		Increase or Decrease	
		FTE	Amount	FTE	Amount	FTE	Amount
	Personnel compensation						
11.1	Full-time permanent		165		149		-16
11.3	Other than full-time permanent		32		29		-3
11.5	Other personnel compensation		4		3		-1
	Total personnel compensation	2,799	201	2,519	181	-280	-20
12.1	Civilian personnel benefits		67		60		-7
21.0	Travel and transportation of persons		13		12		-1
22.0	Transportation of things		1		1		0
23.1	Rental payments to GSA		21		19		-2
23.2	Rental payments to others		1		1		0
23.3	Communications, utilities, and miscellaneous charges		10		9		-1
25.1	Advisory and assistance services		7		6		-1
25.2	Other services		61		55		-6
25.3	Other purchases of goods and services from Government accounts		26		23		-3
25.4	Operation and maintenance of facilities		6		5		-1
25.5	Research and development contracts		1		1		0
25.7	Operation and maintenance of equipment		8		7		-1
26.0	Supplies and materials		13		12		-1
31.0	Equipment		19		17		-2
41.0	Grants, subsidies, and contributions		34		31		-3
	Total requirements		489		440		-49

United States Geological Survey

Federal Funds

General and special funds:

SURVEYS, INVESTIGATIONS, AND RESEARCH

Program and Financing

(Millions of Dollars)

Identification Code		2016	2017	2018
14-0804-0-1-306		Actual	Estimate	Estimate
	Obligations by program activity:			
00.01	Ecosystems	163	160	133
00.02	Land Resources	143	143	110
00.03	Energy and Mineral Resources, and Environmental Health	95	98	91
00.04	Natural Hazards	141	152	128
00.05	Water Resources	213	213	175
00.06	Core Science Systems	117	111	92
00.07	Science Support	107	106	93
00.08	Facilities	99	100	112
07.99	Total direct obligations	1,078	1,083	934
08.01	Reimbursable program	489	489	440
09.00	Total new obligations	1,567	1,572	1,374
	Budgetary resources:			
	Unobligated balance:			
10.00	Unobligated balance brought forward, Oct 1	482	518	495
10.21	Recoveries of prior year unpaid obligations	11	0	0
10.50	Unobligated balance (total)	493	518	495
	Budget authority:			
	Appropriations, discretionary:			
11.00	Appropriation	1,062	1,060	922
11.60	Appropriation, discretionary (total)	1,062	1,060	922
	Spending authority from offsetting collections, discretionary:			
17.00	Collected	474	489	440
17.01	Change in uncollected payments, Federal sources	56	0	0
17.50	Spending auth from offsetting collections, disc (total)	530	489	440
19.00	Budget authority (total)	1,592	1,549	1,362
19.30	Total budgetary resources available	2,085	2,067	1,857
	Memorandum (non-add) entries:			
19.41	Unexpired unobligated balance, end of year	518	495	483

SURVEYS, INVESTIGATIONS, AND RESEARCH

Program and Financing cont'd

(Millions of Dollars)

Identification Code		2016	2017	2018
14-0804-0-1-306		Actual	Estimate	Estimate
	Additional offsets against gross budget authority only:			
40.50	Change in uncollected payments, Fed sources, Unexpired	-56	0	0
40.52	Offsetting collections credited to expired accounts	14	0	0
40.60	Additional offsets against budget authority only (total)	-42	0	0
40.70	Budget authority, net (discretionary)	1,062	1,060	922
40.80	Outlays, net (discretionary)	1,050	993	981
	Mandatory:			
	Outlays, gross:			
41.01	Outlays from mandatory balances	1	13	9
41.80	Budget authority, net (total)	1,062	1,060	922
41.90	Outlays, net (total)	1,051	1,006	990

SURVEYS, INVESTIGATIONS, AND RESEARCH

Object Classification

(Millions of Dollars)

Identification Code		2016	2017	2018
14-0804-0-1-306		Actual	Estimate	Estimate
Direct obligations:				
Personnel compensation:				
11.1	Full-time permanent	406	409	350
11.3	Other than full-time permanent	40	41	34
11.5	Other personnel compensation	8	8	7
11.9	Total personnel compensation	454	458	391
12.1	Civilian personnel benefits	147	149	127
13.0	Benefits for former personnel	1	1	1
21.0	Travel and transportation of persons	23	23	19
22.0	Transportation of things	1	1	1
23.1	Rental payments to GSA	60	58	70
23.2	Rental payment to others	2	2	2
23.3	Communications, utilities, and miscellaneous charges	18	18	15
24.0	Printing and reproduction	1	1	1
25.1	Advisory and assistance services	20	15	13
25.2	Other services from non-Fed sources	97	87	69
25.3	Other goods and services from Fed sources	73	73	60
25.4	Operation and maintenance of facilities	12	15	15
25.5	Research and development contracts	3	3	3
25.7	Operation and maintenance of equipment	20	26	26
26.0	Supplies and materials	24	24	24
31.0	Equipment	39	46	46
32.0	Land and structures	1	1	1
41.0	Grants, subsidies, and contributions	82	82	50
99.0	Direct obligations	1,078	1,083	934

SURVEYS, INVESTIGATIONS, AND RESEARCH

Object Classification cont'd

(Millions of Dollars)

Identification Code		2016	2017	2018
14-0804-0-1-306		Actual	Estimate	Estimate
Reimbursable obligations:				
Personnel compensation:				
11.1	Full-time permanent	165	165	149
11.3	Other than full-time permanent	32	32	29
11.5	Other personnel compensation	4	4	3
11.9	Total personnel compensation	201	201	181
12.1	Civilian personnel benefits	67	67	60
21.0	Travel and transportation of persons	13	13	12
22.0	Transportation of things	1	1	1
23.1	Rental payments to GSA	21	21	19
23.2	Rental payments to others	1	1	1
23.3	Communications., utilities, and miscellaneous charges	10	10	9
25.1	Advisory and assistance services	7	7	6
25.2	Other services from non-Fed sources	61	61	55
25.3	Other goods and services from Fed sources	26	26	23
25.4	Operation and maintenance of facilities	6	6	5
25.5	Research and development contracts	1	1	1
25.7	Operation and maintenance of equipment	8	8	7
26.0	Supplies and materials	13	13	12
31.0	Equipment	19	19	17
41.0	Grants, subsidies, and contributions	34	34	31
99.0	Reimbursable obligations	489	489	440
99.9	Total new obligations	1,567	1,572	1,374

SURVEYS, INVESTIGATIONS, AND RESEARCH

Employment Summary

Identification Code		2016	2017	2018
14-0804-0-1-306		Actual	Estimate	Estimate
Direct:				
1001	Civilian full-time equivalent employment	4,923	4,923	4,114
Reimbursable:				
2001	Civilian full-time equivalent employment	2,799	2,799	2,519
Allocation account:				
3001	Civilian full-time equivalent employment	72	72	72

Sundry Exhibits

Funding of U.S. Geological Survey Programs
(Obligations)
(Thousands of Dollars)

	2016 Actual	2017 Estimate	2018 Estimate
Surveys, Investigations, and Research (SIR)			
Ecosystems			
Appropriated			
Multi-Year appropriation	162,935	160,453	133,518
Total (appropriated)	162,935	160,453	133,518
Reimbursements			
<i>Non-Federal (Domestic) sources</i>			
Technology Transfer	3,627	3,627	3,264
Miscellaneous	11,283	11,283	10,155
Subtotal (non-Federal domestic sources)	14,910	14,910	13,419
<i>Non-Federal (Foreign) sources</i>			
Miscellaneous	23	23	21
Subtotal (non-Federal Foreign sources)	23	23	21
<i>State and local sources</i>			
States-Coop (matched - In-Kind Services) NON ADD	331	331	298
Subtotal (state and local sources)	0	0	0
<i>Federal sources</i>			
Department of Agriculture	3,300	3,300	2,970
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	227	227	204
Other	164	164	148
Department of Defense			
Corps of Engineers	16,498	16,498	14,848
National Geospatial-Intelligence Agency	2,084	2,084	1,876
Other	1,776	1,776	1,598
Department of Energy			
Bonneville Power Administration	1,804	1,804	1,624
Other	392	392	353
Department of Homeland Security	103	103	93
Department of Interior			
Bureau of Land Management	6,407	6,407	5,766
Bureau of Ocean Energy Management	1,127	1,127	1,014
Bureau of Reclamation	12,530	12,530	11,277
Fish and Wildlife Service	8,337	8,337	7,503
National Park Service	3,070	3,070	2,763
Office of Secretary			
Interior Business Center	523	523	471
Other	552	552	497
Department of State	43	43	39
Environmental Protection Agency	440	440	396
Health and Human Services	179	179	161
National Aeronautics & Space Admin	209	209	188
Subtotal (Federal sources)	59,765	59,765	53,789
Total (reimbursements)	74,698	74,698	67,229
Total: Ecosystems	237,633	235,151	200,747

Sundry Exhibits

	2016 Actual	2017 Estimate	2018 Estimate
Surveys, Investigations, and Research (SIR)			
Land Resources			
Appropriated			
Multi-Year appropriation	81,649	88,562	44,141
No-Year appropriation	61,465	54,466	65,934
Total (appropriated)	143,114	143,028	110,075
Reimbursements			
<i>Non-Federal (Domestic) sources</i>			
Technology Transfer	80	80	72
Miscellaneous	175	175	158
Subtotal (non-Federal domestic sources)	255	255	230
<i>Non-Federal (Foreign) sources</i>			
Miscellaneous	1,356	1,356	1,220
Subtotal (non-Federal Foreign sources)	1,356	1,356	1,220
<i>State and local sources</i>			
States-Coop (matched - In-Kind Services) NON ADD	30	30	27
Subtotal (state and local sources)	0	0	0
<i>Federal sources</i>			
Agency for International Development	6,256	6,256	5,630
Department of Agriculture	948	948	853
Department of Commerce	219	219	197
Department of Defense			
Corps of Engineers	323	323	291
Other	101	101	91
Department of Energy	108	108	97
Department of Homeland Security			
Federal Emergency Management Agency	62	62	56
Department of Interior			
Bureau of Indian Affairs	74	74	67
Bureau of Land Management	1,426	1,426	1,283
Bureau of Reclamation	40	40	36
Fish and Wildlife Service	126	126	113
National Park Service	458	458	412
Office of Secretary			
Interior Business Center	3,986	3,986	3,587
Environmental Protection Agency	1,380	1,380	1,242
Health and Human Services	95	95	86
National Aeronautics & Space Admin	11,064	11,064	9,958
Sale of maps, photos, reproductions, & digital products	314	314	283
Miscellaneous	8	8	7
Subtotal (Federal sources)	26,988	26,988	24,289
Total (reimbursements)	28,599	28,599	25,739
Total: Land Resources	171,713	171,627	135,814

