BUDGET JUSTIFICATIONS

The United States Department of the Interior

and Performance Information
Fiscal Year 2020

U.S. GEOLOGICAL SURVEY

NOTICE: These budget justifications are prepared for the Interior, Environment and Related Agencies Appropriations Subcommittees. Approval for release of the justifications prior to their printing in the public record of the Subcommittee hearings may be obtained through the Office of Budget of the Department of the Interior.

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Overview

Overview and Executive Summary

The U.S. Geological Survey (USGS) 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." In 1962, Congress expanded the USGS Organic Act to include examinations outside the national domain.

Today, the USGS provides research and integrated assessments of natural resources; supports the stewardship of public lands and waters; and delivers natural hazard science to protect public safety, health, and American economic prosperity. The USGS provides science to inform stewardship of energy and mineral resources; to sustain healthy fish and wildlife populations; to improve resilience to natural hazards and enhance community safety and well-being; to improve water resource decision-making; and to provide accurate, high-resolution geospatial, land use, and biogeographic data. Scientific coordination and collaboration within Interior and across the government is central to the USGS mission. The diversity of the USGS scientific expertise enables the bureau to carry out large-scale, multi-disciplinary investigations and provide scientific information to resource managers and planners, emergency response officials, and the public.

Budget Highlights

The 2020 budget request for the USGS is $983.5 million. The budget funds scientific monitoring, research, and mapping to support management strategies for land, water, and species. The budget funds energy and mineral resource assessments to identify the location and nature of resources and applies science to safeguard communities against natural hazards. The budget supports Landsat 9 Ground System Development to meet a fiscal year 2021 launch, and invests in critical mineral resource assessments, utilizing tools such as light detection and ranging (lidar) elevation mapping, geologic mapping, and airborne geophysics to identify mineral resources that are of significant value to the United States, and can inform strategies to reduce critical mineral import dependence.

The 2020 budget ensures scientific capabilities to:

- Monitor and ensure the availability and quality of the Nation's fresh water supply.
- Monitor and improve the ability to prepare for, respond to, mitigate the effects of, and become more resilient to natural hazards.
- Provide assessments of conventional and alternative domestic energy resources, as well as inform national security, trade, and other priorities through assessments of international resources.
- Provide assessments of domestic sources of minerals that can be used for infrastructure development, new technologies, and national security.
- Understand the functions and health of ecosystems, research native and invasive species, and investigate wildlife diseases.

- Provide insight, analyses, and data that helps Interior agencies manage lands and resources.

Interior Reorganization

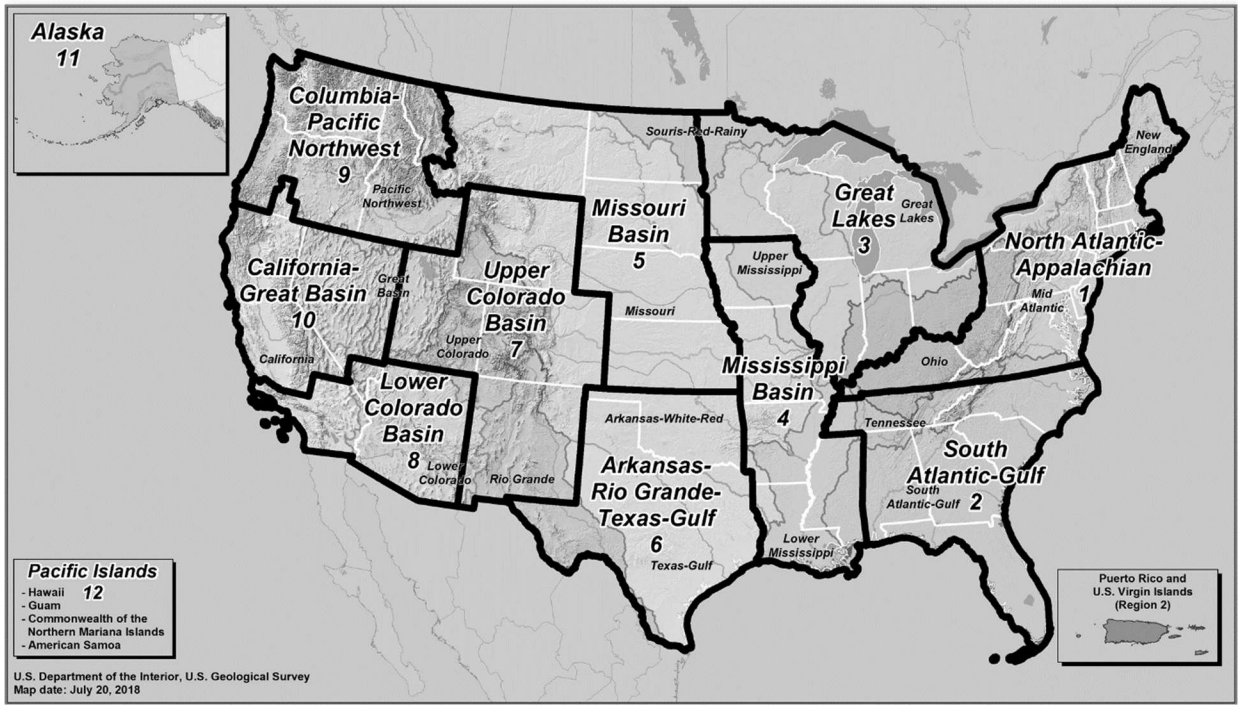
Over many decades, the Department of the Interior experienced new bureaus becoming established on an ad hoc basis with their own unique regional organizations. This ultimately resulted in a complicated series of 49 regional boundaries among 8 bureaus. This complexity led to the situation where bureau regional leadership was often focused on different geographic areas, did not have adequate and shared understanding of the needs and perspectives of regional stakeholders, and opportunities to share administrative capacity across bureaus were difficult to recognize and implement. Further, members of the public were often frustrated by problems in inter-bureau decision making where uncoordinated timelines and processes could lead to unnecessarily long delays in reaching a decision. The Department's reorganization is focused on making improvements across each of these areas.

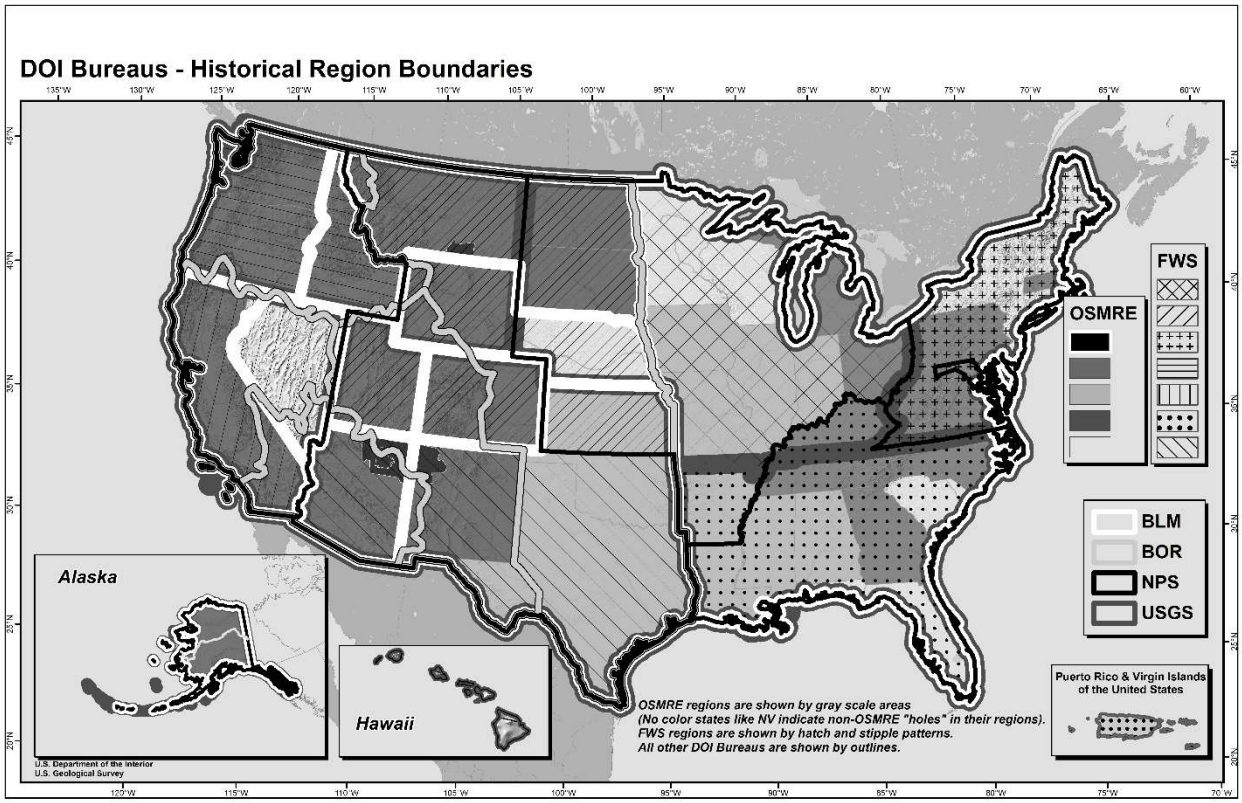
The 2020 budget request for USGS includes $6.2 million to support the reorganization of the Department of the Interior. On August 22, 2018, after working closely with stakeholders across the country on options to consolidate Interior's 49 different regions into common regions, the Department announced the designation of Interior's 12 new unified regions. As a result of Tribal consultation, BIA, BIE, and the Office of the Special Trustee for American Indians will not realign their regional field structures.

Establishing unified regions across bureaus is the cornerstone of the reforms designed to improve Interior's service delivery to the public. Within each unified region, bureaus will focus work on the same resources and constituents and improve coordination across the Department. For the public, fewer regions make it easier to do business with Interior, particularly when the public interacts with several bureaus or jurisdictions.

As part of the reorganization reforms, Interior will relocate some bureau headquarters functions out West where the preponderance of Interior's assets and acres are located. The USGS is currently assessing what headquarters functions could be delivered more effectively out West and identifying staff and functions to be moved. Interior will leverage the unified regional structure to improve and streamline business operations using shared services and best practices across the Department, focusing primarily on human resources, information technology, and acquisition services. Work is underway in 2019 to plan implementation, conduct analysis, and identify areas for collaboration within the new regions.

DOI 12 Unified Regions





The table below shows alignment of the seven USGS Regional Directors to Interior's 12 unified regions.

USGS Office Name	Interior Regional Alignment
Northeast (NE)	Region 1: North Atlantic-Appalachian
Southeast (SE)	Region 2: South Atlantic-Gulf Region 4: Mississippi-Basin Region 6: Arkansas-Rio Grande-Texas-Gulf
Midcontinent (MC)	Region 3: Great Lakes Region 5: Missouri-Basin
Rocky Mountains (RM)	Region 7: Upper Colorado-Basin
Southwest (SW)	Region 8: Lower Colorado-Basin Region 10: California-Great-Basin
Northwest-Pacific Islands (NWPI)	Region 9: Columbia-Pacific Northwest Region 12: Pacific Islands
Alaska (AK)	Region 11: Alaska

Government Reform

President Trump signed an Executive Order to modernize and reform the executive branch and Interior is leading the way, developing, and executing a program that will streamline processes and better serve the American people. The absolute first step in building a better and more efficient executive branch though is fostering a culture of ethics and respect amongst colleagues.

Interior has launched several top management objectives to better achieve Departmental goals and lead the agency moving forward. From day one of this Administration, Interior's leadership has made the work environment a priority. There is zero tolerance for any type of workplace harassment at Interior. The Department is instilling a culture change through clear management accountability, swift personnel actions, reporting procedures for harassment conduct, improved training, and substantive action plans.

In the area of anti-harassment efforts, each bureau and office has made significant headway in putting a diverse set of measures in place to prevent and address unacceptable conduct. Interior has also launched an internal Workplace Culture Transformation Advisory Council to include leadership from across the Department to keep a focus on Interior's commitment to the workplace environment. The Council will look at common issues raised in the Federal Employee Viewpoint Survey, ways to improve employee engagement, and building career paths which cross bureau silos; all with the goal to transform Interior's workplace culture for our employees, so they can realize their individual potential and be their most productive selves for the American people.

Another management priority is creating a strong ethical culture to ensure Interior employees honor the public's trust to manage taxpayer funds responsibly and avoid conflicts of interest. The expectations for appropriate employee conduct have been made clear. The Department has set goals and expectations for qualified ethics officials within Interior sufficient to ensure our operations are conducted ethically and ensure all employees have access to prompt, accurate ethics advice.

2020 Budget Request *(dollars in thousands)*			
	2018 Actual	2019 Full Year CR	2020 Request
Current (without supplemental)	1,148,457	1,148,457	983,467
Supplemental	42,246	-	-
Current *(with supplemental)*	1,190,703	1,148,457	983,467
Operation and Maintenance of Quarters	*53*	*55*	*57*
Contributed Funds	*935*	*862*	*819*
Permanent	988	917	876
Total Current and Permanent	1,191,691	1,149,374	984,343
Direct FTEs	*4,623*	*4,623*	*3,873*

2020 Budget Request *(dollars in thousands)*						
	2018 Actual	2019 Full Year CR	2020			
			Fixed Costs	Internal Transfers	Program Changes	Request
Ecosystems	217,442	217,442	609	59,710	(77,002)	141,049
Land Resources	152,499	152,499	0	-152,499	0	0
Energy and Mineral Resources	80,243	80,243	366	-22,595	5,463	86,072
Natural Hazards	178,613	178,613	439	-	(34,027)	145,025
Water Resources	229,952	229,952	689	12,398	(50,719)	179,922
Core Science Systems	219,288	219,288	481	102,986	(12,576)	207,193
Science Support	102,828	102,828	615	-	(533)	102,910
Facilities	120,091	120,091	8,602	-	(7,397)	121,296
Surveys, Investigations and Research	1,148,457	1,148,457	11,801	0	(176,791)	983,467

FTE			
	2018 Actual	2019 Full Year CR	2020 Request
Direct	4,623	4,623	3,873
Reimbursable	2,913	2,913	2,913
Working Capital Fund	117	117	117
Allocations	29	29	29
Contributed Funds	5	5	5
Total	7,687	7,687	6,937

Administration and Interior Priorities

This budget advances these Administration goals:

I. Conserve Land, Water and Species and Create a Conservation Stewardship Legacy.

USGS Role: ***Provide Science to Inform Land, Water, and Species Management*** – Develop high-fidelity water forecasts; and early warning systems for invasive species, wildlife disease, and adaptation planning. To meet this goal, the USGS will be focusing on the work and related goals listed below within the Water and Ecosystems mission areas. This work supports the National Park Service (NPS), the Fish and Wildlife Service (FWS), the Bureau of Reclamation (BOR), the Bureau of Land Management (BLM), as well as Bureau of Ocean Energy Management (BOEM), National Oceanic and Atmospheric Administration (NOAA), United States Department of Agriculture (USDA), United States Department of Defense (DOD), State, Tribes, and local water resource management agencies, and the Interstate Boundary Water Commission. In 2020, the USGS will:

- Develop science and tools to identify areas of high resource potential and minimize environmental impacts by the end of June 2021. During FY 2020, the USGS plans to complete a beta version of the smart energy tool. In 2018, the USGS engaged with partners to discuss smart energy resource management strategies, initiated research that will provide the science and data that will help inform energy resource management strategies and finalized a tool that will provide access to management options in sagebrush rangelands.
- Conduct research on species on the FWS 7-year Listing Workplan to develop scientific products and tools to inform key uncertainties in the status of the species and collaborative conservation efforts by the end of December 2021. During FY 2020, the USGS plans to complete species and population viability surveys by the end of October 2020. The FWS 7-Year Listing Workplan prioritizes research for addressing Endangered Species Act listing and critical habitat decisions throughout the next seven years. In 2018, the USGS completed a science plan and initiated research in support of the FWS 7-year listing workplan to fill information gaps required by the FWS to make informed listing decisions.
- Enhance biosurveillance of wildlife diseases and aquatic invasive species by 2021. In FY 2020, the USGS plans to continue to develop and expand tools, including the Alert Risk Mapper and data visualization tools. In 2018, examples of improved, online information and data delivery for biosurveillance of wildlife disease and aquatic invasive species include: (1) the newly released NABat Data Explorer tool that integrates survey information from NABat with white nose syndrome (WNS) diagnostic data, and historical bat occurrence data; and (2) the NAS Flood and Storm Tracker (in coordination with the Water Mission Area) that combines information on potential flooding associated with a storm event with known locations of established or possibly established nonindigenous aquatic species (NAS) from the USGS Nonindigenous Aquatic Species database to identify NAS with a risk of spreading

into additional watersheds. Both tools inform surveillance activities and aid managers control the spread of wildlife disease and aquatic invasive species.