	2016 Actual	2017 Estimate	2018 Estimate
Surveys, Investigations, and Research (SIR)			
Energy and Mineral Resources, and Environmental Health			
Appropriated			
Multi-Year appropriation	94,586	97,451	91,651
No-Year appropriation	95	147	0
Total (appropriated)	94,681	97,598	91,651
Reimbursements			
<i>Non-Federal (Domestic) sources</i>			
Technology Transfer	1,009	1,009	908
Miscellaneous	501	501	451
Subtotal (non-Federal domestic sources)	1,510	1,510	1,359
<i>State and local sources</i>			
States-Coop (matched - In-Kind Services) NON ADD	80	80	72
States-Coop (unmatched)	21	21	19
Subtotal (state and local sources)	21	21	19
<i>Federal sources</i>			
Department of Agriculture	42	42	38
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	83	83	75
Department of Defense			
Corps of Engineers	253	253	228
National Geospatial-Intelligence Agency	50	50	45
Other	1,126	1,126	1,013
Department of Energy	13	13	12
Department of Interior			
Bureau of Indian Affairs	7	7	6
Bureau of Land Management	4,226	4,226	3,803
Bureau of Ocean Energy Management	5	5	5
Bureau of Reclamation	15	15	14
Fish and Wildlife Service	376	376	338
National Park Service	226	226	203
Office of Secretary			
Interior Business Center	999	999	899
Department of Justice	93	93	84
Environmental Protection Agency	217	217	195
Subtotal (Federal sources)	7,731	7,731	6,958
Total (reimbursements)	9,262	9,262	8,336
Total: Energy and Mineral Resources, and Environmental Health	103,943	106,860	99,987

Sundry Exhibits

	2016 Actual	2017 Estimate	2018 Estimate
Surveys, Investigations, and Research (SIR)			
Natural Hazards			
Appropriated			
Multi-Year appropriation	139,951	139,328	119,142
Total (appropriated)	139,951	139,328	119,142
Reimbursements			
<i>Non-Federal (Domestic) sources</i>			
Technology Transfer	1,103	1,103	993
Miscellaneous	1,860	1,860	1,674
Subtotal (non-Federal domestic sources)	2,963	2,963	2,667
<i>Non-Federal (Foreign) sources</i>			
Saudi Geological Survey	1,825	1,825	1,643
Miscellaneous	18	18	16
Subtotal (non-Federal Foreign sources)	1,843	1,843	1,659
<i>State and local sources</i>			
States-Coop (matched - In-Kind Services) NON ADD	932	932	839
States-Coop (unmatched)	259	259	233
Subtotal (state and local sources)	259	259	233
<i>Federal sources</i>			
Agency for International Development	6,546	6,546	5,891
Department of Agriculture	200	200	180
Department of Commerce	165	165	149
Department of Defense			
Corps of Engineers	711	711	640
National Geospatial-Intelligence Agency	67	67	60
Other	762	762	686
Department of Energy	2,512	2,512	2,261
Department of Homeland Security			
Federal Emergency Management Agency	139	139	125
Department of Interior			
Bureau of Land Management	63	63	57
Bureau of Ocean Energy Management	500	500	450
Bureau of Reclamation	13	13	12
Fish and Wildlife Service	84	84	76
National Park Service	58	58	52
Office of Secretary			
Interior Business Center	81	81	73
Department of State	47	47	42
Department of Veterans Affairs	213	213	192
Environmental Protection Agency	168	168	151
Health and Human Services	0	0	0
National Aeronautics & Space Admin	8,404	8,404	7,564
National Science Foundation	60	60	54
Nuclear Regulatory Commission	231	231	208
Subtotal (Federal sources)	21,024	21,024	18,923
Total (reimbursements)	26,089	26,089	23,482
Total: Natural Hazards *	166,040	165,417	142,624

* This table does not include obligations for the Spectrum Relocation Fund, since it is a mandatory fund. MAX obligations do include the Spectrum Relocation Fund. The amounts included in MAX are: FY 2016 \$1,088K, FY 2017 \$12,495K, and FY 2018 \$8,807K.

	2016 Actual	2017 Estimate	2018 Estimate
Surveys, Investigations, and Research (SIR)			
Water Resources			
Appropriated			
Multi-Year appropriation	212,528	213,113	174,904
Total (appropriated)	212,528	213,113	174,904
Reimbursements			
<i>Non-Federal (Domestic) sources</i>			
Permittees & licensees- Fed Energy Regulatory Commission	6,085	6,085	5,477
Technology Transfer	4,413	4,413	3,972
Miscellaneous	4,045	4,045	3,641
Subtotal (non-Federal domestic sources)	14,543	14,543	13,090
<i>Non-Federal (Foreign) sources</i>			
The Environment Agency - Abu Dhabi	905	905	815
Miscellaneous	539	539	485
Subtotal (non-Federal Foreign sources)	1,444	1,444	1,300
<i>State and local sources</i>			
States-Coop (matched)	57,710	60,185	57,710
States-Coop (matched - In-Kind Services) NON ADD	1,291	1,291	1,162
States-Coop (unmatched)	104,173	101,698	87,985
Subtotal (state and local sources)	161,883	161,883	145,695
<i>Federal sources</i>			
Agency for International Development	140	140	126
Department of Agriculture	1,596	1,596	1,436
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	70	70	63
Other	18	18	16
Department of Defense			
Corps of Engineers	38,589	38,589	34,730
National Geospatial-Intelligence Agency	1,313	1,313	1,182
Other	5,563	5,563	5,007
Department of Energy			
Bonneville Power Administration	440	440	396
Other	5,461	5,461	4,915
Department of Homeland Security			
Federal Emergency Management Agency	3,996	3,996	3,596
Other	407	407	366
Department of Interior			
Bureau of Indian Affairs	182	182	164
Bureau of Land Management	2,940	2,940	2,646
Bureau of Reclamation	17,765	17,765	15,989
Fish and Wildlife Service	1,976	1,976	1,778
National Park Service	2,016	2,016	1,814
Office of Secretary			
Interior Business Center	526	526	473
Other	29	29	26
Office of Surface Mining	115	115	104

Sundry Exhibits

	2016	2017	2018
	Actual	Estimate	Estimate
Surveys, Investigations, and Research (SIR)			
Water Resources, continued			
Department of Justice	11	11	10
Department of State	1,740	1,740	1,566
Environmental Protection Agency	33,587	33,587	30,228
Health and Human Services	87	87	78
National Aeronautics & Space Admin	1,266	1,266	1,139
Nuclear Regulatory Commission	372	372	335
Tennessee Valley Authority	436	436	392
Subtotal (Federal sources)	120,641	120,641	108,575
Total (reimbursements)	298,511	298,511	268,660
Total: Water Resources	511,039	511,624	443,564

	2016 Actual	2017 Estimate	2018 Estimate
Surveys, Investigations, and Research (SIR)			
Core Science Systems			
Appropriated			
Multi-Year appropriation	116,505	111,110	91,661
Total (appropriated)	116,505	111,110	91,661
Reimbursements			
<i>Non-Federal (Domestic) sources</i>			
Technology Transfer	332	332	299
Miscellaneous	14	14	13
Subtotal (non-Federal domestic sources)	346	346	312
<i>State and local sources</i>			
States-Coop (matched - In-Kind Services) NON ADD	18	18	16
States-Coop (unmatched)	9,593	9,593	8,634
Subtotal (state and local sources)	9,593	9,593	8,634
<i>Federal sources</i>			
Department of Agriculture	11,271	11,271	10,144
Department of Commerce			
Nat'l Oceanic & Atmospheric Admin	113	113	102
Other	229	229	206
Department of Defense			
Corps of Engineers	489	489	440
National Geospatial-Intelligence Agency	28	28	25
Department of Education	25	25	23
Department of Energy	166	166	149
Department of Homeland Security			
Federal Emergency Management Agency	11,378	11,378	10,240
Other	226	226	203
Department of Interior			
Bureau of Land Management	468	468	421
Bureau of Reclamation	43	43	39
Fish and Wildlife Service	587	587	528
National Park Service	1,532	1,532	1,379
Office of Secretary			
Interior Business Center	86	86	77
Department of Justice	50	50	45
Department of State	50	50	45
Department of Transportation	50	50	45
Department of Treasury	25	25	23
Department of Veterans Affairs	25	25	23
Environmental Protection Agency	226	226	203
General Services Administration	100	100	90
Health and Human Services	50	50	45
Housing and Urban Development	50	50	45
National Aeronautics & Space Admin	226	226	203
National Science Foundation	1,043	1,043	939
Tennessee Valley Authority	80	80	72
Miscellaneous	75	75	68
Subtotal (Federal sources)	28,691	28,691	25,822
Total (reimbursements)	38,630	38,630	34,768
Total: Core Science Systems *	155,135	149,740	126,429

* This table does not include obligations from the unobligated balance transfer from USAID, which is included in MAX. The amount for FY 2016 is \$400K.

Sundry Exhibits

	2016 Actual	2017 Estimate	2018 Estimate
Surveys, Investigations, and Research (SIR)			
Science Support			
Appropriated			
Multi-Year appropriation	107,219	105,468	92,095
Total (appropriated)	107,219	105,468	92,095
Reimbursements			
<i>Non-Federal (Domestic) sources</i>			
Map Receipts	1,586	1,586	1,427
Sale of photos, reproductions, and digital products	1,472	1,472	1,325
Technology Transfer	88	88	79
Subtotal (non-Federal domestic sources)	3,146	3,146	2,831
<i>Federal sources</i>			
Department of Agriculture	8	8	7
Department of Defense	385	385	347
Department of Interior			
Bureau of Indian Affairs	93	93	84
Bureau of Land Management	29	29	26
Bureau of Safety and Environmental Enforcement	62	62	56
Fish and Wildlife Service	114	114	103
National Park Service	7	7	6
Office of Secretary			
Interior Business Center	1,143	1,143	1,029
Other	581	581	523
Office of Surface Mining	15	15	14
General Services Administration	12	12	11
Sale of maps, photos, reproductions, & digital products	1,173	1,173	1,056
Miscellaneous	23	23	21
Subtotal (Federal sources)	3,645	3,645	3,283
Total (reimbursements)	6,791	6,791	6,114
Total: Science Support *	114,010	112,259	98,209

* This table does not include obligations for the Spectrum Relocation Fund, since it is a mandatory fund. MAX obligations do include the Spectrum Relocation Fund. The amounts included in MAX are: FY 2016 \$142K, FY 2017 \$623K, and FY 2017 \$672K.

	2016 Actual	2017 Estimate	2018 Estimate
Surveys, Investigations, and Research (SIR)			
Facilities			
Appropriated			
Multi-Year appropriation	93,773	91,673	103,400
No-Year appropriation	5,221	8,117	8,266
Total (appropriated)	98,994	99,790	111,666
Reimbursements			
<i>Federal sources</i>			
Department of Commerce	877	877	789
Department of Defense	1,867	1,867	1,680
Bureau of Land Management	277	277	249
Bureau of Safety and Environmental Enforcement	79	79	71
National Park Service	1,130	1,130	1,017
Office of Secretary			
Interior Business Center	1,860	1,860	1,674
Other	570	570	513
Subtotal (Federal sources)	6,660	6,660	5,993
Total (reimbursements)	6,660	6,660	5,993
Total: Facilities	105,654	106,450	117,659

SIR Summary:

Appropriated			
Multi-Year appropriation	1,009,146	1,007,158	850,512
No-Year appropriation	66,781	62,730	74,200
subtotal (appropriated)	1,075,927	1,069,888	924,712
Reimbursements			
Non-Federal Sources			
Map Receipts	1,586	1,586	1,427
Domestic	36,087	36,087	32,481
Foreign	4,666	4,666	4,200
State and local sources	171,756	171,756	154,581
Federal Sources	275,145	275,145	247,632
subtotal (reimbursements)	489,240	489,240	440,321
Total: SIR *	1,565,167	1,559,128	1,365,033

* This table does not include obligations for the Spectrum Relocation Fund, since it is a mandatory fund. MAX obligations do include the Spectrum Relocation Fund. The amounts included in MAX are: FY 2016 \$1,230K, FY 2017 \$13,118K, and FY 2018 \$9,479K. This table also does not include obligations from the unobligated balance transfer from USAID, which is included in MAX. The amount for FY 2016 is \$400K.

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	2016 Actual	2017 Estimate	2018 Estimate
Surveys, Investigations, and Research (SIR)			
Contributed Funds:			
Permanent, indefinite appropriation:			
Ecosystems	689	509	423
Land Resources	8	18	0
Energy and Mineral Resources, and Environmental Health	54	38	21
Natural Hazards	87	6	20
Water Resources	255	163	81
Total: Contributed Funds	1,093	734	545
Operation and Maintenance of Quarters:			
Permanent, indefinite appropriation:			
Ecosystems	21	34	36
Natural Hazards	11	32	13
Total: Operation and Maintenance of Quarters	32	66	49
Working Capital Fund:			
National Water Quality Lab	19,074	17,000	16,000
Hydrologic Instrumentation Facility	19,934	20,323	20,192
Other	35,545	74,970	49,891
Total: Working Capital Fund	74,553	112,293	86,083
Allocations from other Federal Agencies: *			
Department of the Interior: Departmental Offices			
Natural Resource Damage Assessment	1,747	4,000	4,000
Central Hazardous Materials Fund	50	200	50
Total: Allocations	1,797	4,200	4,050

* Allocations are shown in the year they are received, not when they are obligated.

United States Geological Survey
Trust Funds
 CONTRIBUTED FUNDS
Special and Trust Fund Receipts
 (Millions of Dollars)

Identification Code		2016	2017	2018
14-8562-0-7-306		Actual	Estimate	Estimate
01.00	Balance, start of year	0	0	0
	Receipts:			
	Current law:			
11.30	Contributed Funds, Geological Survey	1	1	1
20.00	Total: Balances and receipts	1	1	1
	Appropriations:			
	Current law:			
21.01	Contributed Funds	-1	-1	-1
50.99	Balance, end of year	0	0	0

Program and Financing
 (Millions of Dollars)

Identification Code		2016	2017	2018
14-8562-0-7-306		Actual	Estimate	Estimate
	Obligations by program activity:			
08.01	Donations and contributed funds	1	1	1
09.00	Total new obligations, unexpired accounts	1	1	1
	Budgetary resources:			
	Unobligated balance:			
10.00	Unobligated balance brought forward, Oct 1	1	1	1
	Budget authority:			
	Appropriation, mandatory:			
12.01	Appropriation (trust fund)	1	1	1
12.60	Appropriation, mandatory (total)	1	1	1
19.30	Total budgetary resources available	2	2	2
	Memorandum (non-add) entries:			
19.41	Unexpired unobligated balance, end of year	1	1	1

Sundry Exhibits

CONTRIBUTED FUNDS
Program and Financing cont'd
(Millions of Dollars)

Identification Code		2016	2017	2018
14-8562-0-7-306		Actual	Estimate	Estimate
	Change in obligated balance:			
	Unpaid obligations:			
30.00	Unpaid obligations, brought forward, Oct 1	0	0	1
30.10	New obligations, unexpired accounts	1	1	1
30.20	Outlays (gross)	-1	0	-1
30.50	Unpaid obligations, end of year	0	1	1
	Memorandum (non-add) entries:			
31.00	Obligated balance, start of year	0	0	1
32.00	Obligated balance, end of year	0	1	1
	Budget authority and outlays, net:			
	Mandatory:			
40.90	Budget authority, gross	1	1	1
	Outlays, gross:			
41.01	Outlays from mandatory balances	1	0	1
41.10	Outlays, gross (total)	1	0	1
41.80	Budget authority, net (total)	1	1	1
41.90	Outlays, net (total)	1	0	1

Object Classification

(Millions of Dollars)

Identification Code		2016	2017	2018
14-8562-0-7-306		Actual	Estimate	Estimate
	Direct obligations:			
99.5	Adjustment for rounding	1	1	1
99.9	Total new obligations	1	1	1

CONTRIBUTED FUNDS
Employment Summary

Identification Code	2016	2017	2018
14-8562-0-7-306	Actual	Estimate	Estimate
1001	5	5	5
Direct: Civilian full-time equivalent employment			

Employee Count by Grade
(Total Employment)

	2016 Actual	2017 Estimate	2018 Estimate
Executive Level V	1	1	1
SES	17	21	21
Subtotal	18	22	22
SL – 00	10	10	11
ST – 00	44	55	60
Subtotal	54	65	71
GS/GM – 15	480	470	402
GS/GM – 14	736	721	617
GS/GM – 13	1,232	1,207	1,032
GS – 12	1,527	1,496	1,279
GS – 11	1,235	1,210	1,035
GS – 10	17	17	14
GS – 9	932	913	781
GS – 8	242	237	203
GS – 7	593	581	497
GS – 6	243	238	204
GS – 5	406	398	340
GS – 4	179	175	150
GS – 3	72	71	60
GS – 2	33	32	28
GS – 1	8	8	7
Subtotal	7,935	7,776	6,648
Other Pay Schedule Systems	327	327	327
Total employment (actual/estimate)	8,335	8,190	7,068

Section 403 Compliance

This section describes details related to any assessments to, or within the USGS to support bureauwide services and functions. Details regarding the USGS's payments to the Department of the Interior's Working Capital Fund, and payments to other Federal Agencies are included in the External Administrative Costs subsection. Additional information on internal assessments and cost allocation methodologies can be found in the Bureau Administrative Costs subsection.

	2018 Estimate (\$000)
External Administrative Costs	
The Department of the Interior's Working Capital Fund	
WCF Centralized Billings	\$16,442
WCF Direct Billings	\$10,204
Payments to Other Federal Agencies	
Worker's Compensation Payments	-\$75
Unemployment Compensation Payments	\$9
GSA Rental Payments	\$11,800
Bureau Administrative Costs	
Shared Program Costs	\$13,639
Internal Bureau Overhead	\$38,500

External Administrative Costs

The Department of the Interior's Working Capital Fund

The Department's Working Capital Fund was established pursuant to 43 U.S.C. 1467, to provide common administrative and support services efficiently and economically at cost. The Fund is a revolving fund, whereby capital is expended to provide services for customers who pay for the services. Customers consist of the Department's bureaus and offices, as well as other Federal agencies. Through the use of centrally provided services, the Department standardized key administrative areas such as commonly used administrative systems, support services for those located in and around the Main and South Interior building complex, and centrally managed departmental operations that are beneficial to the bureaus and offices.

Centralized billing is used whenever the product or service being provided is not severable or it is inefficient to bill for the exact amount of product or service being procured. Customers are billed each year using a pre-established basis that is adjusted annually to reflect change over time. These bills are paid for by both the Administrative & Management and the Information Services subactivities within Science Support, and payment may be adjusted accordingly between these lines during the year of

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execution based on the enacted appropriation. The following table provides the actual centralized billing to the USGS for 2016 and estimates for 2017 and 2018.

WORKING CAPITAL FUND REVENUE - Centralized Billing FY 2018 President's Budget GEOLOGICAL SURVEY (\$ in thousands)				
Activity/Office	2016 Revised	2017 Pres Budget	2017 Revised	2018 Estimate
FBMS Infrastructure Hosting & Support	1,083.1	1,072.9	1,072.9	1,127.6
FBMS Business Integration Office	1,083.1	1,072.9	1,072.9	1,127.6
Aviation Management	432.5	397.5	397.5	361.6
Office of Aviation Services	432.5	397.5	397.5	361.6
Mail and Messenger Services	0.9	1.9	1.9	0.7
Safety, Environmental, and Health Services	0.5	1.0	1.0	0.4
Shipping/Receiving & Moving Services	0.3	0.6	0.6	0.2
Personal Property Accountability Services	0.4	0.8	0.8	0.3
Interior Complex Management & Svcs	0.3	0.7	0.7	0.3
Departmental Library	7.4	4.6	4.6	12.4
Mail Policy	30.7	31.3	31.3	30.9
Conference and Special Events Services	0.7	1.4	1.4	0.6
Space Management Services	0.2	0.4	0.4	0.2
Office of Facilities & Admin Services	41.5	42.6	42.6	46.0
Office of Valuation Services				
Subtotal OS Shared Services	1,557.1	1,513.0	1,513.0	1,535.1
Alaska Resources Library and Information Services	153.4	153.4	153.4	164.1
Secretary's Immediate Office	153.4	153.4	153.4	164.1
Document Management Unit	0.0	0.5	0.5	
FOIA Tracking & Reporting System	46.8	54.3	54.3	58.0
Office of the Executive Secretariat	46.8	54.8	54.8	58.0
Alaska Affairs Office	11.0	11.0	11.0	11.0
Secretary's Immediate Office	11.0	11.0	11.0	11.0
Departmental News and Information	140.7	143.3	143.3	143.9
Office of Communications	140.7	143.3	143.3	143.9
Departmental Museum	133.8	136.3	136.3	136.8
Secretary's Immediate Office	133.8	136.3	136.3	136.8
FedCenter	1.9	1.9	1.9	1.9
Compliance Support ESF-11/ESF-11 Website	2.3	2.3	2.3	2.3
Office of Environmental Policy and Compliance	4.2	4.2	4.2	4.2
Invasive Species Council	216.4	216.4	216.4	216.4