- Reduce invasive annual grasses and sagebrush wildfire by evaluating, improving, or developing a set of tools, including a field guide, that can be used to reduce the spread of fire-prone invasive annual grasses, manage the risk of wildfire, and improve restoration of the sagebrush ecosystem by July 2022. In FY 2020, the USGS will scientifically evaluate fire behavior and calibrate and improve fire fuel models for the Great Basin. In 2018, the USGS engaged with the Wildland Fire Leadership Council to produce a compendium of information, data, and tools that are currently available to support the Interior's Directive on Wildland Fire to use active management to reduce wildland fire risk, and to identify enhancements needed to increase the country's ability to address wildland fire challenges.
- Complete regional models and three-dimensional maps for water quality by 2022. By the end of 2020, the USGS will complete models that evaluate ecologic stressors, contaminants, nutrients, sediment, flow, and habitat – on the health of streams in the Midcontinent, Southeast, Northeast, Northwest, and Southwest Basins. In 2018, the USGS released the data, models, and an interactive web tool to visualize and download the results for one region: the Midcontinent. These data and models provide information on which human and natural factors are the most critical in affecting stream quality and, thus, provide insights about possible approaches to protect the health of streams in a given region.
- In support of the National Water Census, provide daily water budget estimates for at least seven water budget components in small watersheds by 2022 to allow water resource managers to make near-real time decisions. By the end of September 2020, the USGS will provide daily water budget estimates for at least five water budget components for small watersheds. As of 2018, the USGS is providing daily estimates for two water budget components: precipitation and streamflow.

USGS Role: ***Deliver 21st Century Mapping and Land Imaging*** – Develop the next generation of Earth remote sensing products, maps, and data (Landsat and 3DEP). This work supports BLM, BOR, NPS, BIA, FWS, NASA, NOAA, DOD, DLA, FEMA, NRCS, USFS, and State and local agencies. In 2020, the USGS will:

- Work within the USGS's 3D Elevation Program (3DEP) Partnership to provide three-dimensional topographic data representation (elevation lidar) of the Nation's natural and constructed features for 100 percent of the United States by 2026. By the end of 2020, there will be lidar data coverage for 72 percent of the United States. In 2018, the USGS 3DEP completed a total of 53.1 percent of the Nation with 3DEP-quality data (including achieving 98 percent of coverage for Alaska).
- Complete 100 percent of the National Hydrography Dataset Plus High Resolution (NHDPlus HR) by 2026, to provide data for monitoring water quality and availability, agriculture, flood risk management, environmental health, and coastal management. By the end of 2020, 84 percent of the NHDPlus HR will be completed. The USGS and NOAA lead a national mapping initiative called 3D Nation, which coordinates the coastal topographic and bathymetric mapping activities of the USGS, NOAA, FEMA, USACE and other Federal/State elevation

activities. 3D Nation will provide a consistent set of standards and objectives to support the Nation's mapping needs. In 2018, the USGS completed high-resolution hydrography data (NHDPlus HR) coverage for 72 percent of the Nation. The NHDPlus HR provides the foundation required to connect water-related data and measurements in a single unified system. This offers ten times more detail to enable complex models such as NOAA's National Water Model to forecast floods at the neighborhood level.

- Continue sustainable national land imaging through the development and launch of Landsat 9 by 2021, and the determination of what system will follow. During FY 2020, the USGS will continue development and undertake a number of reviews (flight operation, operational readiness, and launch readiness) to prepare for a successful launch and deployment of the satellite.
- Coordinate initial concept development with NASA and deliver a report by the end of 2019. In 2018, the NASA/USGS Landsat 9 Project Team successfully completed its Mission Critical Design Review, a major milestone that essentially locks in the final design for the entire mission and allows the program to remain on schedule for a fiscal year 2021 launch.
- Improve the accuracy of Alaska mapping by updating 100 percent of topographic maps for Alaska by 2022. By the end of 2018, 72 percent of Alaska's topographic maps had been updated. In 2020, 92 percent of Alaska's topographic maps will have been updated.
- Increase U.S. three-dimensional geological map coverage at a scale useable for energy and mineral resource management and raw material assessments by the end of FY 2022. By the end of 2020, 54.7 percent of the United States will be geologically mapped at a scale useful for minerals assessments. These digital geologic maps are available to the public through the National Geologic Map Database. In 2018, the USGS made available to the public over 40,000 square miles of new geologic maps for the Nation through the National Geologic Map Database.
- Provide tools and aggregate recreational trails data to create recreational trails maps to enable the extension of the trails network so citizens can to traverse the Nation's public lands by the end of fiscal year 2020. This project started in fiscal year 2019. The USGS is working on a prototype trails connectivity tool.

II. Utilizing our Natural Resources

USGS Role: ***Deliver Science for Energy and Mineral Resources*** - Enhance opportunities for energy independence and develop a modern understanding of the Nation's critical mineral endowment. This work supports NPS, BLM, BOEM, FWS, as well as DOD, USFS, and States and local governments.

In 2018, USGS announced its largest continuous oil and gas assessment ever released. This assessment for Permian Basin resources in New Mexico and West Texas estimated a mean 46.3 billion barrels of oil, 281 trillion cubic feet of natural gas, and 20 billion barrels of natural gas liquids. In 2020, the USGS will:

- Update the estimate of undiscovered, technically recoverable hydrocarbon resources present within Alaska's North Slope (ANS) in cooperation with BLM and BOEM by the end of 2020. In 2018, the USGS released 18 resource assessments (as of Aug 16, 2018). These included a resource assessment in the National Petroleum Reserve-Alaska (NPR-A), which estimates mean undiscovered, technically recoverable resources of 8.7 billion barrels of oil and 25 trillion cubic feet of natural gas.
- Identify U.S. critical mineral resources that would reduce mineral import dependence through the completion of airborne aeromagnetic coverage of parts of the United States. In 2020, progress will continue acquisition of new topographic, geologic mapping, and aeromagnetic data in areas with potential for hosting critical minerals. In 2018, the USGS developed a three-dimensional critical minerals mapping plan in support of Secretarial Order 3359.
- By the end of December 2020, provide complete geophysical and geological data to establish limits of the U.S. Extended Continental Shelf (ECS). During FY 2020, the USGS will provide geophysical and geological data and interpretations related to ECS limits in the Bering Sea, Eastern Gulf of Mexico, Atlantic, and Pacific. The USGS has published geophysical and geologic data, interpretations, and supporting evidence for the Arctic and Western Gulf of Mexico to the ECS task force.

III. Protecting our People and the Border

USGS Priority: ***Make Available Science to Safeguard Communities from Natural Hazards*** **-** Develop Early Warning Systems for Natural Hazards. This work supports stakeholders across the Nation, including FEMA, NSF, NRC, the American Red Cross, and State and local governments.

- Operate West Coast Earthquake Early Warning (EEW) ShakeAlert – In 2020, the USGS will operate, in cooperation with States and other partners, the existing Shake Alert EEW system. Seismic network coverage necessary for EEW for California will be at approximately 74 percent and 40 percent for Oregon and Washington. Geodetic data and new geodetic algorithms will be brought into the production. Completed the production EEW system, version 2.0 in August 2018 and the first phase of public alerting began in CY 2019 in California. The USGS is committed to working with Congress to determine the appropriate Federal, State, and local cost share associated with any future ShakeAlert developments.
- Modernize Volcano Monitoring networks with digital communication and instrumentation by the end of FY 2020. In 2018, the USGS spent approximately $1.5 million on analog to digital station conversion activities including instrumentation purchases that will be needed during the 2019 field season. The upgrades improved telemetry capabilities in support of increased bandwidth and performance requirements, as well as for compliance with National Telecommunications and Information Administration compliance. In 2019, another major equipment purchase of $2.0 million for additional instruments and related equipment will be made. It is anticipated that another major equipment purchase will be made by in late FY 2019 for additional new equipment and instrumentation to be installed in FY 2020 and FY 2021. The USGS targeted the conversion of 20 Alaskan sites from analog to digital telemetry during the 2018 field season. Upgrades were made at 10 existing digital sites to replace equipment

and radios with new technology. The conversions and upgrades were performed on nine monitoring networks. In addition, a new digital broadband station was installed on Bogoslof volcano in 2018.

- Safeguard the Nation's Coastal Regions by providing coastal hazard and vulnerability tools to inform decision-making by 2021. In 2020, the USGS will provide long-term coastal vulnerability assessments through public Web tools for the entire California coast; deliver updated national synthesis of longer-term shoreline change; and continue integration of NOAA and USGS models, data, and delivery systems to provide operational total water level and coastal erosion forecasts for the Atlantic and Gulf of Mexico coasts. In 2018, the USGS assessed near and long-term coastal flooding and erosion risks from major storms and persistent coastal change, providing online tools for coastal planners and emergency responders.
- Landslides Hazards Post-Wildfire – USGS partners make requests to deliver post-wildfire debris-flow hazard assessments after wildfires have occurred. These assessments are used to inform landslide response plans and to guide alerting for impacted areas. The USGS field teams also characterize debris-flows to improve debris flow hazard assessments and early warning products. In 2018, the USGS delivered 79 post-wildfire debris-flow hazard assessments to meet requests from Interior, U.S. Forest Service, and State partners. The assessments delivered were for the Thomas Fire, the largest wildfire in southern California history. These assessments were used by the State of California and by the National Weather Service to guide flash-flood and debris-flow alerts for a series of winter storms that impacted the area. USGS field teams also worked with California State partners to characterize the debris-flows generated from hillsides burned by the Thomas Fire that devastated the community of Montecito.
- Expand data collection networks, equipment, and flood inundation maps that improve capacity to provide information used for flood prediction. During 2020, the USGS will deploy storm sensor housing in Puerto Rico, the West Coast, and Hawaii; order final next generation storm sensor design with conductivity and temperature sensors integrated with pressure sensors; and develop real-time transition for storm wave and tide sensors. In 2018, the USGS received next-generation rapid deployable gages and conducted lab testing for new storm surge sensors and strengthened more than 140 streamgage housings along the Gulf Coast. The USGS also published detailed flood information from Hurricane Harvey, which will assist officials in updating building codes, planning evacuation routes, floodplain management, assessments, and planning efforts to become more flood-resilient.

IV. Modernizing our Organization and Infrastructure for the Next 100 Years

USGS Priority: Modernizing our Organization and Infrastructure – Align USGS offices with the Interior unified regions, to efficiently align our programs, leverage resources and capabilities more effectively, and to improve our infrastructure. This work supports all Interior bureaus, NOAA, and NASA.

- **Continue to implement the reorganization of the Department of the Interior by** relocating staff, as necessary, and improving operations through the use of technology, shared services,

and consistent practice. The USGS has aligned the new unified regions boundaries to the existing USGS regional directors. In 2019, the reporting structure will be in place.

- Renovate buildings at **Moffett Field** and move personnel, offices, and labs from Menlo Park into the renovated **facilities** by the end of FY 2021, avoiding over $67 million in GSA rent costs**.** During 2020, the USGS will continue to renovate lab and office space at Moffett Field. The USGS is on schedule and budget with this effort.
- Renovate Denver Federal Center – Building 67 – to co-locate USGS staff by the end of 2019.

- Relocation from Denver Federal Center – Building 20 to the Colorado School of Mines. The USGS has signed a cooperative agreement with the Colorado School of Mines to relocate staff currently on the Denver Federal Center to a new building on the CSM campus once construction is complete.
- Advance USGS Information Management Technology solutions, including implementing a DOI Cloud Solution.

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Technical Adjustments

Technical Adjustments

The 2020 President's budget proposes:

- Organizational structural shifts in support of the larger DOI reorganization that will improve integration of USGS scientific programs and align resources more effectively to achieve mission goals and objectives.
- Budget realignments and restructures, including consolidating the function of two mission areas, Land Resources and Environmental Health, and realigning the structure of the Ecosystems, Water Resources, and Core Science Systems Mission areas.

These proposed budget structure adjustments and associated organizational structure shifts strengthen the USGS's capability to manage and leverage funding in order to deliver research and scientific products to other Interior bureaus, Federal agencies, and USGS collaborators outside of the Federal Government.

The budget proposes the following organizational restructure:

Establishing a headquarters presence in the West – The USGS has strong partnerships with State geologists, State management agencies, State universities, and a wide variety of public entities with water resources management responsibilities in the region. Currently, the USGS has headquarter representation in three major hubs for bureau-level support activities (Sacramento, CA, Denver, CO, and Washington, DC (Reston, VA) metro areas) and with seven regional directors aligned to the Interior unified regions.

The USGS proposes to move selected leaders and their staff from Reston, VA, to Lakewood, CO. This positions the USGS to improve support, engagement and collaboration with the Interior resource management agencies, the U.S. Forest Service, and other stakeholders and partners whose activities are concentrated in the West.

Other benefits include:

- Enhanced management and oversight.
- Improved efficiencies by co-locating in more central time zones.
- Improved customer service and partner/stakeholder engagement.
- Increased potential to recruit new hires with natural science background.
- Reduced cost of living and reduce traffic congestion.
- Potential for reduced leasing costs and consolidation. The USGS Facility in Reston, VA, includes bureau-level support, scientists, and labs. The operations and science activities would remain in Reston. This represents about 900 USGS employees.

The headquarters functions that would relocate to Lakewood, CO, are some of the direct reports to the Director's office, including key leaders and some staff. In addition to the relocation of some leadership positions, approximately 60 staff positions would be established in Lakewood in a phased manner, filling vacancies with duty stations in the West and relocating staff as needed over time. This approach will minimize disruption to the USGS mission and maintain continuity with USGS stakeholders.

Consolidate Mission Areas – The budget proposes to realign USGS mission areas to ensure that programs of related focus and practice are managed within the same mission area, including aligning land imaging programs with other mapping programs, and integrating adaptation and landscape science into the biological science programs of the USGS.

The shift consolidates seven mission areas into five, which allows the USGS to eliminate several vacant positions and realign programs to leverage existing support staff. This reduces the number of USGS Associate Director positions from seven to five. This reduction of mission areas aligns with government-wide goals to improve efficiency and utilize resources and expertise that is readily available.

The budget proposes the following budget restructure:

Consolidation of the Land Resources and Environmental Health budget activities – The organizational restructure of the Land Resources and Environmental Health mission areas described above is proposed alongside the consolidation of the budget for these functions into programs where similar work is conducted. This includes aligning land imaging programs with other mapping programs, integrating hydrological programs into the same mission area, and consolidating adaptation and landscape science into the biological science programs of the USGS.

Restructure of the Water Resources Mission Area – This restructure aligns program operations into Water Resources Availability and Water Observing Systems programs to achieve integrated observation, understanding, prediction, and delivery of water science and information to the Nation.

The **Water Resources Availability Program** includes the activities of the existing Water Availability and Use Science program, related elements of the National Water Quality program, and Harmful Algal Bloom and related work on the hydrology of toxins previously conducted outside of the Water Resources Mission area. This subactivity would conduct water availability assessments, measure and estimate water budgets, and develop models, and would also conduct interpretive studies and research to better understand the water quality aspects of water availability.

The **Water Observing Systems Program** includes the activities of the existing Groundwater and Streamflow Information program, which is the funding source for the streamgage network, and elements of the National Water Quality program that are focused on observations of surface water and groundwater. This subactivity would focus on enhancing and supporting observational networks that monitor water quantity and the

subactivity would also support monitoring of sediment, nutrients, and other contaminants that contribute to water quality.

Restructure of the Ecosystems Mission Area – This focuses USGS biological and ecological capabilities on providing science for natural resource management decisions by Federal, State, and Tribal agencies, with emphasis on Department of the Interior trust responsibilities for lands, species, and priority ecosystems to meet the needs for science in resource management decisions. The budget proposes a structure for the Ecosystems Mission Area to conduct work through four independent, yet integrated programs:

The **Species Management Research Program** conducts science to protect, conserve, and enhance species of fish and wildlife under trust responsibility of Interior bureaus and their partners. This subactivity would include funding from the following subactivities in the former structure: Status and Trends Program; Fisheries Program; Wildlife Program; and Environments Program. Additionally, any activities of the Contaminant Biology Program would be conducted in this subactivity.

The **Land Management Research Program** conducts science to effectively manage lands, waters, and ecosystems under trust responsibility of Interior bureaus and their partners. This subactivity would include funding from the following subactivities in the former structure: Status and Trends Program; Fisheries Program; Wildlife Program; and Environments Program. Additionally, any activities related to Biologic Carbon, formerly in the Land Change Science subactivity, would be in this new subactivity.

The **Biological Threats Research Program** conducts science to manage invasive species and wildlife diseases that pose significant ecologic, human health, or economic threat to the resources of the United States. This subactivity would include funding from the following subactivities in the former structure: Fisheries Program; Wildlife Program; and Invasive Species Program.