WORKING CAPITAL FUND REVENUE - Centralized Billing				
FY 2018 President's Budget				
GEOLOGICAL SURVEY				
(\$ in thousands)				
Activity/Office	2016 Revised	2017 Pres Budget	2017 Revised	2018 Estimate
Invasive Species Coordinator	39.2	39.2	39.2	39.2
Office of Policy Analysis	255.5	255.5	255.5	255.5
International Affairs Office				
CPIC	28.5	28.6	28.6	28.2
Office of Budget	28.5	28.6	28.6	28.2
Financial Statement, Internal Controls & Performance Report	76.3	77.7	77.7	78.0
Travel Management Center	38.9	36.2	36.2	34.0
e-Travel	211.3	192.9	192.9	181.0
Partnerships	34.6	35.3	35.3	35.4
Office of Financial Management	361.1	342.1	342.1	328.4
Interior Collections Management System (IG-ICMS)	2.1	0.0	0.0	0.0
Space Management Initiative	40.9	41.6	41.6	48.5
Renewable Energy Certificates	33.0	32.4	32.4	48.1
Facility Maintenance Management System	4.6	4.1	4.1	4.1
Interior Asset Disposal System O&M	5.1	5.1	5.1	5.1
Office of Property and Acquisition Management	85.7	83.2	83.2	105.7
Planning and Performance Management	136.4	139.0	139.0	139.3
Office of Planning and Performance Management	136.4	139.0	139.0	139.3
Department-wide Worker's Compensation Program Coordination	22.5	22.5	22.5	22.5
OPM Federal Employment Services	42.6	43.5	43.5	43.6
Accessibility and Special Hiring Programs	70.4	71.7	71.7	72.0
Human Resources Accountability Team	75.4	76.8	76.8	77.0
Employee and Labor Relations Tracking System	3.8	3.8	3.8	3.8
Consolidated Employee Assistance Program	83.8	85.3	85.3	85.7
Office of Human Resources	298.4	303.6	303.6	304.6
EEO Complaints Tracking System	1.4	1.6	1.6	1.6
Special Emphasis Program	4.6	4.7	4.7	4.7
Office of Civil Rights	6.0	6.3	6.3	6.3
Occupational Safety and Health	174.1	177.4	177.4	177.9
Safety Management Information System	139.4	142.1	142.1	142.4
Office of Occupational Health and Safety	313.6	319.5	319.5	320.3
Leadership Development Programs	109.1	111.2	111.2	111.6

WORKING CAPITAL FUND REVENUE - Centralized Billing
FY 2018 President's Budget
GEOLOGICAL SURVEY
(\$ in thousands)

Activity/Office	2016 Revised	2017 Pres Budget	2017 Revised	2018 Estimate
Dept-Wide Training Programs (Excludes Online Learning)	111.8	137.4	113.7	112.1
Learning & Performance Center Management	78.5	71.1	71.1	68.6
DOIU Management	75.8	77.2	77.2	77.6
Online Learning (DOI Learn)	188.2	164.6	188.2	185.5
DOI University	563.4	561.5	561.5	555.4
Security (Classified Information Facility)	59.4	60.5	60.5	60.7
Law Enforcement Coordination	79.7	81.3	81.3	105.6
Security (MIB/SIB Complex)	3.8	7.5	7.5	3.0
Victim Witness Coordinator	21.5	21.9	21.9	21.9
OLES Detailees - Training and Compliance	0.0	93.4	0.0	0.0
Office of Law Enforcement and Security	164.4	264.5	171.2	191.2
Interior Operations Center	252.4	257.1	256.1	256.7
Emergency Preparedness (COOP)	107.7	109.8	109.8	110.0
Emergency Response	136.5	161.6	161.6	162.0
MIB Emergency Health and Safety	0.1	0.2	0.2	0.1
Federal Executive Board	31.5	32.1	32.1	32.2
Send Word Now Emergency Notification System	0.0		1.1	1.1
Office of Emergency Management	528.1	560.8	560.8	562.1
Alternative Dispute Resolution Training	5.7	5.8	5.8	5.8
Collaborative Action and Dispute Resolution	5.7	5.8	5.8	5.8
Cooperative Ecosystem Study Units (CESU)	50.9	50.8	50.8	50.8
CFO Financial Statement Audit	610.0	523.6	523.6	523.6
Glen Canyon Adaptive Management (GCAMP)	130.7	130.7	130.7	130.7
Department-wide Activities	791.7	705.1	705.1	705.1
Ethics	60.2	61.3	61.3	71.0
FOIA Appeals	26.0	8.8	8.8	10.7
Torts Management Support	0.0		0.0	23.1
Office of the Solicitor	86.3	70.1	70.1	104.9
Subtotal OS Activities	4,114.6	4,148.6	4,055.2	4,130.8
IT Transformation Planning (ITT)	832.0	780.0	780.0	0.0
Office of the Chief Information Officer	832.0	780.0	780.0	0.0
Enterprise Directory Services	653.5	593.1	593.1	591.0

WORKING CAPITAL FUND REVENUE - Centralized Billing FY 2018 President's Budget GEOLOGICAL SURVEY (\$ in thousands)				
Activity/Office	2016 Revised	2017 Pres Budget	2017 Revised	2018 Estimate
IT Desktop Software Administration	173.5	144.9	144.9	149.1
IOS Collaboration	136.4	137.3	137.3	135.6
Unified Messaging	162.0	239.2	239.2	215.8
<hr/>				
Office of Information Assurance	1,125.5	1,114.5	1,114.5	1,091.4
Privacy and Civil Liberties	109.3	136.1	136.1	166.1
Identity Credential Access Management (ICAM)	144.6	125.1	125.1	125.5
Threat Management	956.0	780.6	780.6	782.6
Information Systems Security Operations (ISSO)	25.0	31.4	31.4	6.5
Office of Information Assurance (OIA) Operations	78.6	123.1	123.1	157.9
Assessment & Authorization Services	29.3	28.4	28.4	30.7
IT Security	34.2	156.8	156.8	158.5
Enterprise Continuous Diagnostics and Monitoring	124.1	126.6	126.6	126.4
Enterprise Security Information & Event Mgmt Solution (SIEM)	268.4	269.8	269.8	267.9
<hr/>				
Office of Information Assurance	1,769.5	1,777.9	1,777.9	1,822.1
Hosting Services	134.7	76.2	76.2	78.3
<hr/>				
Office of IT Service Delivery - Hosting Services	134.7	76.2	76.2	78.3
<hr/>				
Electronic Records Management	472.5	509.7	509.7	537.1
Solutions, Design and Innovation (SDI)	127.6	125.0	125.0	127.4
Geospatial Services	27.4	28.5	28.5	28.9
E-Forms	0.0	218.8	218.8	219.4
<hr/>				
Office of Information and Technology Management	627.5	882.0	882.0	912.7
<hr/>				
Enterprise Services Network	1,160.5	439.8	439.8	435.6
Frequency Management Support	69.8	76.7	76.7	60.0
NTIA Spectrum Management	113.1	108.3	108.3	129.9
Radio Program Management Office	74.1	129.7	129.7	63.4
Federal Relay Service	28.4	29.0	29.0	29.9
MIB Data Networking	0.3	0.6	0.6	0.2
Telecommunication Services	0.8	1.5	1.5	0.6
Integrated Digital Voice Communications System	0.6	1.3	1.3	0.5
Enterprise Services Network - Central Bill Pass Throughs	1,460.4	1,864.9	1,864.9	1,853.7
<hr/>				
Office of IT Service Delivery - Telecommunications Services	2,908.0	2,651.8	2,651.8	2,573.9
<hr/>				
Enterprise Service Desk	95.5	0.0	0.0	0.0

Sundry Exhibits

WORKING CAPITAL FUND REVENUE - Centralized Billing
 FY 2018 President's Budget
 GEOLOGICAL SURVEY
 (\$ in thousands)

Activity/Office	2016 Revised	2017 Pres Budget	2017 Revised	2018 Estimate
Office of IT Service Delivery - Customer Support Services	95.5	0.0	0.0	0.0
Architecture & IT Portfolio Performance Management	492.0	402.9	402.9	459.4
Compliance and Audit Management	285.7	309.3	309.3	312.4
IT Budget Formulation & Portfolio Development	305.0	324.7	324.7	350.7
Office of Planning and Performance Management	1,082.7	1,037.0	1,037.0	1,122.5
Sustain Data Center Consolidation and Cloud Hosting Capabilities	0.0		0.0	281.7
Gateway/Bandwidth Expansion	0.0		0.0	281.6
Office of IT Service Delivery - Telecommunication Services	0.0		0.0	563.3
e-Government Initiatives	376.4	380.4	380.4	0.0
e-Gov Program Manager	0.0		0.0	9.1
e-Gov e-rulemaking	0.0		0.0	116.8
e-Gov - GovBenefits - Disaster Assistance Improvement Plan DHS	0.0		0.0	7.6
e-Gov - Integrated Acquisition Environment (IAE) Loans and	0.0		0.0	43.5
e-Gov - Human Resources Line of Business (HRLoB) OPM	0.0		0.0	15.8
e-Gov - Financial Management Line of Business (FMLoB)	0.0		0.0	14.8
e-Gov - GovBenefits.Gov Dept of Labor	0.0		0.0	12.1
e-Gov - Grants.gov HHS	0.0		0.0	107.3
e-Gov - Performance Management Line of Business (PMLoB)	0.0		0.0	6.6
e-Gov - Budget Formulation and Execution LoB	0.0		0.0	13.1
Office of Planning and Performance Management	376.4	380.4	380.4	346.6
Office of Planning and Performance Management				
Subtotal IT Shared Services	8,951.8	8,699.7	8,699.7	8,510.8
Federal Personnel and Payroll System (FPPS)	1,885.9	1,502.5	1,481.5	1,487.7
Drug Testing	28.5	18.5	14.9	15.1
OPM Employee Express	62.0	85.3	84.1	83.8
HR Systems Integration Framework (HRSIF)	85.3	64.1	63.2	63.2
HRLOB - HRSIF Central Bill	0.0	25.8	25.5	26.1
HR LOB - FPPS	0.0	372.9	367.7	381.2
IBC Human Resources Directorate	2,061.7	2,069.1	2,036.9	2,057.1
Quarters Program	1.0	0.7	0.9	0.9
Quarters - iQMIS CB	0.3	0.3	0.5	0.5
IBC Financial Management Directorate	1.3	1.0	1.4	1.4
Boise Acquisition Office	370.7	145.7	145.7	207.4
IBC Acquisitions Services Directorate	370.7	145.7	145.7	207.4
Subtotal Interior Business Center	2,433.7	2,215.8	2,184.0	2,265.9
TOTAL	17,057.2	16,577.2	16,451.9	16,442.6

Direct billing is used whenever the product or service provided is again severable, but is sold through a time and materials reimbursable support agreement or similar contractual arrangement. The following tables provide the actual direct and reimbursable collections from the USGS for 2016, and estimated billings and collections for 2017 and 2018.

WORKING CAPITAL FUND REVENUE - Direct Billing				
FY 2018 President's Budget				
GEOLOGICAL SURVEY				
(\$ in thousands)				
Activity/Office	2016 Actual	2017 Pres Budget	2017 Estimate	2018 Estimate
OS Shared Services				
Financial and Business Mgmt System - FBMS				
Creative Communications	3.1	5.6	3.1	3.1
Office of Facilities & Admin Services	3.1	5.6	3.1	3.1
OFAS - MIB Space Agreement Components				
Office of Valuation Services	—	—	—	—
Federal Consulting Group / DOIU	—	—	—	—
Office of Aviation Services	—	—	—	—
Subtotal OS Shared Services	3.1	5.6	3.1	3.1
OS Activities				
Secretary's Immediate Office				
Office of Environmental Policy and Compliance				
Ocean Coastal Great Lakes Activities	40.0	40.4	40.0	40.4
Office of Policy Analysis	40.0	40.4	40.0	40.4
Office of Budget				
Single Audit Clearinghouse	0.2	0.2	0.4	0.4
Office of Financial Management	0.2	0.2	0.4	0.4
e-OPF	133.8	133.8	140.0	140.0
Office of Human Resources	133.8	133.8	140.0	140.0
Equal Employment Opportunity (EEO) Investigations	1.7	3.9	1.7	1.7
Equal Employment Opportunity (EEO) Training	1.5	1.5	1.5	1.5
Office of Civil Rights	3.2	5.4	3.1	3.1
Online Learning	27.4	25.2	28.1	28.1
Consolidated Direct Billed Leadership & Perf Centers	61.9	62.5	62.5	62.5
Senior Executive Service Candidate Development Program	18.2	0.0	10.2	10.2
DOI University (DOIU)	107.5	87.7	100.8	100.8
Office of Law Enforcement, Security, and Emergency Management				
Federal Flexible Savings Account (FSA) Program	26.8	52.8	37.6	37.6
Department-wide Programs	26.8	52.8	37.6	37.6
Subtotal OS Activities	311.5	320.3	321.9	322.3

Sundry Exhibits

WORKING CAPITAL FUND REVENUE - Direct Billing
FY 2018 President's Budget
GEOLOGICAL SURVEY
(\$ in thousands)

Activity/Office	2016 Actual	2017 Pres Budget	2017 Estimate	2018 Estimate
IT Shared Services				
Unified Messaging	1,256.7	1,504.7	1,175.0	1,219.1
		0.0		
Office of IT Service Delivery - End User Services	1,256.7	1,504.7	1,175.0	1,219.1
Anti-Virus Software Licenses		308.0	0.0	
Identity, Credential Access Management (ICAM)	1,122.3	1,122.3	1,122.3	1,155.9
Data at Rest Initiative	15.0	15.5	15.5	15.5
CDM Licenses	0.0		0.0	357.5
Office of Information Assurance	1,137.3	1,445.7	1,137.8	1,528.9
Data Center Consolidation and Cloud Planning, Analysis and	114.4	115.8	0.0	0.0
Core Hosting Services	377.3	376.1	375.8	243.4
Office of IT Service Delivery - Hosting Services	491.7	491.9	375.8	243.4
ESRI Enterprise Licenses	1,141.7	1,172.9	1,172.9	1,172.9
Electronic Records Management	600.3	718.7	545.5	541.1
Imagery for the Nation (IFTN) - ESRI Enterprise Licenses	950.0	950.0	950.0	949.8
Office of Information and Technology Management	2,692.0	2,841.6	2,668.5	2,663.8
Information Systems Security Operations (ISSO)	31.4	31.4	4.7	4.7
PPCD Security Compliance		0.0		0.0
Office of Information Assurance/Security	31.4	31.4	4.7	4.7
Enterprise Services Network	2,706.8	2,706.8	3,343.7	3,343.7
ISSO Network Support Services	12.9	12.9	5.5	5.5
Office of IT Service Delivery - Telecommunications Services	2,719.7	2,719.7	3,349.3	3,349.3
Customer Support Services Division	0.3	0.3	3.7	3.6
Office of IT Service Delivery - Customer Support Services	0.3	0.3	3.7	3.6
Subtotal IT Shared Services	8,329.1	9,035.4	8,714.8	9,012.8

WORKING CAPITAL FUND REVENUE - Direct Billing				
FY 2018 President's Budget				
GEOLOGICAL SURVEY				
(\$ in thousands)				
Activity/Office	2016 Actual	2017 Pres Budget	2017 Estimate	2018 Estimate
Interior Business Center				
IBC Office of the Director				
Payroll & HR Systems	466.3	411.6	406.0	415.2
Payroll & HR Systems (Passthrough)	385.2	396.2	364.4	375.5
HRLOB - Direct Bill	59.1	59.8	59.4	62.2
IBC Human Resources Systems	910.7	867.6	829.8	853.0
IBC Human Resources Directorate				
IBC Financial Management Systems				
Indirect Cost Negotiations - DOI Support	6.1	6.4	6.4	12.5
IBC Financial Management Directorate	6.1	6.4	6.4	12.5
	0.0	0.0		
IBC Acquisitions Services Directorate	0.0	0.0		
Subtotal Interior Business Center	916.8	873.9	836.1	865.5
TOTAL	9,560.5	10,235.2	9,875.9	10,203.8

Payments to Other Federal Agencies

	2016 Actual	2017 Change	2018 Change
Worker's Compensation Payments	2,331	151	-75
The adjustment is for the change in costs of compensating injured employees and dependents of employees who suffer accidental deaths while on duty. Costs for the BY will reimburse the Department of Labor, Federal Employees Compensation Fund, pursuant to 5 U.S.C. 8147(b) as amended by Public Law 94-273.			
Unemployment Compensation Payments	604	-78	9
The adjustment is for projected changes in the costs of unemployment compensation claims to be paid to the Department of Labor, Federal Employees Compensation Account, in the Unemployment Trust Fund, pursuant to Public Law 96-499.			
GSA Rental Payments	81,198	1,223	11,800
The adjustment is for changes in the costs payable to General Services Administration (GSA) and others resulting from changes in rates for office and non-office space estimated by GSA, as well as the rental costs of other currently occupied space. These costs include building security, the case of GSA space, these are paid to DHS. Costs of mandatory office relocations, i.e., relocations in cases where due to external events there is no alternative but to vacate the currently occupied space, are also included.			

Bureau Administrative Costs

Shared Program Costs

The USGS maintains less than one percent of its appropriation for other bureau-wide support and science-related activities. These funds are used for initiatives which may be unfunded mandates, are crosscutting in nature, or respond to new and emerging scientific issues.

Sundry Exhibits

The funding for the initiatives in the Shared Program Costs are assessed at the budget activity level, based upon one of two methodologies: proportionately, based on total appropriated funds for the mission area; or proportionately, based on total funds for the mission area, including reimbursable funding sources, and are distributed to the initiatives efficiently. The methodology used is tied to the nature of the initiative. For instance, an initiative that is crosscutting to all the mission areas, but is purely an Interior priority (one in which an external partner is not a stakeholder, nor receives direct benefit of the service) would receive its funding based upon a calculation on appropriated funds only. Conversely, an initiative where all customers of the USGS either directly or indirectly receive benefit, such as the aforementioned information technology compliance and security upgrades, would be calculated to each of the mission areas based upon all funding sources, both appropriated and reimbursable. The initiatives on the Shared Program Cost Chart are vetted each year with the Executive Leadership Team of the USGS, and are decided upon in a voting process to ensure bureauwide concurrence.

The following initiatives are currently planned for the USGS's 2018 Shared Program Costs:

2018 Shared Program Cost Chart (\$000)

Mission Area	Ecosystems	Climate & Land Use Change	Energy and Minerals	Environmental Health	Natural Hazards	Water Resources	Core Science Systems	Total
Delta Science **	120.3	112.4	55.0	16.0	109.2	161.7	87.4	662.1
Grand Canyon Monitoring **	183.0	171.0	83.7	24.3	166.2	246.1	133.0	1,007.4
Regional Science **	473.3	442.3	216.5	62.9	429.7	636.3	343.9	2,604.8
John Wesley Powell Center **	85.5	79.9	39.1	11.4	77.6	114.9	62.1	470.5
International Program **	293.2	274.0	134.1	39.0	266.2	394.2	213.0	1,613.8
Information Management and Technology *	713.5	540.9	246.2	70.1	522.5	1,565.4	472.2	4,130.7
Web Re-engineering *	500.9	379.8	172.9	49.2	366.8	1,099.0	331.5	2,900.0
QMS Laboratory Review **	45.4	42.4	20.8	6.0	41.2	61.1	33.0	250.0
Total Program Costs	2,415.1	2,042.8	968.3	279.0	1,979.4	4,278.7	1,676.0	13,639.4

* Proportionally spread by total funds.

** Proportionally spread by appropriated funds.

Delta Science – The California Bay-Delta is recognized as one of the world's threatened treasures of biodiversity, which supports unique native species and their critical tidal habitats. The USGS participates in the Delta Science Federal-State partnership which coordinates the efforts of 25 State and Federal agencies to improve the quality and reliability of California's water supplies while restoring the Bay-Delta ecosystem. USGS science contributes to restoration challenges such as water supply reliability, water quality, sustainability of native species, and flood risk.

Grand Canyon Monitoring – The USGS's Grand Canyon Monitoring and Research Center (GCMRC) is the science provider for the Glen Canyon Dam Adaptive Management Program. In this role, the research center provides the public and decisionmakers with relevant scientific information about the status and trends of natural, cultural, and recreational resources found in those portions of Grand Canyon National Park and Glen Canyon National Recreation Area affected by Glen Canyon Dam operations.

Regional Science – The implementation of the USGS Science Strategy calls for the integration of the full breadth and depth of USGS capabilities; building on existing strengths and partnerships. To that end, many of the USGS's historical "single-discipline" science centers are now reflections of this science strategy, and perform research and conduct science across many USGS mission areas, and need to respond quickly to new and emerging science issues. This funding brings scientists together to work

across teams and across regions, to respond to the Nation's highest and changing priorities, respond to global trends, and conduct the best possible science.