The **Climate Adaptation Science Center** conducts science to understand and manage climate and other stressors to the Nation's natural resources. The work of Climate Adaptation Science Centers (CASC) along with the Climate Research and Development Program and landscape science components of the Land Change Science program would be a part of this new subactivity. The CASC would be integrated as both a program and a science center with Regional Climate Adaptation Science Centers becoming hubs of the National Climate Adaptation Science Center and continue to work directly with partners and stakeholders on issues of local concern.

Consolidating research spread across five existing Ecosystem programs and similar activities from outside of the Ecosystems mission area will improve communication and provide clarity for project and program outcomes on the most pressing resource management issues of the Department and other Federal, State, and Tribal resource management agencies.

Restructure of the Core Science Systems Mission Area – To integrate the existing topographic, geologic, and biogeographic mapping and core science analysis and synthesis activities with the remote sensing and land change science assessment capabilities of the USGS, the restructure aligns the National Land Imaging Program and related elements of the Land Resources mission area into the Core Science Systems Mission Area.

The **National Land Imaging Program**, including satellite operations and Landsat 9 ground systems development, integrates with the mapping and analytic activities of the Core Science Systems mission area and will support mapping accuracy enabled by cutting-edge technologies for land use planning, collaborative conservation, and hazard event risk characterization for communities and ecosystems. It includes the National Civil Applications Center and the Earth Resources Observation Science Center. Additionally, land cover monitoring and assessment activities are transferred into the National Land Imaging subactivity.

The **Science Synthesis, Analysis, and Research Program** integrates the risk and vulnerability assessments. This supports precise planning for recreational use on public lands; collaborative conservation with Interior partners; and hazard event risk characterization for communities and ecosystems.

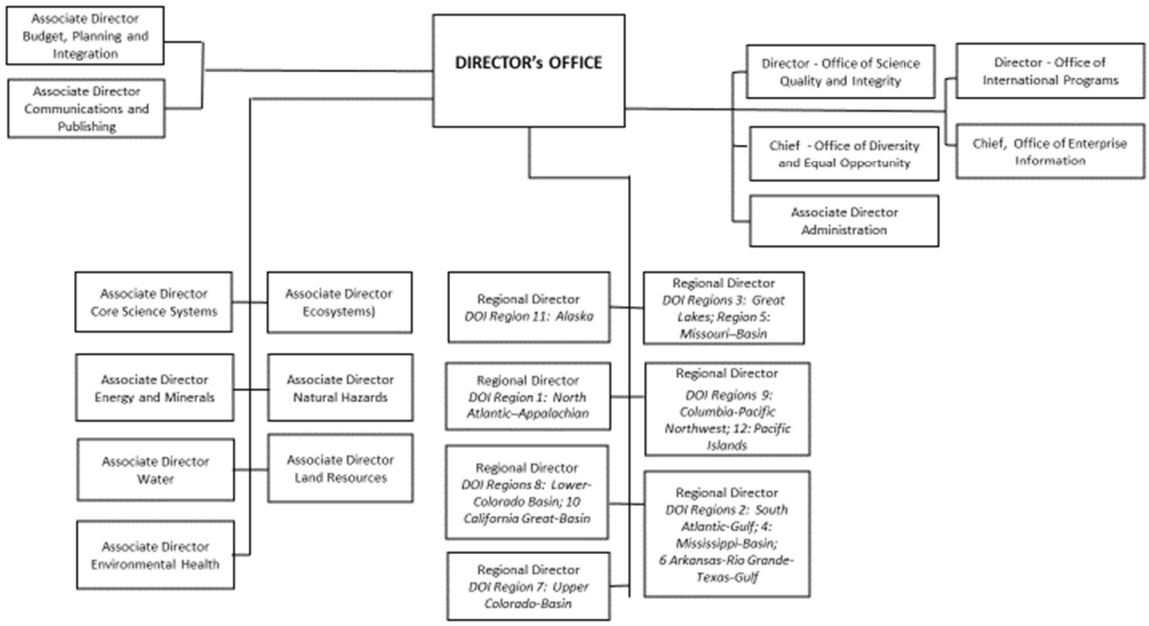
The tables on the following pages show the program crosswalks from the existing mission areas into the new mission areas, including the mission area restructures proposed in the sections above.

2020 President's Budget Request Former Budget Subactivities Surveys, Investigations, and Research $000s	Species Management Research Program	Land Management Research Program	Biological Threats Research Science Center	Climate Adaptation Science Center	Cooperative Research Unit Program	Water Resources Availability Program	Water Observing Systems Program	Water Resources Research Act Program	National Land Imaging Program	National Geospatial Program	National Cooperative Geologic Mapping Program	Science Synthesis, Analysis, and Research Program
Ecosystems												
Status and Trends Program	10,108	5,300										
Fisheries Program	8,824	3,523	3,343									
Wildlife Program	20,203	10,470	8,323									
Environments Program	5,224	24,500										
Invasive Species			17,330									
Cooperative Research Units					0							
Land Resources												
National Land Imaging Program									80,922			
Land Change Science Program												
Biologic Carbon		0										
Climate Research and Development				10,912								
Land Cover Monitoring and Assessments									8,033			
Risk and Vulnerability Assessments												1,936
National and Regional Climate Adaptation Science Centers				12,989								
Environmental Health												
Contaminants Biology Program	0											
Toxic Substance Hydrology Program												
Water Resources												
Water Availability and Use Science Program						34,351						
Cooperative Matching Funds [non-add]						*[11,397]*						
Groundwater and Streamflow Information Program							69,915					
Cooperative Matching Funds [non-add]							*[29,799]*					
National Water Quality Program						39,507	35,149					
Cooperative Matching Funds [non-add]						*[9,000]*	*[7,514]*					
Water Resources Research Act Program												
Core Science Systems												
National Geospatial Program										67,854		
National Cooperative Geological Mapping Program											24,397	
Science Synthesis, Analysis, and Research Program												24,051
Total USGS	44,359	43,793	28,996	23,901	0	73,858	105,064	0	88,955	67,854	24,397	25,987

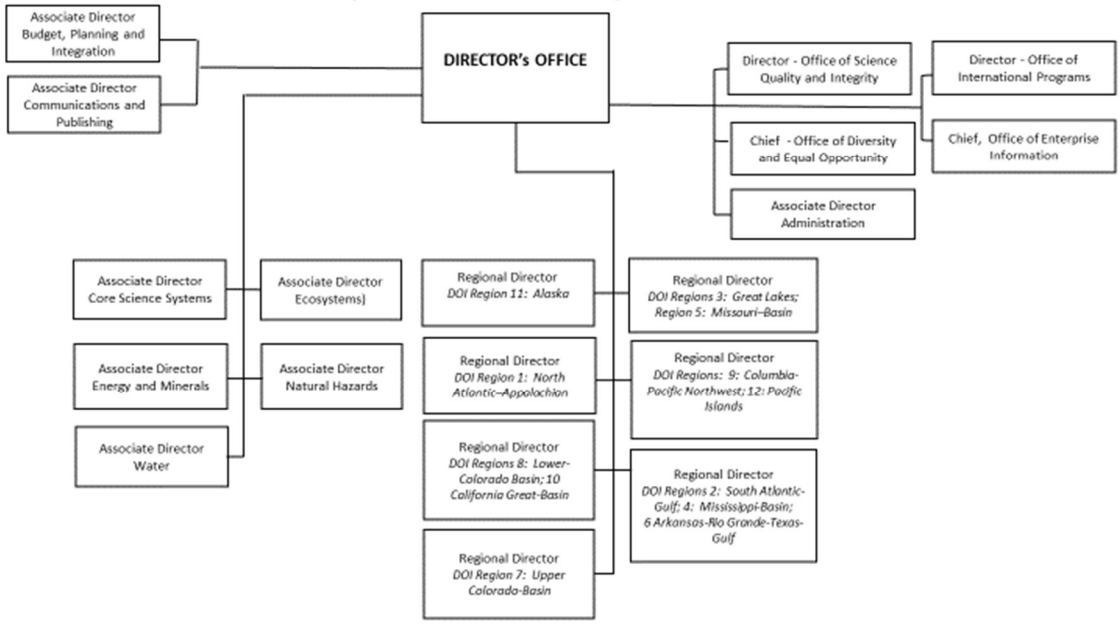
2019 Continuing Resolution Former Budget Subactivities Surveys, Investigations, and Research $000s	Species Management Research Program	Land Management Research Program	Biological Threats Research Science Center	Climate Adaptation Science Center	Cooperative Research Unit Program	Water Resources Availability Program	Water Observing Systems Program	Water Resources Research Act Program	National Land Imaging Program	National Geospatial Program	National Cooperative Geologic Mapping Program	Science Synthesis, Analysis, and Research Program
Ecosystems												
Status and Trends Program	13,090	7,383										
Fisheries Program	10,250	6,540	3,346									
Wildlife Program	25,408	12,276	8,323									
Environments Program	5,166	31,249										
Invasive Species			17,330									
Cooperative Research Units					17,371							
Land Resources												
National Land Imaging Program									93,094			
Land Change Science Program												
Biologic Carbon		5,025										
Climate Research and Development				19,153								
Land Cover Monitoring and Assessments									7,971			
Risk and Vulnerability Assessments												1,921
National and Regional Climate Adaptation Science Centers				25,335								
Environmental Health												
Contaminants Biology Program	10,197											
Toxic Substance Hydrology Program						12,398						
Water Resources												
Water Availability and Use Science Program						46,052						
Cooperative Matching Funds [non-add]						*[12,397]*						
Groundwater and Streamflow Information Program							74,173					
Cooperative Matching Funds [non-add]							*[30,299]*					
National Water Quality Program						52,457	38,372					
Cooperative Matching Funds [non-add]						*[9,000]*	*[8,231]*					
Water Resources Research Act Program								6,500				
Core Science Systems												
National Geospatial Program										67,854		
National Cooperative Geological Mapping Program											24,397	
Science Synthesis, Analysis, and Research Program												24,051
Total USGS	64,111	62,473	28,999	44,488	17,371	110,907	112,545	6,500	101,065	67,854	24,397	25,972

2018 Enacted Former Budget Subactivities Surveys, Investigations, and Research $000s	Species Management Research Program	Land Management Research Program	Biological Threats Research Science Center	Climate Adaptation Science Center	Cooperative Research Unit Program	Water Resources Availability Program	Water Observing Systems Program	Water Resources Research Act Program	National Land Imaging Program	National Geospatial Program	National Cooperative Geologic Mapping Program	Science Synthesis, Analysis, and Research Program
Ecosystems												
Status and Trends Program	13,090	7,383										
Fisheries Program	10,250	6,540	3,346									
Wildlife Program	25,408	12,276	8,323									
Environments Program	5,166	31,249										
Invasive Species			17,330									
Cooperative Research Units					17,371							
Land Resources												
National Land Imaging Program									93,094			
Land Change Science Program												
Biologic Carbon		5,025										
Climate Research and Development				19,153								
Land Cover Monitoring and Assessments												
Risk and Vulnerability Assessments									7,971			
National and Regional Climate Adaptation Science Centers				25,335								1,921
Environmental Health												
Contaminants Biology Program	10,197											
Toxic Substance Hydrology Program						12,398						
Water Resources												
Water Availability and Use Science Program						46,052						
Cooperative Matching Funds [non-add]						*[12,397]*						
Groundwater and Streamflow Information Program							74,173					
Cooperative Matching Funds [non-add]							*[30[299]*					
National Water Quality Program						52,457	38,372					
Cooperative Matching Funds [non-add]						*[9,000]*	*[8231]*					
Water Resources Research Act Program								6,500				
Core Science Systems												
National Geospatial Program										67,854		
National Cooperative Geological Mapping Program											24,397	
Science Synthesis, Analysis, and Research Program												24,051
Total USGS	64,111	62,473	28,999	44,488	17,371	110,907	112,545	6,500	101,065	67,854	24,397	25,972

2019 USGS Organization



Proposed USGS Organization



Budget at a Glance

Budget at a Glance (Dollars in Thousands)	2018 Actual	2019 Full Year CR	2020 Fixed Costs	2020 Internal Transfers	2020 Program Changes	2020 Request
Species Management Research	**[64,111]**	**[64,111]**	**198**	**64,111**	**-19,950**	**44,359**
Transfer from Status and Trends Program				*13,090*		
Transfer from Fisheries Program				*10,250*		
Transfer from Wildlife Program				*25,408*		
Transfer from Environments Program				*5,166*		
Transfer from Environmental Health, Contaminants Biology Program				*10,197*		
Museum Collections					*-1,600*	
Species-Specific Research					*-6,653*	
Toxicological and Pathogenic Diseases in Individual Organisms					*-5,099*	
Toxicological and Pathogenic Diseases in Populations					*-5,098*	
Whooping Crane Propagation					*-1,500*	
Land Management Research	**[62,473]**	**[62,473]**	**163**	**62,473**	**-18,843**	**43,793**
Transfer from Status and Trends Program				*7,383*		
Transfer from Fisheries Program				*6,540*		
Transfer from Wildlife Program				*12,276*		
Transfer from Environments Program				*31,249*		
Transfer from Land Resources, Land Change Science Program				*5,025*		
Biological Carbon Sequestration					*-5,025*	
Chesapeake Bay					*-2,599*	
Contaminants Research					*-1,000*	
Greater Everglades					*-4,272*	
Species Habitat Research					*-1,485*	
Land and Water Management Research					*-4,462*	
Biological Threats Research	**[28,999]**	**[28,999]**	**151**	**28,999**	**-154**	**28,996**
Transfer from Fisheries Program				*3,346*		
Transfer from Wildlife Program				*8,323*		
Transfer from Invasive Species Program				*17,330*		
White Nose Syndrome Research					*-154*	

Budget at a Glance (Dollars in Thousands)	2018 Actual	2019 Full Year CR	2020 Fixed Costs	2020 Internal Transfers	2020 Program Changes	2020 Request
Climate Adaptation Science Center	**[44,488]**	**[44,488]**	**97**	**44,488**	**-20,684**	**23,901**
Transfer from Land Resources, Land Change Science Program (LR)				*19,153*		
Transfer from Land Resources, National & Regional Climate Adaptation Ctrs				*25,335*		
Arctic					*-528*	
Climate Research and Development					*-6,125*	
Landscape Science					*-2,213*	
Realign Centers					*-11,318*	
Tribal Climate Adaptation Science					*-500*	
Cooperative Research Units	**17,371**	**17,371**	**0**	**0**	**-17,371**	**0**
Transfer from CRU						
Cooperative Research Units					*-17,371*	
Status and Trends	**20,473**	**20,473**		**(20,473)**		
Transfer to Species Management Research Program				*(13,090)*		
Transfer to Land Management Research Program				*(73,873)*		
Fisheries Program	**20,136**	**20,136**		**(20,136)**		
Transfer to Species Management Research Program				*(10,250)*		
Transfer to Land Management Research Program				*(6,540)*		
Transfer to Biological Threats Research Program				*(3,346)*		
Wildlife Program	**46,007**	**46,007**		**(46,007)**		
Transfer to Species Management Research Program				*(25,408)*		
Transfer to Land Management Research Program				*(12,276)*		
Transfer to Biological Threats Research Program				*(8,323)*		
Environments Program	**36,415**	**36,415**		**(36,415)**		
Transfer to Species Management Research Program				*(5,166)*		
Transfer to Land Management Research Program				*(31,249)*		
Invasive Species	**17,330**	**17,330**		**(17,330)**		
Transfer to Biological Threats Research Program				*(17,330)*		
Total, Ecosystems	**157,732**	**157,732**	**609**	**59,710**	**-77,002**	**141,049**

Budget at a Glance (Dollars in Thousands)	2018 Actual	2019 Full Year CR	2020 Fixed Costs	2020 Internal Transfers	2020 Program Changes	2020 Request
National Land Imaging Program	**93,094**	**93,094**	**0**	**(93,094)**		
Transfer to Core Science Systems, National Land Imaging Program				*(93,094)*		
Land Change Science	**34,070**	**34,070**		**(34,070)**		
Transfer to Ecosystems, Land Management Research Program				*(50,205)*		
Transfer to Ecosystems, Climate Adaptation Science Center Program				*(19,153)*		
Transfer to Core Science Systems, Science Synthesis, Analysis and Research				*(1,921)*		
Transfer to Core Science Systems, National Land Imaging Program				*(7,971)*		
National Regional Climate Adaptation Science Centers	**25,335**	**25,335**		**(25,335)**		
Transfer to Ecosystems, Climate Adaptation Science Center Program				*(25,335)*		
Total, Land Resources	**152,499**	**152,499**	**0**	**(152,499)**	**0**	**0**
Mineral Resources Program	**49,371**	**49,371**	**241**	**0**	**10,581**	**60,193**
Continuation of the Magnetotelluric Survey of the United States					*1,726*	
Critical Minerals Mapping Initiative (Earth MRI)					*10,598*	
Domestic Minerals Base Assessment					*-1,000*	
Minerals Information					*-371*	
Research and Assessment					*-372*	
Energy Resources Program	**30,872**	**30,872**	**125**	**0**	**-5,118**	**25,879**
Alaska North Slope Resource Assessments					*-4,700*	
Coal and Uranium Assessments					*-1,519*	
Geologic Carbon Sequestration					*-1,891*	
Modernize and Provide Multi-Resource Assessments					*2,992*	
Contaminant Biology Program	**10,197**	**10,197**	**0**	**(10,197)**		
Transfer to Ecosystems, Species Management Research Program				*(10,197)*		
Toxic Substances Hydrology Program	**12,398**	**12,398**	**0**	**(12,398)**		
Transfer to Water Resources, Water Resources Availability Program				*(12,398)*		
Total, Energy and Mineral Resources, and Environmental Health	**102,838**	**102,838**	**366**	**(22,595)**	**5,463**	**86,072**
Earthquake Hazards	**83,403**	**83,403**	**172**	**0**	**-19,272**	**64,303**
National Seismic Hazard Model improvements and Alaska Update					*2,654*	
Advanced National Seismic System Deferred Maintenance					*-5,000*	
Earthscope Stations					*-1,400*	
Maintain ShakeAlert Earthquake Early Warning Capacity					*-14,700*	
Seismic Network Improvements					*-826*	

Budget at a Glance (Dollars in Thousands)	2018 Actual	2019 Full Year CR	2020 Fixed Costs	2020 Internal Transfers	2020 Program Changes	2020 Request
Volcano Hazards	**42,621**	**42,621**	**97**	**0**	**-14,597**	**28,121**
Completion of Upgrades and Repairs to Instruments on High Threat Volcanoes					*-13,000*	
Next-Generation Lahar Detection System Equipment					*-1,500*	
Volcano Hazard Assessments					*-97*	
Landslide Hazards	**3,538**	**3,538**	**16**	**0**	**0**	**3,554**
Global Seismographic Network	**6,653**	**6,653**	**8**	**0**	**0**	**6,661**
Geomagnetism	**1,888**	**1,888**	**0**	**0**	**0**	**1,888**
Coastal/Marine Hazards and Resources Program	**40,510**	**40,510**	**146**	**0**	**-158**	**40,498**
Research for Coastal, Wetland, and Estuarine Restoration					*-158*	
Total, Natural Hazards	**178,613**	**178,613**	**439**	**0**	**-34,027**	**145,025**
Water Resources Availability Program	**0**	**0**	**348**	**110,907**	**-36,397**	**74,858**
Transfer from Environmental Health, Toxic Substances Hydrology Program				*12,398*		
Transfer from Water Availability and Use Science Program				*46,052*		
Transfer from National Water Quality Program				*52,457*		
Constituent and Contaminant Hydrology					*-10,848*	
Cooperative Matching Funds - Water Use Research					*-1,000*	
Harmful Algal Blooms					*-1,350*	
Mississippi Alluvial Plain Aquifer Assessment					*-2,797*	
National Park Service Water-Quality Partnership					*-1,743*	
Regional Water-Quality Assessments					*-4,100*	
Research and Development to Advance Water Science					*-10874*	
Shallow and Fractured Bedrock Groundwater Research					*-300*	
U.S.-Mexico Transboundary Aquifer Assessment					*-1,000*	
Water Use Data and Research					*-1,500*	
Water Use Research - Unconventional Oil and Gas					*-250*	
Water-Quality Trends					*-635*	

Budget at a Glance (Dollars in Thousands)	2018 Actual	2019 Full Year CR	2020 Fixed Costs	2020 Internal Transfers	2020 Program Changes	2020 Request
Water Observing Systems Program	**0**	**0**	**341**	**112,545**	**-7,822**	**105,064**
Transfer from Groundwater and Streamflow Information Program	*[74,173]*	*[74,173]*		*74,173*		
Transfer from National Water Quality Program	*[38,372]*	*[38,372]*		*38,372*		
Cooperative Matching Funds - Tribal Water					*-500*	
Cooperative Matching Funds - Urban Water Federal Partnership					*-717*	
Groundwater Quality Monitoring Network					*-1,094*	
National Atmospheric Deposition Program					*-1,576*	
National Groundwater Monitoring Network					*-2,395*	
Research and Development to Advance Water Science					*-1,540*	
Water Resources Research Act Program	**6,500**	**6,500**	**0**	**0**	**-6500**	**0**
Program Grants					*-6500*	
Water Availability and Use Science Program	**46,052**	**46,052**		**(46,052)**		
Transfer to Water Resources Availability Program	*[46,052]*	*[46,052]*		*(46,052)*		
Groundwater and Streamflow Information Program	**74,173**	**74,173**		**(74,173)**		
Transfer to Water Observing Systems Program	*[74,173]*	*[74,173]*		*(74,173)*		
National Water Quality Program	**90,829**	**90,829**		**(90,829)**		
Transfer to Water Resources Availability Program				*(52,457)*		
Transfer to Water Observing Systems Program				*(38,372)*		
Total, Water Resources	**217,554**	**217,554**	**689**	**12,398**	**-50,719**	**179,922**
National Geospatial Program	**67,854**	**67,854**	**177**	**0**	**-177**	**67,854**
Program Operations					*-177*	
National Cooperative Geologic Mapping Program	**24,397**	**24,397**	**71**	**0**	**-71**	**24,397**
Program Operations					*-71*	
Science Synthesis, Analysis and Research Program	**24,051**	**24,051**	**74**	**1,921**	**-59**	**25,987**
Transfer from Land Resource, Land Change Science Program				*1,921*		
Program Operations					*-59*	

Budget at a Glance (Dollars in Thousands)	2018 Actual	2019 Full Year CR	2020 Fixed Costs	2020 Internal Transfers	2020 Program Changes	2020 Request
National Land Imaging Program	**0**	**0**	**159**	**101,065**	**-12,269**	**88,955**
Transfer from Land Resources, National Land Imaging Program				*93,094*		
Transfer from Land Resources, Land Change Science Program				*7,971*		
Landsat 9 Ground Systems Development					*5,800*	
Remote Sensing State Grants					*-1,215*	
Research and Investigations					*-5,949*	
Satellite Operations					*-10,905*	
Total, Core Science Systems	**116,302**	**116,302**	**481**	**102,986**	**-12,576**	**207,193**
Administration and Management	**80,881**	**80,881**	**572**	**0**	**-490**	**80,963**
Administration and Management					*-6,690*	
Support for Interior Reorganization					*6,200*	
Information Services	**21,947**	**21,947**	**43**	**0**	**-43**	**21,947**
Total, Science Support	**102,828**	**102,828**	**615**	**0**	**-533**	**102,910**
Rental Payments and Operations & Maintenance	**104,927**	**104,927**	**8602**	**0**	**-208**	**113,321**
Menlo Park Relocation					*682*	
Operations and Maintenance					*-890*	
Deferred Maintenance and Capital Improvement	**15,164**	**15,164**	**0**	**0**	**-7,189**	**7,975**
Projects					*-7,189*	
Total, Facilities	**120,091**	**120,091**	**8602**	**0**	**-7,397**	**121,296**
Total, Surveys, Investigations and Research	**1,148,457**	**1,148,457**	**11,801**	**0**	**-176,791**	**983,467**

Note: Total 2018 amount does not include $42,246 in supplemental appropriations.

Ecosystems

Ecosystems

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Ecosystems[1]	**157,732**	**157,732**	**609**	**59,710**	**(77,002)**	**141,049**	**(76,393)**
FTE	*850*	*850*	*-*	*203*	*(443)*	*610*	*(443)*
Species Management Research Program	**[64,111]**	**[64,111]**	**198**	**64,111**	**(19,950)**	**44,359**	**(19,752)**
FTE	*[345]*	*[345]*	*-*	*345*	*(127)*	*218*	*(127)*
Land Management Research Program	**[62,473]**	**[62,473]**	**163**	**62,473**	**(18,843)**	**43,793**	**(18,680)**
FTE	*[325]*	*[325]*	*-*	*325*	*(125)*	*200*	*(125)*
Biological Threats Research Program	**[28,999]**	**[28,999]**	**151**	**28,999**	**(154)**	**28,996**	**(3)**
FTE	*[147]*	*[147]*	*-*	*147*	*-*	*147*	*-*
Cooperative Research Units Program	**17,371**	**17,371**	**-**	**0**	**(17,371)**	**-**	**(17,371)**
FTE	*125*	*125*	*-*		*(125)*	*-*	*(125)*
Climate Adaptation Science Center	**[44,488]**	**[44,488]**	**97**	**44,488**	**(20,684)**	**23,901**	**(20,587)**
FTE	*[111]*	*[111]*	*-*	*111*	*(66)*	*45*	*(66)*
Status and Trends	**20,473**	**20,473**		**(20,473)**	**-**	**-**	**-**
FTE	*100*	*100*	*-*	*-100*	*-*	*-*	*-*
Fisheries Program	**20,136**	**20,136**		**(20,136)**	**-**	**-**	**-**
FTE	*117*	*117*	*-*	*-117*	*-*	*-*	*-*
Wildlife Program	**46,007**	**46,007**		**(46,007)**	**-**	**-**	**-**
FTE	*251*	*251*	*-*	*-251*	*-*	*-*	*-*
Environments Program	**36,415**	**36,415**		**(36,415)**	**-**	**-**	**-**
FTE	*175*	*175*	*-*	*-175*	*-*	*-*	*-*
Invasive Species Program	**17,330**	**17,330**		**(17,330)**	**-**	**-**	**-**
FTE	82	82	-	-82	-	-	-

[1] The amounts shown for 2018 and 2019 represent the old structure, in the new structure, the 2018 Actual and 2019 CR would be $217,442.

The 2020 budget request for Ecosystems is $141,049,000 and 610 FTE.

Through the Ecosystems Mission Area, the USGS provides scientific information and decision support to meet Interior's shared responsibility for land and species management, develop energy and mineral resources on Interior lands and the Outer Continental Shelf, reduce risk of invasive species and wildlife diseases, and fulfill treaty obligations with Tribes. The USGS helps protect the Nation's fish and wildlife

heritage by bridging the gap between science and management for harvested species, at-risk species and species of management concern. The USGS works with many Federal, State, local, and Tribal partners to sustain hunting, fishing, and wildlife-related recreational activities of the American public that contribute $144 billion and 480,000 jobs to the U.S. economy (*2017 National Recreation Economy Report, Outdoor Industry Association*). The USGS identifies threats and designs conservation measures to preclude the need for listing species as endangered or threatened; help listed species recover; prevent or minimize damage from invasive species and wildlife disease outbreaks; and apply decision science so that management and policy actions are transparent and durable. Ecosystems sciences are essential for making cost-effective resource management decisions for the Nation's lands and waterways; providing decision makers with regional and nationwide monitoring of key environmental indicators for terrestrial, freshwater, and marine habitats and the species that utilize those habitats. 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 and to support public land and resource management decisions. Many of these databases include decades-long records of observations, collected under strict standards of quality assurance and quality control.

The Ecosystems Mission Area conducts work through four independent, yet highly integrated, scientific programs:

1. **Species Management Research Program** – science to protect, conserve, and enhance species of fish and wildlife under trust responsibility of Interior bureaus and their partners.
2. **Land Management Research Program** – science to effectively manage lands, waters, and ecosystems under trust responsibility of Interior bureaus and their partners.
3. **Biological Threats Research Program** – science to manage invasive species and wildlife diseases that pose significant ecologic, human health, or economic threat to the resources of the United States.
4. **Climate Adaptation Science Center** – science to understand and manage climate and other stressors to the Nation's natural resources.

Through these four programs, the Ecosystems Mission Area would provide base funding for 16 Biological Science Centers, the Climate Adaptation Science Center, and 50 Biological Field Stations across the United States. This distributed workforce enables USGS scientists to work directly with resource managers on the species and lands for which they are making critical management decisions. To address higher priorities, the USGS is not requesting funds for the Cooperative Research Units. 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 programs.

Species Management Research Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Species Management Research Program	**0**	**0**	**198**	**64,111**	**(19,950)**	**44,359**	**(19,752)**
Transfer from Status and Trends Program	*[13,090]*	*[13,090]*		*13,090*			
Transfer from Fisheries Program	*[10,250]*	*[10,250]*		*10,250*			
Transfer from Wildlife Program	*[25,408]*	*[25,408]*		*25,408*			
Transfer from Environments Program	*[5,166]*	*[5,166]*		*5,166*			
Transfer from Contaminants Biology Program	*[10,197]*	*[10,197]*		*10,197*			
Museum Collections	*[1,600]*	*[1,600]*			*(1,600)*	*[0]*	
Species-Specific Research	*[14,865]*	*[14,865]*			*(6,653)*	*[8,410]*	
Whooping Crane Propagation	*[1,500]*	*[1,500]*			*(1,500)*	*[0]*	
Toxicological and Pathogenic Disease in Individual Organisms	*[5,099]*	*[5,099]*			*(5,099)*	*[0]*	
Toxicological and Pathogenic Disease in Populations of Organisms	*[5,098]*	*[5,098]*			*(5,098)*	*[0]*	
FTE	**0**	**0**		**345**	**(127)**	**218**	**(127)**

*Transfers in 2018 and 2019 are for display purposes and are non-add.

Program Description

The Species Management Research Program provides science to protect, conserve, and enhance species of fish and wildlife that are important to the U.S. public, with a particular focus on Interior trust responsibilities as defined by Congress and the White House. Interior and other Federal, State, and Tribal partners make a multitude of resource management decisions each year on issues as diverse as hunting and fishing regulations, land management for multiple uses, species listing and delisting, water allocations, and permitting for economic activities such as energy production and transmission, mining, timbering, grazing, and commercial development. Uncertainty in the outcome and ramifications of those decisions on the sustainability of fish and wildlife is complicated by environmental challenges such as natural disasters, unpredictable weather patterns and extreme events, invasive species, emerging fish and wildlife diseases, and increased demands for water, land, food, energy, transportation, critical minerals, and living resources by the American public. In the face of these competing needs and environmental complexities, objective and timely science is critical for sound decisions to protect resources, safeguard humans, and grow the economy.

The Species Management Research Program funds capacity within the USGS to address all aspects of species biology needed by Interior and other Federal, State, and Tribal managers to make informed, cost-effective, and balanced decisions on fish and wildlife issues of economic, social, ecologic, and cultural importance. The Program also focuses on research that improves the ability of managers to anticipate, adapt to, and alleviate the impacts of natural and human-driven environmental stressors. The USGS conducts studies on life history, population ecology, and conservation and restoration strategies for at-risk species, Federal and State listed species, migratory species, interjurisdictional species, and the habitat requirements of those species. These investigations lead to more effective and viable conservation actions that reduce the need for formal listing, support the goal of downlisting or delisting, and support sustainable populations of harvested species. Research also includes development and application of advanced technologies such as remote sensing and molecular genetics to assess population status and health.

There are two components within the Species Management Research Program:

- ***Species Biology*** – Research into the life history, conservation, and recovery of species of management concern, including threatened and endangered species, trust species protected by Federal law, species under consideration for listing, and species that are economically important for commercial and recreational hunting and fishing. Particular focus is on migratory bird management, Great Lakes fisheries management, marine mammals for which Interior has management responsibility, amphibians, bats, species for which information is lacking to inform listing, downlisting or delisting decisions, and big game movements and migration corridors.
- ***Species Stressors*** – Research into the cause and mitigation of environmental and anthropogenic stressors that potentially impact the health and reproductive capacity of species of management concern, including development, fire, drought, extreme storm events, and land use change.

2020 Activities

The 2020 budget request supports:

- Fisheries stock assessments used by States, Tribes, and provinces to manage a $7 billion annual commercial and recreational fishing industry in the Great Lakes.
- Waterfowl population assessments used by the National Flyway Councils to establish hunting regulations with Canada and Mexico to sustain a $3 billion annual waterfowl hunting industry.
- Bat population assessments throughout North America to understand disease and other ecological stressors on bat-related control of insects that threaten agriculture and human health.
- Seabird migration studies and deep-sea coral assessments used by the Bureau of Ocean Energy Management (BOEM) to inform energy and mineral development off the Atlantic coast.
- Polar bear, walrus, and sea otter population assessments used by BOEM and the U.S. Fish and Wildlife Service (FWS) to inform permitting of energy development in Alaska and the Pacific.
- Research and decision-support tools to address science needs of the FWS 7-Year Listing Workplan to support upcoming listing, delisting, and downlisting and recovery decisions.

- Research on connectivity and ecological flows to provide information and decision-support tools to help water managers understand how changes in water quantity, quality and timing and extreme hydrologic events such as floods and droughts, affect fisheries and other aquatic resources of concern.
- Development of information, technologies, and monitoring protocols used by Federal and State agencies in the design and siting of energy, transportation, and other infrastructure projects to reduce conflict with wildlife, streamline development, and comply with applicable laws and regulations.
- Design and evaluation of fish passage structures and dam removal plans to enhance fish migration or prevent invasive species introduction in U.S. rivers and the Great Lakes to enhance recreational, commercial, and subsistence fisheries.
- Development of new technologies to provide better, faster, safer, and cheaper data acquisition over larger geographic areas and weather conditions for more effective fish and wildlife management by Interior bureaus and other Federal, State, and Tribal agencies.