John Wesley Powell Center – The John Wesley Powell Center for Analysis and Synthesis serves as a catalyst for innovative thinking in Earth system science research. Initiated as one means of implementing the USGS Science Strategy, the Powell Center supports scientist-driven interdisciplinary analysis and synthesis of complex natural science problems. USGS scientists are encouraged to propose working groups reflecting a mix of USGS scientists and their colleagues from government and academia focused on major earth science issues. The Powell Center work generates cutting-edge, high-visibility publications.

International Programs – The Office of International Programs is dedicated to high quality, timely, scientific study that is international in scope and that focuses on the USGS Science Strategy's themes. As one of the world's premier science agencies, the USGS has long recognized the mutual benefits resulting from interaction with scientific partners abroad and extending research and investigations to other countries. By providing reliable scientific information about the Earth and its resources from an international perspective, the USGS Office of International Programs supports US foreign policy and national security; provides a basis for science diplomacy, and improves the scientific basis for managing ecosystems and natural resources.

DOI IT Transformation – This funding will be used to support Interior's efforts in IT Transformation. These funds will support the Department's activities related to data center consolidation, single-source messaging, and cloud-based electronic forms, records, documents and content management solutions.

Web Reengineering – This funding will streamline and organize USGS's web presence to create a more effective and manageable Web presence and to provide Web-enabled technology, real-time access, social and collaborative cloud-based tools, and extensive use of mobile and tablet devices.

QMS Laboratory Review – Conduct a multi-phase review of all USGS laboratories on processes, procedures, and best practices to meet our Nation's need. The multi-phase study will be independently conducted to assure our facilities across the nation have an overall Quality Management System (QMS). QMS is a written and documented collection of quality assurance manuals, standard operating procedures (SOPs), laboratory practices and policies, and commitments by an organization to report data of known and documented quality in terms of traceability, transparency, reliability, consistency, and reproducibility.

Internal Bureau Overhead Cost Allocation Methodology

The USGS manages overhead costs at two levels—the bureau and science center. Bureau level costs include headquarters and area executive, managerial, supervisory, administrative, and financial functions and bureauwide systems. At the bureau level, funding appropriated to the Science Support budget activity pays the bureauwide overhead costs in the same proportion as appropriated funding is to total funding. For this reason, bureauwide overhead costs collected on reimbursable support agreements are deposited within Science Support program areas, as well.

Sundry Exhibits

The USGS assesses a bureau overhead rate, estimated to remain at 12 percent, on reimbursable work from non-Interior customers to recoup their share of bureau-level costs. In some cases, the USGS assesses a special or reduced rate when it can be demonstrated that indirect costs are substantially and consistently less than the norm and the amount collected covers the full costs, such as with pass-through funding where the Survey does not perform any of the actual work. The following table shows the funding available to the Science Support program, including the anticipated overhead collections to pay for bureauwide costs.

(Dollars in Thousands)

Source of Funding	2018	2018	2018
	Budget Request	Estimated Bureau Overhead Distribution	Estimated Total
Science Support			
Administration and Management	69,379	29,889	99,268
Information Services	19,989	8,611	28,600
Total Funding	89,368	38,500	127,868

At the science center level, because there generally is not an appropriated funding source to pay the local overhead (common services) costs, both the appropriated and reimbursable funding are assessed a percentage to cover their share of science center-level costs. Science center common services costs include center costs that are not directly attributable to a specific activity or project, such as managerial, supervisory, administrative, and financial functions and related systems, as well as costs incidental to providing services and products, such as postage, training, miscellaneous supplies and materials. The cost during 2016, for the local overhead, totaled \$200 million from both appropriated and reimbursable funds.

In recognition of the USGS role as the science bureau for the Department of the Interior, the USGS is continuing to give Interior bureaus and offices a "preferred" customer rate on overhead charges for a significant portion of reimbursable work, to the extent that matching funds are available within the USGS budget. The maximum rate that cost centers may charge other Interior bureaus for common services and bureau costs combined remains 15 percent net. In 2016, of the 15 percent, 7.5 percent is applied to bureau costs, and the remaining 7.5 percent is applied to common services costs. Cost centers must fund the common services costs not recovered (e.g., the difference between the cost center's standard common services costs and the 7.5 percent) from USGS appropriated funds. In this way, the USGS is partnering on the science needs of Interior from both the bureau and cost centers.

The Chief Financial Officer establishes the USGS bureau special rate for each fiscal year. The special rate for 2017 is estimated to remain at three percent. Cost centers do not charge more than the bureau special rate for facilities-related costs or their standard common services rate when funding is approved for a bureau-level special rate. Special rates are applied under the following circumstances:

- When the USGS receives funds from a non-USGS organization and awards a grant to a third-party entity.

- When the USGS receives funds from one or more non-USGS organizations to support, under USGS leadership, a strategic science objective that includes the USGS passing through funds to one or more third-party entities.
- When the USGS receives funds from a non-USGS organization for the purpose of the customer acquiring services through the Cartographic Services or the Remotely Sensed Data Contracts. The special rate helps encourage other Federal agencies to use these contracts for cartographic services and remotely sensed data, rather than establishing and managing their own contracts, and ensures greater data consistency through the use of common service providers.
- When the USGS receives funds from a non-USGS organization for the purpose of passing through the customer's funds to State and local governments for the direct purchase of geospatial data.
- Ecosystem's Cooperative Research Units (CRUs) are supported by a three-way partnership including the USGS, a State, and a university. The academic institutions where CRUs are co-located provide significant administrative support. In recognition of the direct services support received from the non-USGS partners, CRUs only recover one-half of the bureau rate (six percent) normally recovered from reimbursable customers or partners.

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Appendix

Alphabetical List of Acronyms

AAAS	American Association for the Advancement of Science
AAPG	American Association of Petroleum Geologists
ABC	Activity-Based Costing
ABC/M	Activity-Based Costing/Management
ABP	Asset Business Plan
ACCCNRS	Advisory Committee on Climate Change and Natural Resources Science
ACES	Achieving Cost Efficiencies for Science
ACI	American Competitive Initiative
ACP	Arctic Coastal Plain
ACWI	Advisory Committee on Water Information
ADA	Americans with Disabilities Act
AEI	Administration and Enterprise Information
AFS	American Fisheries Society
AFWA	U.S. Air Force Weather Agency
AMD	Aviation Management Directorate
AMP	Asset Management Plan
AMWG	Adaptive Management Work Group
ANS	Alaska North Slope
ANS	Aquatic Nuisance Species (Ecosystems)
ANSS	Advanced National Seismic System
ANWR	Arctic National Wildlife Refuge
APHIS	Department of Agriculture Animal and Plant Health Inspection Service
API	Asset Priority Index
AR	Accounts Receivable
AR5	5 th Assessment Report
ARMI	Amphibian Research and Monitoring Initiative
ARRA	American Recovery and Reinvestment Act
ASC	Alaska Science Center
ASIWPCA	Association of State and Interstate Water Pollution Control Administrators
AVHRR	Advanced Very High Resolution Radiometer
AVO	Alaska Volcano Observatory
AWiFS	Advanced Wide Field Sensor
BASIS+	Budget and Science Information System
BBL	Bird Banding Laboratory
BBS	Bird Breeding Survey
BEN	Balkan Endemic Nephropathy
BT	Budget Team
BGN	Board of Geographic Names
BIA	Bureau of Indian Affairs
BIMD	Biological Information Management and Delivery

Acronyms

BIP	Biological Informatics Program (Equivalent to BMID)
BIS	Commerce - Bureau of Industry and Security
BLM	Bureau of Land Management
BLT	Business Leaders Team
BMPs	Best Management Practices
BNP	Biscayne National Park
BOR	Bureau of Reclamation
BPA	Blank Purchase Agreement
BPC	Bureau Program Council
BPI	USGS Office of Budget, Planning, and Integration
BPXA	BP Exploration (Alaska)
BSR	Business Strategy Review
CA	Condition Assessment
CAC	Civil Applications Committee
CALFED	California Federal (Bay-Delta Authority program)
CAP	Cooperative Agreements Program
CARA	Circum-Arctic Resource Appraisal
C&A	Certification and Accreditation
CC	Cost Center
CBERS	China/Brazil Earth Resources Satellite
CBLCM	Chesapeake Bay Land Cover Management
CBM	Coal bed Methane
CBP	Chesapeake Bay Program
CCI	Collaborative Communications Infrastructure
CCOAT	Coast Chesapeake Online Assessment Tool
CCSP	U.S. Climate Change Science Program
CDC	Centers for Disease Control and Prevention
CDR	Critical Design Review (Climate and Land Use)
CDR	Climate Data Record (Climate and Land Use)
CDI	Council for Data Integration
CEN	Climate Effects Network
CENR	Committee on Environment and Natural Resources
CEAP	Conservation Effects Assessment Project
CEGIS	Center of Excellence for Geographic Information Science
CEOS	Committee on Earth Observation Satellites
CEQ/NSTC	Council on Environmental Quality/National Science and Technology Council
CERC	Columbia Environmental Research Center
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERP	Comprehensive Everglades Restoration Plan
CESU	Cooperative Ecosystems Study Unit
CFO	Chief Financial Officer
CIO	Chief Information Officer
CISN	California Integrated Seismic Network

CITES	Conventional on International Trade in Endangered Species
CLU	Climate and Land Use Change
CMG	Coastal and Marine Geology
CMGP	Coastal and Marine Geology Program
CMSP	Coastal and Marine Spatial Planning
CNS	Central portion of the North Slope
CO ₂	Carbon Dioxide
COAST	Chesapeake Online Adaptive Support Toolkit
CoML	U.S. National Committee for the Census of Marine Life
CORE	Committee on Resource Evaluation
CPIC	Capital Planning and Investment Control
CR	Central Region
CRADA	Cooperative Research and Development Agreement
CRSSP	Commercial Remote Sensing Space Policy
CRTF	Coral Reef Task Force
CRU	Cooperative Research Units
CRUISE	Columbia River USGS Integrated Science Explorer
CRV	Current Replacement Value
CRWA	Charles River Watershed Association
CSC	Climate Science Center
CSI	Core Science Informatics
CSIP	Cost Savings and Innovation Plan
CSIRC	Computer Security Incident Response Capability
CSMP	California Seafloor Mapping Program
CSRS	Civil Service Retirement System
CSS	Core Science Systems
CTBTO	Comprehensive Test Ban Treaty Organization
CUES	Comprehensive Urban Ecosystems Studies
CUSEC	Central United States Earthquake Consortium
CVJV	Central Habitat Joint Venture
CVO	Cascades Volcano Observatory
CWD	Chronic Wasting Disease
CWP	Cooperative Water Program
CWS	Canadian Wildlife Service
DCIA	Debt Collection Improvement Act
DEM	Digital Elevation Model
DEP	[State] Department of Environmental Protection
DEQ	[State] Department of Environmental Quality
DFRs	Departmental Functional Reviews
DGH	Indian Directorate General of Hydrocarbons
DHS	Department of Homeland Security
DiGIR	Distributed Generic Information Retrieval
DMC	Data Management Center