2020 Program Change Summary

The 2020 budget request for the Species Management Research Program is $44,359,000 and 218 FTE, which includes:

- Museum Collections (-$1,600,000 and -11 FTE)
- Species-Specific Research (-$6,653,000 and -43 FTE)
- Whooping Crane Propagation (-$1,500,000 and -5 FTE)
- Toxicological and Pathogenic Disease in Individual Organisms (-$5,099,000 and -34 FTE)
- Toxicological and Pathogenic Disease in Populations of Organisms (-$5,098,000 and -34 FTE)

Program Overview

Interior has marine mammal management responsibilities for manatees, sea otters, walrus, and polar bears. The USGS maintains robust research portfolios on all four species, including long-term datasets of population levels, animal movements, and habitat interactions. USGS science informed recent Endangered Species Act determinations, such as the FWS's decisions not to list walrus and to downlist manatees from Endangered to Threatened.

FWS receives recommendations for game and non-game migratory bird management from the National Flyway Councils, which are composed of representative of the States, provinces, and territories within each of four geographic regions of the United States. The USGS provides the foundational scientific information on migratory bird populations and trends used in Flyway Council recommendations through the USGS Bird Banding Laboratory and the North American Breeding Bird Survey, which maintain science-based population data on more than 400 bird species in North America.

FWS has published a work plan of all species for which the bureau is required to make listing decision within the next seven years. In consultation with the FWS, the USGS is conducting research to address key uncertainties in population status and habitat identification to inform those decisions and facilitate proactive and collaborative conservation between Interior and State Fish and Wildlife management agencies and other stakeholders and partners.

Under the 1954 Convention on Great Lakes Fisheries, Interior has responsibility to provide technical support for multi-jurisdictional recreational and commercial fisheries, tribal harvest, allocation decisions, and fish stocking activities that are cooperatively managed by States, provinces, and Tribes in the Great Lakes region. In fulfillment of this responsibility, the USGS maintains a fleet of modern research vessels in each of the five Great Lakes to conduct fisheries population surveys, fisheries research, and remote sensing technology development to assess deep-water ecosystems, food webs, fish movement and behavior, fish population structure, and fish habitat to provide real-time information for management of this rapidly changing and internationally important fishery.

Interior bureaus, primarily the National Park Service (NPS), FWS, and the Bureau of Land Management (BLM) collectively manage approximately 20 percent of the surface acres of the United States. The USGS National Phenology Network (NPN) produces and delivers maps of real-time and forecasted plant and animal activity used by resource managers within these bureaus to manage invasive species, insect pests, wildlife disease, recreational opportunities, and critical habitats for managed species. Recent emphasis within the NPN is on delivery of real-time and short-term forecasts of disease vectors such as ticks and mosquitos that threaten public safety within Federal lands.

Interior bureaus, primarily FWS, NPS, and BLM collectively manage a wild range of fish and wildlife species across the United States and its territories. Often, these species are co-managed with other Federal agencies, States, Tribes, and foreign countries. Science funded through the Species Management Research Program provides research, technology, and decision-support tools for informed management of these species, including harvested species, threatened and endangered species, Interior trust species protected by law, sensitive species that are declining, rare, or uncommon that may be candidates for future listing consideration, and species of management concern identified by State natural resource management agencies.

Land Management Research Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Land Management Research Program	**0**	**0**	**163**	**62,473**	**(18,843)**	**43,793**	**(18,680)**
Transfer from Status and Trends Program	*[7,383]*	*[7,383]*		*7,383*			
Transfer from Fisheries Program	*[6,540]*	*[6,540]*		*6,540*			
Transfer from Wildlife Program	*[12,276]*	*[12,276]*		*12,276*			
Transfer from Environments Program	*[31,249]*	*[31,249]*		*31,249*			
Transfer from Land Change Science Program (LR)	*[5,025]*	*[5,025]*		*5,025*			
Land and Water Management Research	*[10,423]*	*[10,423]*			*(4,462)*	*[5,961]*	
Contaminants Research	*[2,000]*	*[2,000]*			*(1,000)*	*[1,000]*	
Species Habitat Research	*[2,788]*	*[2,788]*			*(1,485)*	*[1,303]*	
Chesapeake Bay	*[3,700]*	*[3,700]*			*(2,599)*	*[1,101]*	
Greater Everglades	*[5,850]*	*[5,850]*			*(4,272)*	*[1,578]*	
Biological Carbon Sequestration	*[5,025]*	*[5,025]*			*(5,025)*	*[0]*	
FTE	**0**	**0**		**325**	**(125)**	**200**	**(125)**

*Transfers for 2018 and 2019 are for display purposes and are non-add.

Program Description

The Land Management Research Program provides science to understand natural and human influences on lands, waters, and ecosystems under management responsibility of Interior bureaus and other Federal, State, and Tribal partners. This information helps resource managers balance land uses, resolve and avoid resource management conflicts, enhance and maintain trust lands for future generations, and keep U.S. communities safe. The USGS analyzes data collected over many decades to predict and assess the effects of threats on current and future land uses and develop and distribute tools to help managers understand risk and make cost-effective resource management decisions. The USGS develops new techniques to improve the condition of degraded lands and to provide information on costs and return on investments made by resource managers. Information and tools resulting from studies help streamline permitting decisions by Interior bureaus by helping managers identify actual vs perceived risk of development and to select cost-effective and least-impactful alternatives when appropriate.

The Land Management Research Program complements the Species Management Research Program by providing science to understand how land and water management activities on Interior lands influence habitats needed to maintain species of conservation concern, to provide for fishing and hunting opportunities, to implement land and water management efforts to preclude species from being listed

under the Endangered Species Act, and to delist or downlist imperiled species in terrestrial, aquatic, coastal and estuarine systems. The Program also helps Interior land managers predict wildfire risk and behavior by understanding fuel loads and treatments, assess risk of post-fire landslides, monitor and air and water quality impacts, and determine cost-effective restoration actions. The Program also provides science to understand coastal resilience and recovery after major storms to support coastal economies, to protect lives and property, and to minimize impacts of future storms or other major events.

There are two components within the Land Management Research Program:

- ***Priority Landscapes*** – Place-based research to inform management decisions within lands owned or co-managed by the Department of the Interior. Current areas of focus include national parks, wildlife refuges, BLM lands, and priority ecosystems including the Arctic, Chesapeake Bay, Columbia River, Colorado River, Everglades, Great Lakes, Klamath River, Mississippi River, Pacific Islands, Puget Sound, Sagebrush Steppe, San Francisco Bay, and Southwest deserts.
- ***Management and Restoration*** – Research into ecological processes to inform management and restoration actions, and the design of monitoring strategies to assess the outcome and effectiveness of management actions to inform adaptive management to maximize gain for lowest investment.

2020 Activities

The 2020 budget request supports:

- Development of datasets and tools used by fire and land management agencies, States, Tribes, landowners, and communities to predict and suppress wildfire, and restore fire damaged lands, and prevent uncontrolled wildfires which degrade ecosystems and water quality, threaten human lives and health, and cause billions in property damage across the United States.
- Development of datasets, tools, and technologies to protect lives and infrastructure during major coastal storms and to produce and maintain recreational and commercial fisheries that create jobs and decrease foreign imports of seafood.
- Development of tools, technologies, and decision support for optimal placement of energy facilities to avoid or minimize interaction with wildlife and to achieve compliance with applicable laws and regulations.
- Monitoring, research, and technology development on the causes and potential solutions to harmful algal blooms (HABS) that cause $4 billion damage each year to the U.S. economy from lost tourism revenues, decreased property values, commercial fisheries closures, drinking-water mitigation, and medical expenses.
- Monitoring, research, and technology development to understand and mitigate impacts of extreme weather events such as drought and flood on economically, ecologically, and culturally important fish and other aquatic species.
- Development of decision-support tools and information on the most cost-effective and successful land and water conservation and restoration practices to support Interior lands and trust responsibilities.

- Science and technologies to identify habitat required to maintain target populations of federally listed species, candidate species, and other species of management concern, to effectively move migratory wildlife through corridors between seasonal habitats.
- Research to inform long-term conservation and management strategies for the sage steppe biome and attendant wildlife and habitat, including monitoring, research, and technology to support resource management in the face of fire, drought, wind and water erosion, invasive species, urbanization, energy development and other stressors.

2020 Program Change Summary

The 2020 budget request for the Land Management Research Program is $43,793,000 and 200 FTE, which includes:

- Land and Water Management Research (-$4,462,000 and -30 FTE)
- Contaminants Research (-$1,000,000 and -7 FTE)
- Species Habitat Research (-$1,485,000 and -10 FTE)
- Chesapeake Bay (-$2,599,000 and -17 FTE)
- Greater Everglades (-$4,272,000 and -27 FTE)
- Biological Carbon Sequestration (-5,025,000 and -34 FTE)

Program Overview

The Land Management Research Program includes long-term activities to identify the causes and solutions to environmental degradation of some of the most populated or ecologically sensitive areas of the United States, including the Arctic, Chesapeake Bay, Columbia River, Colorado River, Everglades, Great Lakes, Klamath River, Mississippi River, Pacific Islands, Puget Sound, Sagebrush Steppe, San Francisco Bay, and Southwest deserts. The long-term impact of management actions implemented by States, localities, Tribes, and other Federal agencies to enhance or restore these systems are monitored for effectiveness to facilitate adaptive management and to increase cost effectiveness of future management actions.

The Land Management Research Program funds acquisition of data, science, and technology development to support renewable and non-renewable energy development across the United States, its territories, and the Continental Shelf, including oil and gas, solar, wind, hydropower, and biofuels. This programmatic focus includes USGS-led, collaborative activities such as the Wyoming Landscape Conservation Initiative, a long-term, science-based program focused on assessing, conserving, and enhancing fish and wildlife habitats while facilitating energy development through local collaboration and partnerships, and the Restoration Assessment and Monitoring Program for the Southwest that provides science and guidance on effective strategies to support restoration and rehabilitation planning and outcomes executed by Interior and other agencies in sensitive dryland ecosystems.

The USGS is working with Interior bureaus and Western States to develop maps and analyze datasets to improve understanding of how large game animals such as elk and mule deer utilize winter and summer habitats and migrate seasonally across the landscape to reach those habitats. This information is being used by Federal and State land managers to develop wildlife corridors that effectively conserve and protect these animals during migrations and reduce the incidence of vehicle collisions that pose economic and safety concerns for the public.

The Land Management Research Program funds research, monitoring, and development of decision-support tools, maps, and analyses that focus on land management strategies to reduce economic and environmental impacts of significant environmental threats, such as fire, drought, invasive species, wildlife disease, and coastal storms, with a particular emphasis on Interior-managed lands. Examples include research to inform management of fuel loads and predict post-fire health, safety, and economic risks; research to inform the management of lands and waters to minimize the establishment and spread of invasive species and wildlife disease; management practices to reduce harmful algal blooms, and land management strategies to reduce dust storms that affect transportation safety, impact snowpack, runoff and winter recreation, and carry aero-allergens and disease in the in dryland systems.

The Land Management Research Program funds research, decision science, and adaptive management support to Interior bureaus to identify, maintain, and enhance habitat to reach species management goals for federally listed species as well as species of management responsibility including migratory birds and fish. The Program also supports research to support decision-making designed to prevent species from being listed, and to better provide recreational hunting and fishing opportunities to the American public.

Biological Threats Research Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Biological Threats Research Program	**0**	**0**	**151**	**28,999**	**(154)**	**28,996**	**(3)**
Transfer from Fisheries Program	*[3,346]*	*[3,346]*		*3,346*			
Transfer from Wildlife Program	*[8,323]*	*[8,323]*		*8,323*			
Transfer from Invasive Species Program	*[17,330]*	*[17,330]*		*17,330*			
White Nose Syndrome Research					*(154)*	*[0]*	
FTE	**0**	**0**		**147**	**-**	**147**	**-**

*Transfers for 2018 and 2019 are for display purposes and are non-add.

Program Description

Biological threats such as invasive species and wildlife disease are top conservation concerns of natural resource managers across the Nation. The Biological Threats Program provides essential information, data, research, detection, management methods, and decision-support tools to help resource managers reduce the threat of invasive species and wildlife disease. The USGS works closely with Interior and other Federal, State, local, and Tribal management partners to provide actionable science to prevent, identify, detect, contain, manage, or eradicate invasive species and wildlife disease that pose significant ecological or economic threats to the resources of the United States, and potentially pose human health threats.

There are two components within the Biological Threats Research Program:

- ***Invasive Species*** – Research, monitoring, and technology development to detect, contain, or eradicate non-indigenous species with potential to cause significant ecologic or economic damage or impact human health. Recent emphasis has been on using advanced technologies such as remote sensing and genetics methods to develop species-specific detection and control tools for terrestrial and aquatic species and studies on ecologic impacts, invasion biology, and basic life history to determine risk and develop control strategies. This research may yield new tools to address what were previously intractable problems.
- ***Fish and Wildlife Disease*** – Investigations into national and regional wildlife mortality events and research on fish and wildlife disease ecology, risk assessment, surveillance, impacts, control, and decision support to Federal, State, and Tribal wildlife management agencies. Also includes maintenance of online disease surveillance and risk assessment tools, molecular analyses to

understand global spread of wildlife pathogens, immunology studies to identify the underlying factors associated with wildlife disease resistance and susceptibility, and the development of wildlife vaccines.

2020 Activities

The 2020 budget request supports:

- Risk assessments and advanced tool development for discovery, surveillance, and control of fish diseases of cultured and wild fish managed by the Interior and other Federal, State, and Tribal agencies and the commercial aquaculture industry.
- Surveillance, diagnostic support, and source tracking of wildlife diseases such as avian influenza and development of tools for early detection, risk assessment, and management of diseases such as chronic wasting disease in large game species such as deer and elk.
- Maintaining the Nation's most comprehensive database of wildlife disease information through the online Wildlife Health Information Sharing Partnership-Event Reporting System (WHISPers), which provides near real-time situational awareness and analytical capabilities for natural resource managers and the biosurveillance community, including the Department of Homeland Security's National Biosurveillance Integration Center.
- Supporting the North American response to the devastating White-Nose Syndrome (WNS) in bats by developing early detection and response tools including vaccines; maintaining diagnostic laboratories at the National Wildlife Health Center to support WNS detection; coordinating the North American Bat Monitoring Program and developing statistical and data visualization tools for bat monitoring.
- Delivering data to Federal and State managers and 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 with tools to identify potential invaders after large storm events.
- Technical expertise and capacity to rapidly respond to new invasions, including testing chemical controls to facilitate rapid response to new zebra and quagga mussel infestations and identifying reptile species to aid State partners responding to new infestations.
- Testing and refining 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, reticulated pythons in Puerto Rico, and brown treesnakes on Guam, including the multi-agency Rapid Response Team led by the USGS. These invasive reptiles may threaten native species with extinction.
- Species-specific controls for invasive plants and animals 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 data and technical expertise to reduce the economic and ecologic impacts of salt cedar, cheatgrass, buffelgrass, and other invasive plants 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 limiting the spread of Asian carp into the Great Lakes and reducing their effects elsewhere in the Nation.

2020 Program Change Summary

The 2020 budget request for the Biological Threats Research Program is $28,996,000 and 147 FTE, which includes:

- White Nose Syndrome Research (-$154,000)

Program Overview

The Biological Threats Program develops tools, technologies, and decision support systems to detect, monitor, assess risk, and control nationally significant invasive species and wildlife diseases with particular focus on protecting lands and species under management responsibility of Interior bureaus. Research and technology development focus on species that have potential to cause significant economic, ecologic, or human health concerns. Recent areas of focus include the invasive species Asian carp, sea lamprey, brown treesnake, Burmese python, Argentine black and white tegu, zebra, and quagga mussels, cheatgrass, tamarisk, rapid Ohi'a death, and common reed (*Phragmites*), and the diseases avian influenza, sylvatic plague, bat white nose syndrome, chronic wasting disease in elk and deer, and snake and amphibian fungal infections. A strong emphasis of the Biological Threats Program is transfer of technology developed to combat one invasive species or wildlife disease to newly emerging but lesser studied threats.

Tracking the establishment and spread of existing and new invasive species is critical to reducing the damage they would otherwise cause to ecosystems and the economy. The USGS helps to optimize traditional monitoring methods and develops new tools, particularly molecular techniques, to assist in the early detection. The research focuses on developing and enhancing capabilities to forecast and predict invasive species establishment and spread. Early detection helps resource managers identify and report new invasive species while they are still in very low abundance and containment and eradication costs are minimized. The research improves existing invasive species control methods and develops and tests new chemical, physical, molecular, and biological methods of control, including gene silencing, microbial symbionts, and other innovative technologies. A focus of the research is to integrate control strategies where applicable to empower land and water managers to respond rapidly and cost-effectively to a wide variety of new invasions across the United States.

Asian carp have become established in the Mississippi River basin. There is strong concern among basin states of further spread of invasive carps in the Upper Mississippi River basin, the Great Lakes, and the Tennessee River basin. The carp pose a serious threat to the $7 billion recreational and commercial Great Lakes fishery. To contain and possibly eradicate Asian carp, the USGS is developing and refining new genetic tools for Asian carp detection and developing containment and control tools such as underwater sound barriers, carbon dioxide, commercial harvest, and species-specific toxin delivery systems. A strong emphasis of the Program is to investigate options for combined implementation of tools using an integrated adaptive management approach to decrease cost and increase potential for success.

At the same time that Federal government and the State of Florida are investing billions in ecosystems restoration, invasive species threaten that work. Burmese pythons have become widespread in south Florida, including large portions of the Everglades, where they have decimated many native mammal and bird populations through competition and predation, including killing American alligators. Primary goals are to improve the understanding of python impacts to native ecosystems and develop tools to track and remove reptile invaders, including telemetry, isotopic analysis, and eDNA. The USGS is working to prevent invasive Argentine tegu lizards from expanding into Everglades National Park by developing and deploying high-efficiency traps that have resulted in the removal of hundreds of these large omnivorous lizards from just outside the park. The lizards have the potential to be as ecologically damaging as the Burmese pythons.

The Biological Threats Program conducts multi-scale, integrated assessments to map infestations and accurately monitor the spread of invasive plants in the West to predict areas most vulnerable to invasive species, assess the effects of management practices and natural disturbances on invasive species, evaluate how invasive plants alter the frequency and intensity of wildfires; and improve methods to restore public rangelands affected by invasion of terrestrial plants. The Program also conducts research and develops tools and technologies to control invasive species that cause economic and ecologic harm in the Great Lakes, including sea lamprey, zebra and quagga mussels, and invasive reeds. These technologies are being transferred to other regions of the United States to combat similar invasions, such as zebra and quagga mussels in the Pacific Northwest, where they have the potential to increase regional hydroelectric costs by $500 million annually.

The Biological Threats Program provides funding to assess mass mortalities and develop disease management tools for economically and ecologically important freshwater and marine organisms, such as salmon, sturgeon, trout, whitefish, mussels, and coral. This work enhances biosurveillance of aquatic diseases by improving information and data delivery on monitoring and species occurrences through field and lab research, online databases, and information systems to advance our understanding of the complex interactions that influence disease outbreaks. The USGS investigations into marine diseases impacting sea turtles, coral, and other organisms support FWS, NPS and NOAA species management. For example, in the Pacific Northwest, the USGS is investigating Infectious Hematopoietic Necrosis Virus (IHNV), which causes acute disease in juvenile Pacific salmonid species. By understanding disease patterns and processes, the science is being used by managers to take actions to improve the health of threatened or endangered fish populations.

Endangered black-footed ferrets, prairie dogs, domestic and wild cats, as well as humans, can die from sylvatic plague, a flea-borne bacterial disease. The NPS conducted an epidemiological investigation after two human visitors to Yosemite National Park contracted the disease in 2015. Plague was one of eight zoonotic diseases prioritized by CDC, USDA, and DOI that need to be addressed by the Federal government with a One Health approach. The USGS is investigating the ecology of plague and harnessing that information to develop and adapt integrated pest management tools for natural resource managers. Similarly, the USGS is investigating other vector-borne diseases of concern to DOI bureaus. The technology behind the novel plague vaccine is being used by the USGS to develop a WNS vaccine for bats.

Climate Adaptation Science Center

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Climate Adaptation Science Center	**0**	**0**	**97**	**44,488**	**(20,684)**	**23,901**	**(20,587)**
Transfer from Land Change Science Program (LR)	*[19,153]*	*[19,153]*		*19,153*			
Transfer from National and Regional Climate Adaptation Centers (LR)	*[25,335]*	*[25,335]*		*25,335*			
Landscape Science	*[2,213]*	*[2,213]*			*(2,213)*	*[0]*	
Climate Research and Development	*[16,940]*	*[16,940]*			*(6,125)*	*[10,815]*	
Arctic	*[3,647]*	*[3,647]*			*(528)*	*[3,119]*	
Tribal Climate Adaptation Science	*[500]*	*[500]*			*(500)*	*[0]*	
Realign Climate Adaptation Science Center	*[21,188]*	*[21,188]*			*(11,318)*	*[9,870]*	
FTE	**0**	**0**		**111**	**(66)**	**45**	**(66)**

*Transfers for 2018 and 2019 are for display purposes and are non-add.

Program Description

The Climate Adaptation Science Center program is focused on better understanding impacts of climate and other stressors to the Nation's resources. This program delivers the science to support development of adaptive management plans that incorporate a range of environmental changes and their impacts on fish, wildlife, water, land, and people. It provides data, tools, and applications that help resource managers meet current and emerging challenges that threaten the sustainability of natural resources and delivers research, investigations, models, and applications that provide the scientific bases for land use decisions affecting the safety of communities, economic prosperity, and the natural resources of the Nation.

Science conducted within the program supports adaptation planning initiatives across the Nation to safeguard the health of fish, wildlife, and lands for the benefit of current and future generations. It provides long-term data and interpretations needed by the Species Management Research Program to evaluate population trends for pending listing or delisting decisions of Interior trust species and the Biological Threats Research Program to evaluate ecologic and economic risk of new invasive species and wildlife diseases.

The program focuses on a better understanding of the implications of changing climate on invasive species, high priority species, communities, and ecosystems; increasing understanding of the uncertainties associated with models and modelling results; and advancing the design and evaluation of adaptation strategies. Likewise, it serves as an essential interface between Federal researchers, land managers, and front-line stewards of natural and cultural resources.

It also provides the basic understanding necessary to support climate impact applications developed within the program and provides long-term data and interpretations needed by the Land Management Research Program and other USGS programs to anticipate impacts of changing climate and land use on critical habitats. The program's research combines long-standing expertise in geology, hydrology, biogeochemistry, and ecology to document patterns of change over a range of timescales and to assess and model impacts of these changes at local, regional, and national scales. The research currently focuses on:

- Long-term patterns and impacts of droughts and floods
- Response of coastal regions to changing land use, water management, and sea level
- Patterns and impacts of drought, fire, and other stressors on mountain ecosystems
- Patterns and impacts of change on the cryosphere and Arctic habitats.

These efforts provide the scientific basis for land-use decisions that affect the safety and prosperity of communities and our Nation's natural resources.

2020 Activities

The 2020 budget request supports:

- Maintaining a Climate Adaptation Science Center with 3 regional hubs at host universities, 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.
- Understanding the implications of land and climate change on drought, flooding, wildfire, and other extreme events; coastal resources; arctic habitats; invasive species; high priority species, communities, and ecosystems; and maintaining sustainable harvests of fish and wildlife.
- Exchanging information between scientists and managers to support successful adaptation.
- Synthesizing data and developing tools to support decision makers to ensure that information meets the unique needs of managers.
- Expanding compilation of continental-scale synthesis of natural patterns of drought and impacts on terrestrial and aquatic communities and natural resources to include the entire Holocene period (last 11,700 years). Results will improve capabilities to anticipate the magnitude and breadth of future changes in water availability and the impacts of long-term seasonal changes on society, agriculture, and ecosystems.
- Building upon new methods published in 2019 to consistently measure the ice mass balance (the volume of water contained in glaciers) in benchmark glaciers of Alaska and the Pacific Northwest,

continue development of techniques and observations to understand glacier response to changing climate and downstream socioeconomic impacts of land ice loss (e.g., water availability, sea level).

- Expanding research that documents the response of coastal habitats to changing land management and sea level to encompass the entire southeastern United States coastline. Improved understanding of the processes that control the response will facilitate development of dynamic landscape models that should be applicable to many coastal habitats on national and global scales and improve capabilities to project impacts of different management and environmental changes.

2020 Program Change Summary

The 2020 budget request for the Climate Adaptation Science Center is $23,901,000 and 45 FTE, which includes:

- Landscape Science (-$2,213,000 and -4 FTE)
- Climate Research and Development (-$6,125,000 and -44 FTE)
- Arctic (-$528,000 and -4 FTE)
- Tribal Climate Adaptation Science (-$500,000 and -4 FTE)
- Realign Climate Adaptation Science Center (-$11,318,000 and -10 FTE)

Program Overview

The program conducts and facilitates research to provide information, tools, and applications to help resource managers meet current and emerging challenges that threaten the sustainability of natural resources. It focuses on a better understanding of the implications of changing climate and land use on invasive and high-priority species, communities, and ecosystems; increases understanding of the uncertainties associated with models; and advances the design of adaptation strategies. The program serves as an interface between Federal researchers, land managers, and front-line stewards of natural and cultural resources. The scientific work conducted is responsive to the following guiding principles:

- Meets the needs of resource managers.
- Prioritizes evaluation, translation, and synthesis of climate-impact research findings.
- Promotes rigorous and integrated research to advance fundamental understanding of climate impacts to fish and wildlife 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 program conducts multidisciplinary, foundational research needed to understand and anticipate how changing climate and land use affect habitats and communities across the Nation. The program's research

improves understanding of the forces that shape landscapes and their potential uses and provides data to help distinguish between land surface change resulting from natural forces and those associated with land management. This research provides data to understand how natural disturbances (such as droughts, fire, and sea level change) and land use changes (such as urbanization, agriculture, and water management) affect the composition, distribution, and functioning of land and natural resources. Research products and technical methods produced by the program helps 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.

The USGS will continue analyzing and interpreting continental-scale synthesis of natural patterns of drought and impacts on terrestrial and aquatic communities and natural resources. Based on evaluation of existing datasets from earlier time intervals, key periods of change will be identified for more analyses. Results will improve capabilities to anticipate future changes in water availability across the Nation and the impacts of long-term seasonal changes on society, agriculture, and ecosystems.

The program studies land use and land cover change at multiple scales, documenting the geographic variability of change and defining the environmental, social, technological, and political drivers of change, as well as assessing the impacts of these changes. This includes studying long-term changes in land cover associated with climate variability, fire disturbance, and land management activities. The USGS uses this information to develop spatially explicit models of the impacts of these changes on ecosystem extent and function, and the services they provide.

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Energy and Mineral Resources

Energy and Mineral Resources

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Mineral and Energy Resources	**80,243**	**80,243**	**366**		**5,463**	**86,072**	**5,829**
FTE	*434*	*434*	*366*	*-*	*(8)*	*426*	*(8)*
Mineral Resources Program	**49,371**	**49,371**	**241**	**-**	**10,581**	**60,193**	**10,822**
FTE	*301*	*301*		*-*	*5*	*306*	*5*
Energy Resources Program	**30,872**	**30,872**	**125**	**-**	**(5,118)**	**25,879**	**(4,993)**
FTE	*133*	*133*		*-*	*(13)*	*120*	*(13)*
Environmental Health Programs	**22,595**	**22,595**	**-**	**(22,595)**	**-**	**-**	**-**
FTE	*117*	*117*		*-117*	*-*	*-*	*-*

The 2020 budget request for the Energy and Mineral Resources Mission Area is $86,072,000 and 426 FTE. The Energy and Mineral Resources Mission Area conducts scientific research, completes energy and mineral resource assessments, and compiles information and statistics on the worldwide supply and flow of minerals, including critical minerals, and materials essential to our economy and national security.

Energy and mineral resources are vital components of the Nation's economy. The United States is currently 100 percent dependent on foreign nations for 20 different mineral commodities, including several that are critical minerals for national security and economic growth. The Nation depends on energy to power homes and businesses, as well as minerals to manufacture products such as cell phones, laptops, and cars and renewable energy technologies. As demands for energy and mineral resources grow, the USGS research and assessments become increasingly critical for understanding the occurrence, quality, supply, and use of national and global resources. The in-depth science provided by the USGS Energy and Mineral Resources Mission Area informs strategic, evidence-based economic and geopolitical decisions and facilitates responsible natural resource development.

Mineral Resources Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Mineral Resources Program	**49,371**	**49,371**	**241**	**-**	**10,581**	**60,193**	**10,822**
Critical Minerals (Earth MRI)	-	-			*10,598*	*10,598*	
Domestic Mineral Base Assessment	*1,000*	*1,000*			*(1,000)*	*[0]*	
Research Reduction	*372*	*372*			*(372)*	*[0]*	
Continuation of the Magnetotelluric Survey of the U.S.					*1,726*	*[1,726]*	
Minerals Information	*371*	*371*			*(371)*	*[0]*	
FTE	**301**	**301**			**5**	**306**	**5**

Program Description

The Mineral Resources Program (MRP) is the sole Federal source of scientific information and 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 critical to the economic stability and national security of the United States.

2020 Activities

The 2020 budget request supports:

- Collection, analysis, and dissemination of minerals information and materials flow studies.
- Research on new sources of critical minerals and on the lifecycles of critical minerals.
- Research to understand the genesis and distribution of critical mineral resources throughout the Nation by collecting, preserving and disseminating geological, geochemical, and geophysical data and initiating qualitative and quantitative mineral assessments.
- A prioritized nationwide program of topographic, geologic, and geophysical mapping to enhance understanding of the Nation's mineral resource potential in order to better manage the supply of critical minerals.

2020 Program Change Summary

The 2020 budget request for the Mineral Resources Program is $60,193,000 and 306 FTE, which includes:

- Critical Minerals – Earth Mapping Resources Initiative (Earth MRI) (+$10,598,000 and +4 FTE): Secretarial Order 3359 directs the USGS to develop a plan to improve the topographic, geological, and geophysical mapping of the United States and to make the resulting data available electronically to support management of private-sector mineral exploration of critical minerals and to provide data for land-use planning. The USGS will engage with other Federal agencies, outside partners, and stakeholders to develop mechanisms to acquire new topographic, geologic mapping, and geophysical data in order to better understand critical minerals. New topographic, geological, and geophysical mapping efforts will be funded through contracts and other vehicles with the private sector, States or universities, with the USGS providing critical planning, oversight, and data analysis. The effort will extend existing topographic and elevation coverage by utilizing private-sector contractors for data collection. Geological mapping will be conducted internally by the USGS and externally through partnerships with State geological surveys and universities. Data collection for airborne aeromagnetic surveys, a commonly used geophysical technique for mineral exploration, will be conducted by private-sector contractors; the USGS will ensure data quality and standardization as well as providing data interpretation and analysis. Priority targeted areas include portions of Alaska, the midcontinent region, and the Western United States. These areas should contain significant mineral resources based on comparisons with areas of similar geology elsewhere in the world. However, these resources are not visible at the Earth's surface, so they must be identified through modern geological and geophysical mapping techniques that explore what is underground. All data generated by this effort will be available to the public electronically and provide direct benefits to the Nation's economy. These data may be used by the private sector to identify mineral resources that would reduce mineral import dependence and to evaluate targeted areas for mineral potential. These data are also highly beneficial for infrastructure, transportation, and land-use planning; hazard assessments for landslides, volcanoes, and floods; water resources management; emergency response, and more. In 2020, lidar surveys and geologic mapping will continue and initial airborne geophysical surveys will focus on a limited number of targeted areas where existing lidar (detailed topographic/elevation) coverage is available and the mineral potential is thought to be high, based on existing data. Data from the lidar and geophysical surveys would become available in FY 2021, and beyond. Interpretation of the surveys and results from geologic mapping would become available as they are completed.
- Continuation of the Magnetotelluric Survey of the United States (+$1,726,000 and +1 FTE): Understanding and measuring the Earth's electrical fields (resistivity) is important not only for hazard mitigation, but also for mapping crustal- and lithospheric-scale variations in the Earth's crust within the context of a 'mineral-systems' approach to resource assessment. These magnetotelluric (MT) data can be used to identify crustal regions in which different deposit types and various ore-forming processes are genetically linked to geodynamic and tectonic processes that leave a lasting imprint on the crust and lithosphere. Regional three-dimensional resistivity models have been instrumental to a mineral-system assessment approach in Australia and Canada, specifically in defining the tectonic/metallogenic setting and potential fluid pathways over vast areas. Development and improvement of such resistivity models is needed to provide a three-

dimensional nationwide 'base' model at the mineral-system scale. Additionally, as part of this effort, collection of MT data on a national scale has been started as a basis for modeling the Earth's electric field, both to forecast future electrical storms and to understand ongoing events' likely ramifications. Multi-use applications of these data highlight the need for completing this national-scale magnetotelluric survey and for additional geomagnetic monitoring stations to complete and improve assessments of geoelectric hazards for the continental United States.