Acronyms

DMC	Disaster Monitoring Constellation
DMCI	Deferred Maintenance and Capital Improvements
DNR	Department of Natural Resources
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOGAMI	Oregon Department of Geology and Mineral Industries
DPAS	Data Processing and Archiving
DRAGON	Delta Research and Global Observation Network
DROT	Drift River Oil Terminal
DRTO	Dry Tortugas National Park
DWH	Deepwater Horizon
DSS	Decision Support System
EA	Enterprise Architecture
EAD	Enterprise Active Directory
EAL	Energy Analytical Laboratory
ECMs	Energy Conservation Measures
ECO	Energy Conserving Opportunities
ECS	[U.S.] Extended Continental Shelf
ECV	Essential Climate Variable
EDCs	Endocrine Disrupting Chemicals
EDEN	Everglades Depth Estimation Network
EDMAP	Education Mapping Program (in National Cooperative Geologic Mapping Program)
EDRR	Early Detection, Rapid Assessment and Response
EEOC	Equal Employment Opportunity Commission
EFT	Electronic Funds Transfer
EGIM	Enterprise Geographic Information Management
EGS	Enhanced Geothermal Systems
EHP	Earthquake Hazards Program (Hazards Program)
EHP	Enterprise Hosting Platform (AEI)
EI	Enterprise Information
EIR	Enterprise Information Resources
EISA	Energy Independence and Security Act of 2007
EIS&T	Enterprise Information Security and Technology
ELA	Enterprise License Agreement
ELT	Executive Leadership Team
EMS	Environmental Management System
E.O.	Executive Order
EOL	Encyclopedia of Life
EOP	Executive Office of the President
EOR	Enhanced Oil/Gas Recovery
EPA	U.S. Environmental Protection Agency
EPCA	Energy Policy and Conservation Act of 2000
EPM	Ecosystem Portfolio Model

ER	Eastern Region
ERA	F-Risk Assessment
ERAS	eRemote Access Services
EROS	Earth Resources Observation and Science Center
ERP	Energy Resources Program
ESD	Earth Surface Dynamics
ESI	Environmental Sensitivity Index
ESN	Enterprise Services Network
ESPC	Energy Savings Performance Contract
ESRI	Environmental Systems Research Institute
ET	Evapotranspiration
ETM+	Enhanced Thematic Mapper Plus
EVMS	Earned Value Management System
EWeb	Enterprise Web
FAA	Federal Aviation Administration
FAC	Federal Advisory Committee
FACA	Federal Advisory Committee Act
FAER	Fisheries: Aquatic and Endangered Resources
FASAB	Federal Accounting Standards Advisory Board
FBAT	Facilities Budget Allocation Team
FBMS	Financial Business Management System
FBWT	Fund Balance with Treasury
FCI	Facilities Condition Index
FEA	Federal Enterprise Architecture
FECA	Federal Employee Compensation Act
FEDMAP	Federal Lands Mapping Program (in National Cooperative Geologic Mapping Program)
FEGLI	Federal Employees Group Life Insurance
FEHB	Federal Employees Health Benefit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FERS	Federal Employees Retirement System
FFMIA	Federal Financial Management Improvement Act of 1996
FFS	Fire and Fire Surrogate
FGDC	Federal Geographic Data Committee
FICA	Federal Insurance Contributions Act
FICMNEW	Federal Interagency Committee for the Management of Noxious and Exotic Weeds
FISC	Florida Integrated Science Center
FISMA	Federal Information Security Management Act
FMT	Field Managers Team
FMFIA	Federal Managers' Financial Integrity Act of 1982
FMMS	Facilities Maintenance Management System
FOS	Flight Operations Segment
FOT	Flight Operations Team

Acronyms

FRAMES	Fire Research and Management Exchange System
FRB	Federal Reserve Board
FRPC	Federal Real Property Council
FRPP	Federal Real Property Profile
FSA	Farm Service Agency
FSAM	Federal Segment Architecture Methodology
FSP	Fundamental Science Practice
FTE	Full-Time Equivalent
FWS	U.S. Fish and Wildlife Service
GAAP	Generally Accepted Accounting Principles
GAM	Geographic Analysis and Monitoring Program
GAP	Gap Analysis Program
GAO	Government Accountability Office
GBIP	Great Basin Information Project
GBIS	Global Biodiversity Information Facility
GCDAMP	Glen Canyon Dam Adaptive Management Program
GC-IMS	Global Change-Information Management System
GCP	Global Change Program
GCMRC	Grand Canyon Monitoring and Research Center
GEO	Group on Earth Observations
GEODE	GEO-Data Explorer
GeoMAC	Geospatial Multi-Agency Coordination Group
GEOMAG	Geomagnetism Program
GEOSS	Global Earth Observation System of Systems
GFDL	Geophysical Fluid Dynamics Laboratory
GFL	Global Fiducials Library
GHG	Greenhouse Gas
GIRT	Geospatial Information Response Team
GIS	Geographic Information System
GLS	Global Land Survey
GLSC	Great Lakes Science Center
GNIS	Geographic Names Information System
GOES	Geostationary Operational Environmental Satellites
GOS	Geospatial One-Stop
GPRA	Government Performance and Results Act
GRB	Green River Basin
GHG	Greenhouse Gas
GPS	Global Positioning System
GPSC	Geospatial Products and Services Contract
GSA	General Services Administration
GS-FLOW	Groundwater and Surface-water flow model
GSN	Global Seismographic Network
GWRP	Ground-Water Resources Program

HAZUS	Federal Emergency Management Agency’s Earthquake Loss Estimation Program
HBN	USGS Hydrologic Benchmark Network
HDOA	Hawaii Department of Agriculture
HDR	High-Data Rate Radio
HEDDS	Highly Pathogenic Avian Influenza Early Detection Data System
HDDS	Hazards Data Distribution System
HHS	Department of Health and Human Services
HIF	Hydrologic Instrumentation Facility
HLI	Healthy Lands Initiative
HNA	Hydrologic Networks and Analysis Program
HPO	High Performing Organization
HPPG	High Priority Performance Goal
HR	Human Resources
HR&D	Hydrologic Research and Development Program
HRS	Helibourne electromagnetic Surveys
HSPD -12	Homeland Security Presidential Directive 12
HUB	Historically Underutilized Business
HUD	US Department of Housing and Urban Development
HVO	Hawaii Volcano Observatory
HWATT	Hemlock Woolly Adelgid Action Team
I&M	Inventory and Monitoring – NPS
IAGA	International Association of Geomagnetism and Aeronomy
ICAO	International Civil Authorization Organization
ICL	International Consortium on Landslides
ICRP	Internal Control Review Plan
ICWP	Interstate Council on Water Policy
IDWR	Idaho Department of Water Resources
IEAM	Integrated Environmental Assessment and Management
IGPP	Institute for Geophysics and Planetary Physics
IIE	Integrated Information Environment
ILM	Integrated Landscape Monitoring
IOOS	Integrated Ocean and coastal Observing System
IP	Investment Plan
IPCC	Intergovernmental Panel on Climate Change
IPDS	Information Product Data System
IRB	Investment Review Board
IRIS	Incorporated Research Institutions for Seismology
IRS	Indian Remote Sensing Satellite
InSAR	Interferometric Synthetic Aperture Radar
ISO	International Organization for Standardization
ISSP	Information Security Strategic Plan
IT	Information Technology
ITAP	Invasive Terrestrial Animals and Plants

Acronyms

ITILOB	Information Technology Infrastructure Line of Business
ITIS	Integrated Taxonomic Information System
ITSOT	IT Security Operations Team
ITSSC	IT Security Steering Committee
ITT	Information Technology Transformation
IUCN	International Union for the Conservation of Nature
IUCN	International Union of Conservation Nations
JFA	Joint Funding Agreement
JV	Joint Venture Partnerships
KSF	Thousand Square Feet
LAS	Local Action Strategy
LCAT	Land Cover Analysis Tool
LCC	Landscape Conservation Cooperatives
LCSP	Land Change Science Program
LDCM	Landsat Data Continuity Mission
LDGST	Landsat Data GAP Study Team
LEAG	Long-term Estuary Assessment Group
LHP	Landslide Hazards Program
LiDAR	Light Detecting and Ranging
LIFE	NBII Library of Images from the Environment
LIMA	Landsat Image Mosaic of Antarctica
LMV	Lower Mississippi Valley
LMVJV	Lower Mississippi Valley Joint Venture Office
LOA	Level of Authentication
LRS	Land Remote Sensing
LSC	Leetown Science Center
LST	Landsat Science Team
LTRMP	Long-Term Resource Monitoring Program
LTWG	Landsat Technical Working Group
LUPM	Land Use Portfolio Model
MARCO	Mid-Atlantic Research Consortium for Oceanography
MBTU	Million British thermal units
MD	Management Directive
MEO	Most Effective Organization
METRIC	Mapping EvapoTranspiration with high Resolution and Internalized Calibration
MHDP	Multi-Hazards Demonstration Project
MMS	Minerals Management Service
MOA	Memorandum of Agreement
MOC	Mission Operations Center
MODIS	Moderate Resolution Imaging Spectroradiometer
MODFLOW	Modular Ground-Water Flow Model
MOU	Memorandum of Understanding
MRBI	Mississippi River Basin Healthy Watersheds Initiative

MRDS	Mineral Resources Data System
MRERP	Mineral Resources External Research Program
MRLC	Multi-Resolution Land Characteristics Consortium
MRP	Mineral Resources Program
MSCP	Multi-Species Conservation Program
MSH	Mount St. Helens
MSS	Multi Spectral Scanner
MTBE	Methyl Tert-Butyl Ether
MTBS	Monitoring Trends in Burn Severity
MUSIC	MIT-USGS Science Impact Collaborative
MW	Megawatt
MWE	Megawatt electric
NABCI	North American Bird Conservation Initiative
NACO	National Association of Counties
NADP	National Atmospheric Deposition Program
NAGT	National Association of Geoscience Teachers
NANPCA	Non-indigenous Aquatic Nuisance Prevention and Control Act
NARA	National Archives and Records Administration
NAS	National Academy of Sciences (Core Science)
NAS	USGS National Non-indigenous Aquatic Species Database (Ecosystems)
NASA	National Aeronautics and Space Administration
NASQAN	National Stream Quality Accounting Network
NatWeb	National Web Server System
NAWQA	National Water-Quality Assessment
NBC	Department of the Interior – National Business Center
NBII	National Biological Information Infrastructure
NCA	National Climate Assessment
NCAR	National Center for Atmospheric Research
NCAP	National Civil Applications Program
NCCWSC	National Climate Change and Wildlife Science Center
NCDE	Northern Continental Divide Ecosystem
NCEP/NOAA	National Centers for Environmental Prediction
NCGMP	National Cooperative Geologic Mapping Program
NCIA	National Competitiveness Investment Act
NCPP	USGS National Coastal Program Plan
NCRDS	National Coal Resources Data System
NDMC	National Drought Mitigation Center
NDOP	National Digital Orthoimagery Program
NED	National Elevation Dataset
NEHRP	National Earthquake Hazards Reduction Program
NEIC	National Earthquake Information Center
NEON	National Ecological Observatory Network
NEPA	National Environmental Policy Act