Coordinated through the White House's Office of Science and Technology Policy and National Science and Technology Council (NSTC), this research is responsive to priorities established in the *National Space Weather Strategy*, released by NSTC, as well as related international initiatives for pursuing induction hazard research. This broad collaboration includes scientists from NASA, NOAA, the Institute for Defense Analyses, the Federal Energy Regulatory Commission, the Federal Emergency Management Agency, and NSF.

Since 2017, the National Science Foundation, along with NASA, has funded acquisition of magnetotelluric data on a national scale; to date, magnetotelluric data have been collected by Oregon State University for about 75 percent of the country. In 2020, the USGS will continue this national magnetotelluric survey by funding data collection over the south-central part of the US. Data from this and other geophysical surveys will become available in FY 2021 and beyond.

- Domestic Mineral Base Assessment (-$1,000,000)
- Research Reduction (-$372,000)
- Minerals Information (-$371,000)

Program Overview

The USGS characterizes and identifies mineral resources important to our Nation's economy and way of life. The program uses geologic, geochemical, geophysical, and remote sensing surveys to characterize the mineral potential of the United States. The program supports data collection and research on a wide variety of nonfuel mineral resources that are critical to economic stability and national security.

In 2000, data showed that the United States was 100 percent reliant on foreign sources for 13 minerals and imported a majority of its supply for an additional 20 minerals. By 2016, work by the USGS indicated 100 percent foreign reliance increased to 20 minerals, with a 50 percent or greater foreign dependency for an additional 30 minerals. Research by the USGS helps to define and forecast these dependencies and to inform Federal decision makers about how to address them. Furthermore, a scientific understanding of how minerals interact with the environment informs the management of our public lands and resources and is used for protecting and improving public health and safety.

The MRP examines changes in supply risk and the impact of potential supply disruptions for critical minerals. The USGS National Minerals Information Center (NMIC) has taken a lead role in further development and implementation of a critical minerals initiative under the White House Office of Science and Technology Policy-led National Science and Technology Council, in collaboration with Federal partners and industry stakeholders. The group developed a "criticality tool" based on a number of factors,

which can be used to identify emerging supply risks and evaluate the impact of commodity supply restrictions.

Table 1. Draft list of critical minerals.

[X, applicable sector; --, not applicable]

Mineral commodity	Sectors						Top producer	Top supplier	Notable example application
	Aerospace (nondefense)	Defense	Energy	Telecommunications and electronics	Transportation (nonaerospace)	Other			
Aluminum	X	X	X	X	X	X	China	Canada	Aircraft, power transmission lines, lightweight alloys.
Antimony	--	X	X	X	X	X	China	China	Lead-acid batteries.
Arsenic	--	X	X	X	--	X	China	China	Microwave communications (gallium arsenide).
Barite	--	--	X	X	--	X	China	China	Oil and gas drilling fluid.
Beryllium	X	X	X	X	--	X	United States	Kazakhstan	Satellite communications, beryllium metal for aerospace.
Bismuth	--	X	X	X	--	X	China	China	Pharmaceuticals, lead-free solders.
Cesium and rubidium	X	X	X	X	--	X	Canada	Canada	Medical applications, global positioning satellites, night-vision devices.
Chromium	X	X	X	X	X	X	South Africa	South Africa	Jet engines (superalloys), stainless steels.
Cobalt	X	X	X	X	X	X	Congo[1] (Kinshasa)	Norway	Jet engines (superalloys), rechargeable batteries.
Fluorspar	--	--	X	X	--	X	China	Mexico	Aluminum and steel production, uranium processing.
Gallium	X	X	X	X	--	X	China	China	Radar, light-emitting diodes (LEDs), cellular phones.
Germanium	X	X	X	X	--	X	China	China	Infrared devices, fiber optics.
Graphite (natural)	X	X	X	X	X	X	China	China	Rechargeable batteries, body armor.
Helium	--	--	--	X	--	X	United States	Qatar	Cryogenic (magnetic resonance imaging [MRI]).
Indium	X	X	X	X	--	X	China	Canada	Flat-panel displays (indium-tin-oxide), specialty alloys.
Lithium	X	X	X	X	X	X	Australia	Chile	Rechargeable batteries, aluminum-lithium alloys for aerospace.
Magnesium	X	X	X	X	X	X	China	China	Incendiary countermeasures for aerospace.
Manganese	X	X	X	X	X	X	China	South Africa	Aluminum and steel production, lightweight alloys.
Niobium	X	X	X	X	--	X	Brazil	Brazil	High-strength steel for defense and infrastructure.
Platinum group metals[2]	X	--	X	X	X	X	South Africa	South Africa	Catalysts, superalloys for jet engines.
Potash	--	--	X	X	--	X	Canada	Canada	Agricultural fertilizer.
Rare earth elements[3]	X	X	X	X	X	X	China	China	Aerospace guidance, lasers, fiber optics.
Rhenium	X	--	X	X	--	X	Chile	Chile	Jet engines (superalloys), catalysts.
Scandium	X	X	X	X	--	X	China	China	Lightweight alloys, fuel cells.
Strontium	X	X	X	X	X	X	Spain	Mexico	Aluminum alloys, permanent magnets, flares.
Tantalum	X	X	X	X	--	X	Rwanda	China	Capacitors in cellular phones, jet engines (superalloys).
Tellurium	--	X	X	X	--	X	China	Canada	Infrared devices (night vision), solar cells.
Tin	--	X	--	X	--	X	China	Peru	Solder, flat-panel displays (indium-tin-oxide).
Titanium	X	X	X	X	--	X	China	South Africa	Jet engines (superalloys) and airframes (titanium alloys), armor.
Tungsten	X	X	X	X	--	X	China	China	Cutting and drilling tools, catalysts, jet engines (superalloys).
Uranium	X	X	X	--	--	X	Kazakhstan	Canada	Nuclear applications, medical applications.
Vanadium	X	X	X	X	--	X	China	South Africa	Jet engines (superalloys) and airframes (titanium alloys), high-strength steel.
Zirconium and hafnium	X	X	X	X	--	X	Australia	China	Thermal barrier coating in jet engines, nuclear applications.

[1]Democratic Republic of the Congo.

[2]This category includes platinum, palladium, rhodium, ruthenium, iridium, and osmium.

[3]This category includes yttrium and the lanthanides.

Draft list of critical minerals.

Source: USGS Open-File Report 2018-1021 (*https://pubs.usgs.gov/of/2018/1021/ofr20181021.pdf*).

The USGS previously recognized the geologic similarity of the Southeastern United States to southeastern China where the vast majority of today's "heavy" rare earth elements (the most valuable of the rare earth elements) supply is produced. With the funding proposed in 2020, the USGS will continue to conduct field- and laboratory-based research and literature review on critical minerals, especially in Alaska, the midcontinent, and the Southeastern United States, and will collaborate with NMIC economists and commodity experts to determine which mineral commodities are most critical to our national economy and security, so that future assessments can focus on these commodities.

Critical minerals work of the USGS includes element-specific studies, regional studies, process studies, national and regional databases, as well as work conducted by the NMIC related to international minerals, commodities and materials flow. Collectively, the proposed 2020 work of the USGS for critical minerals within the MRP totals $30.3 million, including $10.6 million requested for the Earth MRI.

The MRP supports research on how and where mineral deposits form and develops methods to detect potential mineral resources. This research has produced innovations in mineral resource science, ranging from collaborating with other Federal agencies, to incorporating the latest space-based and airborne Earth observation instruments and the latest data science, to the discovery of a new uranium, finchite.

The USGS efforts will improve the topographic, geological, and geophysical mapping of the United States and to make the resulting data available electronically to support management of private-sector mineral exploration of critical minerals and to provide data for land-use planning. The USGS geologic, geophysical, and geochemical research enables and improves the assessment of undiscovered mineral resources, most of which are not easily identified at the Earth's surface because they are hidden by non-mineral bearing rocks, soils, or dense vegetation. Geophysical tools and techniques allow geologic units and structures beneath the Earth's surface to be mapped and provide data that can be used to develop three-dimensional models of a particular area to understand how mineral resources are distributed. Innovative new geochemical tools and methods also are being developed by MRP to reduce uncertainty in mineral resource assessments. Currently, less than 20 percent of the United States has been geologically mapped at a scale useful for mineral and energy exploration or for local land-use planning.

The USGS assessments support decision makers' interests in ensuring a secure supply of mineral resources by providing reliable, accurate information about the location, quantity, and quality of mineral resources. Assessments at a variety of scales provide valuable information to a range of users, including Federal, State, and local land-use managers. In addition, the USGS supports development of tools and techniques designed to understand what happens when mineral deposits are weathered or mined. Mineral environmental assessments use knowledge of mineral deposits to anticipate environmental challenges associated with abandoned mines and the effects of developing new mineral deposits, providing specific information on the potential release of contaminants into the environment.

The USGS continues to collaborate with the BLM in developing a geospatial database (USMIN) that captures mine features from topographic maps. This project has been progressing eastward and has now captured 485,000+ points and 79,000+ polygons. Data for Wisconsin, Illinois, Indiana, and Michigan were released in 2018, and data capture for Kentucky and Ohio are largely complete. In 2018, USMIN also issued individual data releases for rare earth elements (rhenium, tungsten, tin, and cobalt) occurrences in the United States as

well as for other significant mineral deposits in Alaska and gold occurrences in the Carlin area of Nevada. The USGS plans to continue to expand upon the data available in USMIN in 2020.

The USGS continued research into the interactions of mineral resources with the environment, both natural and because of resource extraction, to understand emerging challenges and opportunities for future mining and new uses of previously mined materials. One ongoing study focuses on geochemical modeling of the potential use of steel slag as a mechanism to remove phosphate from water.

Geological mapping continues in Alaska's Yukon-Tanana terrane. In addition to contributing to understanding the bedrock geology, this mapping will help determine the source of known placer gold deposits in the region and aid in determining the area's potential to host critical minerals deposits.

The program's Minerals Information function, through the USGS National Minerals Information Center (NMIC), supports collection, analysis, and dissemination of data that document production and consumption for about 100 mineral commodities, both domestically and internationally, for 180 countries. The data provide decision makers with information to ensure that the Nation has an adequate and dependable supply of minerals and mineral materials to meet its defense and economic needs at acceptable costs. The public and private sectors use this information to understand the use and ultimate disposition of materials in the economy and to forecast supply and demand. These data are used to formulate plans to address shortages and interruptions in minerals supplies, and to develop strategies for maintenance of a competitive position in the global economy. The NMIC will continue to provide hundreds of reports such as the Minerals Commodity Summaries, the Minerals Yearbook, the Mineral Industry Surveys, Metal Industry Indicators, and the Nonmetallic Mineral Products Industry Indexes. These and other MRP information products, along with sound analysis from minerals and materials analysis specialists and program scientists, allow for decision makers and stakeholders to understand the changes and importance of mineral resource production, consumption, and use. The NMIC will continue to provide high quality information and analyses that informs Federal critical minerals policy and is of paramount importance to U.S. national security and trade interests.

Energy Resources Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Energy Resources Program	**30,872**	**30,872**	**125**	**-**	**(5,118)**	**25,879**	**(4,993)**
Modernize and Provide Multi-Resource Energy Assessments					*2,992*	*[2,992]*	
Geologic Carbon Sequestration	*2,954*	*2,954*			*(1,891)*	*[1,063]*	
Alaska North Slope Resource Assessments	*4,700*	*4,700*			*(4,700)*	*[0]*	
Coal and Uranium Resource Assessments	*1,519*	*1,519*			*(1,519)*	*[0]*	
FTE	**133**	**133**			**(13)**	**120**	**(13)**

Program Description

The USGS Energy Resources Program (ERP) is the sole provider of publicly available estimates of geological energy resources for the United States (exclusive of the U.S. Outer Continental Shelf) and provides publicly available estimates related to global oil and gas resources. The geologic energy resources that the ERP studies are: oil (including shale and heavy oil), natural gas, coal, coalbed methane, gas hydrates, geothermal resources, and uranium. ERP science informs decision-making related to domestic and foreign energy resources, as well as the management of energy resources on Federal lands.

2020 Activities

The 2020 budget request supports:

- Releasing additional USGS assessments of undiscovered, technically recoverable oil and gas resources in U.S. and non-U.S. basins.
- Continuing the underlying geological, geophysical, and geochemical research that underpins the assessments.
- Publishing assessments of conventional and unconventional oil and gas resources from regions around the world.
- Continuing research into geothermal resources aimed at improving the viability of Enhanced Geothermal Systems and studying environmental impacts of geothermal energy development on Federal lands.
- Expanding unconventional oil and gas research efforts that began in 2016 on the geologic causes of variability in the recovery of petroleum and water, and studies of baseline water quality.

- Supporting USGS gas hydrate studies with the USGS Coastal/Marine Hazards and Resources Program and contribute to DOE- and industry-sponsored cooperative gas hydrate projects.
- Releasing an updating assessment of global petroleum resources. Global assessments will include multiple basins in western Canada and the Surat and Galilee Basins in Australia.
- Supporting domestic petroleum research and assessments of:
    - Section 1002 area of the Alaska North Slope coastal plain based on new three-dimensional seismic data acquired by an industry consortium
    - Anadarko Basin (midcontinent)
    - Sacramento Basin (California)
    - Denver Basin (Colorado and Wyoming)
    - Montana Thrust Belt (Montana)
    - Powder River Basin (Wyoming and Montana)
    - Raton Basin (Colorado and New Mexico)
    - Williston Basin (North and South Dakota; southern Saskatchewan)
- Providing personnel and resources to conduct field and laboratory analyses of material recovered by conventional and pressure core systems, and partner in the synthesis of data from logging, direct sampling, and geophysical and geologic characterization studies in support of an Alaska gas hydrate production test well project.
- Publishing a new Alaska North Slope gas hydrate assessment.
- Continuing to contribute to developing the operational plan in support of the International Ocean Discovery Program sponsored Expedition 386, which consists of a program of five drilling locations in the northern Gulf of Mexico, scheduled for the spring of 2020, whereby the physical and engineering properties of gas hydrates will be further studied to better evaluate scalability and commerciality.
- Continuing studies into the application of economics to resource assessments to understand the economic dynamics of shale gas and oil plays in order to model resource costs and evaluate future potential domestic supplies.
- Continuing the development of a program-wide Laboratory Information Management System (LIMS) for incorporating data management best practices and capabilities to collect, store, manage, process, document, validate, and archive laboratory information assets from ERP laboratories.
- Continuing to maintain and serve data previously provided to the National Coal Resources Data System (NCRDS) from State Cooperators and other ERP-funded efforts.
- Updating data management plans as needed to support of Federal data management policies and Departmental and bureau guidance.

2020 Program Change Summary

The 2020 budget request for the Energy Resources Program is $25,879,000 and 120 FTE, which includes:

- Modernize and Provide Multi-Resource Energy Assessments (+$2,992,000 and 0 FTE): This will enable the ERP to begin modernizing energy resource assessments by developing multi-resource assessments where applicable for future assessments of all types of energy resources. This will also allow the ERP to continue the fundamental research that underpins energy resource assessments.
- Geologic Carbon Sequestration (-$1,891,000 and -4 FTE)
- Alaska North Slope Resource Assessments (-$4,700,000 and -9 FTE)
- Coal and Uranium Resource Assessments (-$1,519,000 and 0 FTE)

Program Overview

The Energy Resources Program (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 ERP also invests in innovation from research to enable and improve assessments of current energy resources to understanding and assessing the potential for transformative new energy resources.

The ERP assesses oil and gas resource potential through in-depth studies of geology and resources in various petroleum provinces throughout the United States. Studies of the geologic, geophysical, and geochemical framework of these areas allows for better understanding of the resource potential and environmental impacts of oil and gas development. The USGS considers the following factors in prioritizing future oil and gas resource assessments: technological changes that enable access to additional resources (e.g., hydraulic fracturing, directional drilling, etc.); additional data that become available (e.g., wells, seismic, production data); history of completed USGS conventional and unconventional resource assessments; and specific requests from other Federal agencies aligned with their priority needs.

The USGS assessments of oil and gas resources are highly relevant to energy policy, especially as recovery processes such as directional drilling and hydraulic fracturing have become widespread in the United States. ERP resource assessments are widely used by a variety of stakeholders, including local, State and Federal governments, land resource managers, and the public. ERP products are also utilized by the U.S. Energy Information Administration (EIA) as the basis for computing reserve estimates for various basins in the United States and globally.

In 2017, in light of recent significant industry discoveries on the Alaska North Slope (ANS) and in response to Secretarial Executive Order 3352, the USGS initiated a multi-bureau effort (with the Bureau of Land Management and the Bureau of Ocean Energy Management) to assess ANS energy resource potential. The USGS continues to collaborate with Natural Resources Canada to improve the understanding of the geologic framework from eastern Arctic Alaska through the Mackenzie Delta and into the southern passive

margin of the Canadian Arctic Islands (including petroleum systems elements).