Acronyms

NEST	National Environmental Status and Trends
NETL	National Energy Technology Laboratory
NFHAP	National Fish Habitat Action Plan
NGA	National Geospatial-Intelligence Agency
NGAC	National Geospatial Advisory Committee
NGGDPP	National Geological and Geophysical Data Preservation Program
NGIC	National Geomagnetic Information Center
NGMA	National Geologic Mapping Act
NGMDP	National Geologic Map Database Project
NGO	Nongovernmental organization
NGP	National Geospatial Program
NGWMN	National Ground Water Monitoring Network
NHD	National Hydrography Dataset
NHWC	National Hydrologic Warning Council
NIEHS	National Institute of Environmental Health Sciences
NIFC	National Interagency Fire Center
NIH	National Institute of Health
NISC	National Invasive Species Council
NISS	National Institute for Invasive Species Science
NISMP	National Invasive Species Management Plan
NIST	National Institute of Standards and Technology
NIWR	National Institutes for Water Resources
NLC	National League of Cities
NLCD	National Land Cover Database
NLIC	National Landslide Information Center
NLI	National Land Imaging Program
NOAA	National Oceanic and Atmospheric Administration
NORAD	North American Aerospace Defense Command
NORTHCOM	U.S. Northern Command
NOSC	National Operations and Security Center
NPN	National Phenology Network
NPRA	National Petroleum Reserve Alaska
NPS	National Park Service
NRDA	Natural Resource Damage Assessment
NRIS	Natural Resource Information System
NRC	National Research Council (United States National Academies)
NRC	Nuclear Regulatory Commission (United States NRC)
NRCS	Natural Resources Conservation Service
NRMP	National Resource Monitoring Partnership
NROC	Northeast Regional Ocean Council
NRP	National Research Program (research organization in USGS Water Resources)
NRPP	National Resource Preservation Program
NSDI	National Spatial Data Infrastructure

NSF	National Science Foundation
NSGIC	National States Geographic Information Council
NSIP	National Streamflow Information Program
NSLRSDA	National Satellite Land Remote Sensing Data Archive
NSMP	National Strong Motion Program
NSPD	National Space Policy
NSTC	National Science and Technology Council
NSVRC	Northern Shenandoah Valley Regional Commission
NTN	National Trends Network
NVCS	National Vegetation Classification Standard
NVEWS	National Volcano Early Warning System
NWAVU	National Water Availability and Use Assessment
NWHC	National Wildlife Health Center
NWIS	National Water Information System
NWQL	National Water Quality Laboratory
NWQMN	National Water Quality Monitoring Network
NWRC	National Wetlands Research Center
NWS	National Weather Service
O&M	Operations and Maintenance
OAEI	Office of Administration and Enterprise Information
OAFM	USGS Office of Accounting and Financial Management
OAG	USGS Office of Acquisition and Grants
OAP	Ocean Action Plan
OBIS	Ocean Biogeographic Information System
OBIS	USGS Office of Business Information Systems, (AEI)
OCAP	USGS Office of Communication and Publications
OED	Office of Employee Development
OEPC	Office of Environmental Policy and Compliance
OES	Office of Emergency Services
OFDA	Office of Foreign Disaster Assistance
OFEE	Office of the Federal Environmental Executive
OFR	Open-File Report
OGC	Open Geospatial Consortium
OHC	USGS Office of Human Capital
OIA	Office of Insular Affairs
OICR	USGS Office of Internal Control and Reporting
OIG	Office of the Inspector General
OGDB	Organic Geochemistry Database
OLI	Operational Land Imager
OMB	Office of Management and Budget
OMS	USGS Office of Management Services
OPA	USGS Office of Policy and Analysis
OPM	Office of Personnel Management

Acronyms

ORPP	Ocean Research Priority Plan
ORPPIS	Ocean Research and Priorities Plan and Implementation Strategy
OSHA	Occupational Safety and Health Administration
OSM	Office of Surface Mining
OSQI	Office of Science Quality and Integrity
OSTP	Office of Science and Technology Policy
OWRS	Office of Western Regional Services
PAGER	Prompt Assessment of Global Earthquakes for Response
PBO	Plate Boundary Observatory
PBX	Private Branch Exchange
PCR	Polymerase Chain Reaction
PDA	Personal Digital Assistant
PDF	Portable Document Format
PDR	Preliminary Design Review
PES	Priority Ecosystem Science
PFM	(Department) Office of Financial Management
PI	Principal Investigator
PII	Personally Identifiable Information
PIP	Performance Improvement Plan
PIP	Program Improvement Plan
PMO	Project Management Office
PNAMP	Pacific Northwest Aquatic Monitoring Partnership
POA&M	Plan of Action and Milestone
PP&E	Property, Plant, and Equipment
PRB	Powder River Basin
PSNER	Puget Sound Near Shore Ecosystem Restoration
PSS	Perimeter Security Standard
PTWC	Pacific Tsunami Warning Center
PWRC	Patuxent Wildlife Research Center
QOL	Quality of Life
R&D	Research and Development
RASA	Regional Aquifer-System Analysis
RCM	Regional Climate Models
RCOOS	Regional Coastal Ocean Observing Systems
REE	Rare Earth Elements
REMS	River Ecosystem and Modeling Science
RFP	Request for Proposal
RGIO	Regional Geospatial Information Office®
RIF	Reduction in Force
RIM	River Input Monitoring Program
RISA	Regional Integrated Science and Assessments – NOAA
RPM	Real Property Management System
RSAC	Remote Sensing Application Center

RSSI	Required Supplementary Stewardship Information
RTS	Reports Tracking System (Water Resources)
R/V	Research Vessel
RWRPC	Regional Water Resources Policy Committee
S&T	USGS Status and Trends Program
SAC	Stakeholder advisory Committee (Climate and Land use)
SAC	USGS Science Advisory Council
SAFOD	San Andreas Fault Observatory at Depth
SAFRR	Science Application for Risk Reduction
SAIN	Southern Appalachian Information Node
SAP	Synthesis and Assessment Product
SAR	Synthetic Aperture Radar
SAUS	Storage Assessment Units
SBFD	San Francisco Bay and freshwater delta
SBSP	South Bay Salt Pond Restoration Project
SCEC	Southern California Earthquake Center
SCR	System Concept Review
SDI	Spatial Data Infrastructures
SDR	Subcommittee for Disaster Reductions
SDRT	Supervisory Development Review Team
SES	Senior Executive Service
SETAC	Society of Environmental Toxicology and Chemistry
SFBD	San Francisco Bay Delta
SFMP	Strategic Facilities Master Plan
SFWMD	South Florida Water Management District
SHC	Strategic Habitat Conservation
SLC	Scan Line Corrector
SGL	Standard General Ledger
SIR	Surveys, Investigations, and Research
SOGW	Subcommittee of Ground Water
SoIVES	Social Values for Ecosystem Services
SOW	Statement of Work
SPARROW	Spatially Referenced Regressions on Watershed Attributes
SPN	Scientific Publishing Network
SPOC	Security Point of Contact
SPOT	Satellite Pour L'Observation de la Terre
SPRESO	South Pole Remote Earth Science Observatory
SRR	Systems Requirement Review
SRTM	Shuttle Radar Topographic Mission
SSRIs	Selective Serotonin Reuptake Inhibitors
STATEMAP	State Mapping Program (in Cooperative Geologic Mapping Program)
STEM	Science, Technology, Engineering and Mathematics
STIG	Security Technical Implementation Guides

Acronyms

SWPC	Space Weather Prediction Center
TAA	Technical Assistance Agreements
TANC	Transport of Anthropogenic and Natural Contaminants
TCOM	Tahoe Constrained Optimization Model
TDWG	Biodiversity Information Standards
TIC	Trusted Internet Connection
TIRS	Thermal Infrared Sensor
TM	Thematic Mapper
TMDL	Total Maximum Daily Loads (Clean Water Act requirement)
TRIGRS	Transient Rainfall Infiltration and Grid-Based Regional Slope-Stability Analysis
TRIP	The Road Indicator Project
TROR	Treasury Report on Receivables
TRPA	Tahoe Regional Planning Agency
TSP	Thrift Savings Plan
UAS	Unmanned Aircraft Systems
UHM	University of Hawaii-Manoa
UIC	Underground Injection Control
URISA	Urban and Regional Information System Association
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAID	U.S. Agency for International Development
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDOE	U.S. Department of Energy
USFS	U.S. Forest Service
USGCRP	U.S. Global Change Research Program
USGEO	U.S. Group on Earth Observations
USGS	U.S. Geological Survey
UMESC	Upper Midwest Environmental Services Center
USNG	United States Nation Grid
VANS	Volcano Activity Notices
VBNS	Very Broadband Network Services
VCP	Vegetation Characterization Program
VDAP	Volcano Disaster Assistance Program
Veg	Vegetation Characterization
VegDRI	Vegetation Drought Response Index
VHP	Volcano Hazards Program
VHSV	Viral Hemorrhagic Septicemia Virus
VOIP	Voice over IP Systems
VONA	Volcano Observatory Notifications for Aviation
VSIP/VERA	Voluntary Separation Incentive Payment/Voluntary Early Retirement Authority
VTC	Video Conferencing
WAN	Wide Area Network

WCCI	Wyoming Cooperative Conservation Initiative
WCF	Working Capital Fund
WCMC	UNEP-World Conservation Monitoring Center
WERC	Western Ecological Research Center
WFRC	Western Fisheries Research Center
WLAN	Wide Local Area Network
WLCI	Wyoming Landscape Conservation Initiative
WNS	White-Nose Syndrome
WNV	West Nile Virus
WPA	World Petroleum Assessment 2000
WR	Western Region
WRD	Water Resources discipline (formerly Water Resources Division)
WRIR	Water Resources Investigation Report
WRRRA	Water Resources Research Act
WRRIs	[State] Water Resources Research Institutes
WSC	[USGS State] Water Science Center
WSWC	Western States Water Council
WTER	Wildlife: Terrestrial and Endangered Resources
WUI	Wildland-Urban Interface
YMP	Yucca Mountain Program
YVO	Yellowstone Volcano Observatory

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