The USGS conducts early-stage research on the geologic processes forming energy resources and the geologic setting of these resources to enable and improve assessments of current national and global coal, oil, and gas resources. Accurate and scientifically based assessments of coal, oil, and gas resources of the Nation and world are dependent upon this geologic information.

The work of the USGS in geologic process and resource characterization also provides a scientific basis upon which to evaluate the potential contributions to future energy supplies from currently used energy resources and from emerging resources such as gas hydrates. The USGS geologic process and resource characterization research also provides a fundamental understanding of the economic viability and potential environmental factors associated with resource development and use. For example, geochemical research helps to explain how oil and gas are generated, how they migrate out of source rocks, and how they accumulate and are preserved in reservoir rocks. Predictive models developed from this research aid in predicting the type, timing, and migration patterns of hydrocarbon generated.

Understanding the potential for further diversifying the U.S. energy portfolio by harnessing our Nation's renewable and alternative energy potential is important for informed decision-making that takes into account the resulting effects on our economy and environment. In 2020, the ERP will support studies to develop, test, and deploy miniature unmanned aerial systems to perform future thermal infrared (or "heat mapping") studies to monitor changes associated with a potential expansion in geothermal production. In addition, the ERP will publish an assessment of resources associated with Enhanced Geothermal Systems located in the Great Basin of Nevada and western Utah.

The USGS Science and Decisions Center (SDC), as part of the ERP, conducts research and applications to increase the use and value of science in decision-making. The SDC's multidisciplinary efforts focus on improved decision-making throughout a variety of natural resource science disciplines. SDC economists and physical, biological, and social scientists work with partners in Interior and other government agencies, academia, and nongovernmental organizations to develop innovative methods, analytical tools, and institutional structures to integrate science more effectively with natural resource management. The SDC also provides the analytical structure and tools to support efficient and effective management of resources. The SDC advances systematic decision-making approaches including assessment of management outcomes and lessons learned in order to help decision makers and improve natural resource management outcomes.

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Natural Hazards

Natural Hazards

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Natural Hazards	**178,613**	**178,613**	**439**	**-**	**(34,027)**	**145,025**	**(33,588)**
FTE	*615*	*615*	*-*	*-*	*(1)*	*614*	*(1)*
Earthquake Hazards	**83,403**	**83,403**	**172**	**-**	**(19,272)**	**64,303**	**(19,100)**
FTE	*225*	*225*	*-*	*-*	*2*	*227*	*2*
Volcano Hazards	**42,621**	**42,621**	**97**	**-**	**(14,597)**	**28,121**	**(14,500)**
FTE	*142*	*142*	*-*	*-*	*(3)*	*139*	*(3)*
Landslide Hazards	**3,538**	**3,538**	**16**	**-**	**-**	**3,554**	**16**
FTE	*21*	*21*	*-*	*-*	*-*	*21*	*-*
Global Seismographic Network	**6,653**	**6,653**	**8**	**-**	**-**	**6,661**	**8**
FTE	*11*	*11*	*-*	*-*	*-*	*11*	*-*
Geomagnetism	**1,888**	**1,888**	**-**	**-**	**-**	**1,888**	**-**
FTE	*9*	*9*	*-*	*-*	*-*	*9*	*-*
Coastal/Marine Hazards and Resources	**40,510**	**40,510**	**146**	**-**	**(158)**	**40,498**	**-12**
FTE	*207*	*207*	*-*	*-*	*-*	*207*	*-*

The 2020 budget request for Natural Hazards is $145,025,000 and 614 FTE.

The USGS provides scientific information to emergency responders, policy makers, and the public to reduce losses from a wide range of natural hazards, including earthquakes, floods, hurricanes, landslides, tsunamis, volcanic eruptions, wildfires, and geomagnetic storms. Working with its partners, cooperators, and customers, the USGS delivers actionable assessments of these hazards and helps to develop effective strategies for achieving more-resilient communities. The USGS is the Federal agency responsible for monitoring and notification of earthquakes, volcanic activity, and landslides and coastal erosion in the United States. For many other hazards, the USGS directly supports the warning responsibility of the National Oceanic and Atmospheric Administration.

To achieve its primary mission, and to fulfill its responsibilities for loss and risk reduction, the USGS Natural Hazards Mission Area develops, delivers, and applies several 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.

Earthquake Hazards Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Earthquake Hazards	**83,403**	**83,403**	**172**	**-**	**(19,272)**	**64,303**	**(19,100)**
National Seismic Hazard Model Improvements &AK Update	-	-			*2,654*	*[2,654]*	
Seismic Network Improvements	*1,800*	*1,800*			*(826)*	*[974]*	
Maintain Earthquake Early Warning (EEW) Capacity	*22,900*	*22,900*			*(14,700)*	*[8,200]*	
ANSS Equipment Upgrade & Replacement	*5,000*	*5,000*			*(5,000)*	*[0]*	
Earthscope Stations	*1,400*	*1,400*			*(1,400)*	*[0]*	
FTE	**225**	**225**			**2**	**227**	**2**

Program Description

The Earthquake Hazards program provides the scientific information, situational awareness, and knowledge necessary to reduce deaths, injuries, and economic losses from earthquakes and earthquake-induced tsunamis, landslides, and soil liquefaction.

2020 Activities

The 2020 budget request supports:

- Monitoring the Nation's earthquakes via the Advanced National Seismic System (ANSS) and through support of several regional seismic networks operated by university partners; providing 24x7 reporting on domestic and global earthquakes; delivering rapid earthquake impact and situational awareness products to support emergency response; and developing improved methods for continued improvement in the quality and timeliness of real-time earthquake information.
- Delivering 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.
- Improving the USGS National Seismic Hazard Model, which describes the likelihood and potential impacts of earthquakes nationwide, and which serves as the basis for seismic provisions in building codes; revising as needed a model update with input from the Building Seismic Safety Council, which develops building code updates; and maintaining associated databases and tools that are widely used by engineers for site-specific engineering design and seismic risk analysis.

- Conducting applied field, laboratory and theoretical research on the causes, characteristics, and effects of earthquakes, including investigations of earthquakes related to wastewater disposal and other industrial activities; and supporting relevant research by expert partners in academia, State agencies and the private sector via competitive grants and cooperative agreements.
- Communicating 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.

2020 Program Change Summary

The 2020 budget request for the Earthquake Hazards Program is $64,303,000 and 227 FTE, which includes:

- National Seismic Hazard Model Improvements and Alaska Update (+$2,654,000 and +10 FTE)
- Seismic Network Improvements (-$826,000 and 0 FTE)
- Maintain Earthquake Early Warning (EEW) Capacity (-$14,700,000 and -8 FTE)
- ANSS Deferred Maintenance (-$5,000,000 and 0 FTE)
- Earthscope Stations (-$1,400,000 and 0 FTE)

Program Overview

Nearly half of the U.S. population is at risk from earthquakes and annualized earthquake losses to the United States infrastructure are estimated at $6.1 billion per year. The USGS provides the scientific information, situational awareness, and knowledge necessary to reduce deaths, injuries, and economic losses from earthquakes and earthquake-induced tsunamis, landslides, and soil liquefaction.

The USGS Earthquake Hazards Program (EHP) is the applied Earth science component of the four-Agency National Earthquake Hazards Reduction Program (NEHRP, reauthorized by the National Earthquake Hazards Reduction Program Reauthorization Act of 2018, P.L. 115-307). 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.

To effect loss reduction, the EHP supports a highly coordinated set of monitoring, hazards assessment, applied research, and risk translation and communication activities in at-risk regions nationwide. Through the National Earthquake Information Center (NEIC), 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. Through the USGS National Seismic Hazard Maps, the EHP provides the basis for seismic provisions in the Nation's building codes, which affect one trillion dollars' worth of new construction annually in the United States.

The USGS issues timely aftershock forecasts following potentially damaging earthquakes within the entire United States and provides aftershock forecasts following significant global earthquakes when called upon by other Federal agencies or international partners.

In 2020, the USGS will continue, in cooperation with States and other partners, to operate and maintain the extant ShakeAlert system based on the revised ShakeAlert Earthquake Early Warning Implementation Plan for the West Coast, which was published in October 2018. The USGS is committed to working with Congress to determine the appropriate Federal, State and local cost share associated with any future ShakeAlert developments.

In 2020, the USGS expect to provide universities, State geological surveys, and private institutions with over $20 million in earthquake hazards applied research grants and cooperative agreements. In recent years, more than 40 entities have been the recipients of this funding that supports earthquake research in high risk areas nationwide, contributes to the maintenance and operation of the USGS Advanced National Seismic System (ANSS), and supports the ShakeAlert West Coast earthquake early warning system.

Volcano Hazards Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Volcano Hazards	**42,621**	**42,621**	**97**	**-**	**(14,597)**	**28,121**	**(14,500)**
Volcano Hazards Assessments	*3,388*	*3,388*			*(97)*	*[3,291]*	
Completion of Upgrades and Repairs to Instruments on High-Threat Volcanoes	*14,000*	*14,000*			*(13,000)*	*[1,000]*	
Next Generation Lahar Detection System Equipment	*1,500*	*1,500*			*(1,500)*	*[0]*	
FTE	**142**	**142**			**(3)**	**139**	**(3)**

Program Description

The Volcano Hazards program is built upon a structure of five volcano observatories that organize the Nation's volcanoes into distinct areas of responsibility. The volcano observatories are managed with recognition of the importance of local knowledge and close ties with local officials and emergency managers, but it relies on interoperability among the observatories, including use of common tools and standards.

2020 Activities

The 2020 budget request supports:

- Conducting field investigations of Very-High-Threat volcanoes and generation of volcanic hazard assessments for these volcanoes.
- Finishing work on hardening the Alaska Volcano Observatory Operations Room with a new emergency generator to maintain situational awareness and monitoring capability even during power failures caused by human or natural causes.
- Converting 30 analog seismometers and analog telemetry nodes at Alaska monitoring stations to digital seismometers with digital data telemetry to make progress on compliance of monitoring networks with the National Telecommunications and Information Administration (NTIA) restrictions on radio frequency utilization.
- Partnering with the USGS 3-DEP initiative and other Federal and State agencies to leverage resources toward acquiring high-resolution light distance and ranging (lidar) data over Very-High-Threat and High-Threat volcanoes.

2020 Program Change Summary

The 2020 budget request for the Volcano Hazards Program is $28,121,000 and 139 FTE, which includes:

- Volcano Hazard Assessments (-$97,000)
- Completion of Upgrades and Repairs to Instruments on High-Threat Volcanoes (-$13,000,000 and -2 FTE)
- Next Generation Lahar Detection System Equipment (-$1,500,000 and -1 FTE)

Program Overview

Volcanic eruptions are among the most destructive phenomena of nature and can have significant social and economic impacts. However, volcanic eruptions are usually predictable well in advance of their occurrence if adequate in-ground instrumentation is in place that can provide the time needed to avoid loss of life and reduce other effects.

The VHP has evaluated all of the Nation's volcanoes to determine the monitoring levels needed commensurate with the threat they pose. This national threat level assessment was first completed in 2005, and is currently being updated based on new data. The USGS and affiliated partners used this threat assessment to design a national-scale plan, the National Volcano Early Warning System (NVEWS), to improve monitoring networks so that unrest can be detected at the earliest stages using in-ground monitoring instrumentation deployed on the Nation's most threatening volcanoes.

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

- 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 NVEWS, the volcano observatories are managed with recognition of the importance of local knowledge and close ties with local officials and emergency managers, but it relies on interoperability among the observatories, including use of common tools and standards. Interoperability among observatories was well demonstrated in the response to the May 3, 2018, eruption of Kilauea Volcano in Hawaii. The VHP surged staff from the other four observatories to assist in the eruption response, either on-island or remotely, effectively augmenting the staff of the Hawaiian Volcano Observatory. 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.

In 2020, the VHP will continue development and testing of the Mt. Rainier Lahar Detection System (RLDS), perform maintenance as needed on 13 current stations, and install 5 new stations in the White River and Puyallup River drainages and 2 repeater-only stations. The VHP will establish real-time data flow from 6 RLDS stations installed in 2019 to the Cascades Volcano Observatory and Pierce County Office of Emergency Management utilizing the Pierce County Continuous Communications Network. Also, the VHP will submit permits for 6 new RLDS stations on U.S. Forest Service land near Mt. Rainier and begin preparations for planned installations of 14 RLDS stations located mostly within Mt. Rainier National Park in 2021.

In 2020, the VHP will convert approximately 32 analog stations to digital stations in the Eastern and Western Aleutians, Alaska Peninsula, and Katmai area. In those same areas, the VHP will conduct scheduled network maintenance as necessary and leverage the increased helicopter, ship, and fixed wing aircraft support to conduct further geologic field investigations and hazard assessments.

In 2020, the VHP will continue to repair and replace monitoring equipment damaged or lost during the Kilauea 2018 eruption and establish new data telemetry paths to Hawaiian Volcano Observatory facilities in Hilo, HI. Also, the VHP will develop options for addressing Hawaiian Volcano Observatory facilities and science infrastructure needs associated with the Kilauea eruption, including design of optimized data telemetry paths for continuous situational awareness and continuity of operations.

Landslide Hazards Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Landslide Hazards	**3,538**	**3,538**	**16**	**-**	**0**	**3,554**	**16**
FTE	**21**	**21**			**0**	**21**	**0**

Program Description

The USGS assists Federal, State, and local agencies through landslide site evaluations and provides strategies for reducing ongoing and future impacts from landslides. The Landslide Hazards program deploys near-real-time monitoring systems at active landslide sites to gather continuous movement, rainfall, and hydrologic 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.

2020 Activities

The 2020 budget request supports:

- Conducting 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.
- Providing post-wildfire debris-flow hazard assessments for major wildfires to Burned Area Emergency Response (BAER) teams, State geological surveys, Federal, State, and local emergency management, and the public.
- Collecting observations, conducting studies, and testing 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.

2020 Program Change Summary

The 2020 budget request for the Landslide Hazards Program is $3,554,000 and 21 FTE.

Program Overview

Landslides occur in all 50 States, and where landslides impact human activities, lives may be lost and property and infrastructure damaged. Widespread landslides can accompany big storms, such as hurricanes,

or earthquakes impacting broad areas hindering rescue and recovery efforts. In 2017, Hurricane Maria generated more than 40,000 landslides across Puerto Rico, impacting transportation and other lifelines. The USGS 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.

The LHP began cooperative work with the National Weather Service in 2005, to deliver alerts for debris flows from recently burned areas in southern California. This pilot project has provided essential guidance to emergency and land managers for many burned areas in the region, including the 2018 Thomas and Woolsey Fires. In FY 2020, the LHP will build on recent scientific advances to expand the pilot project to other parts of California and the Western United States.

Global Seismographic Network

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Global Seismographic Network	6,653	6,653	8	-	0	6,661	8
FTE	11	11			0	11	0

Program Description

The Global Seismographic Network (GSN) consists of more than 150 globally distributed stations. It provides the 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.

2020 Activities

The 2020 budget request supports:

- Focusing efforts on the core priority of operating the 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.
- Continuing a multiyear effort to address the deferred maintenance needs of the Global Seismographic Network (GSN) in order to refresh, support, and maintain the network at a high level of quality and reliability. These network infrastructure needs include installing the new Department of Energy-funded borehole sensors, improving the physical infrastructure of GSN sites, and replacing aged vault sensors.

2020 Program Change Summary

The 2020 Budget Request for the Global Seismographic Network (GSN) is $6,661,000 and 11 FTE.

Program Overview

The Global Seismographic Network (GSN) consists of more than 150 globally distributed stations. It provides the 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.

The USGS is in the process of installing the new high-quality Very Broad Band (VBB) seismic sensors and improving the physical infrastructure of select Global Seismographic Network (GSN) sites. In 2020, the USGS will install 15 to 20 VBB sensors**.**

Geomagnetism Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Geomagnetism	1,888	1,888		-	0	1,888	0
FTE	9	9			0	9	0

Program Description

The Geomagnetism 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. Data, products, and services from the USGS are also used by the electric-power industry to evaluate geomagnetic storm risk. The Geomagnetism Program contributes to interagency efforts to protect national security, homeland security, and commercial assets and operations against the effects of space weather.

2020 Activities

The 2020 budget request supports:

- Continuing to focus on core priorities for operating magnetic observatories and providing real-time geomagnetic data needed for issuing warnings and forecasts of geomagnetic storms.
- Continuing to develop prospective geoelectric hazard maps, develop existing data sets needed to estimate Earth surface impedance, and develop computer-based tools need for real-time mapping of geomagnetic and geoelectric field variation, all of which are needed to help mitigate hazards for the electric-power grid industry and other critical infrastructure.

2020 Program Change Summary

The 2020 budget request for the Geomagnetism Program remains $1,888,000 and 9 FTE.

Program 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 monitors and analyzes 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. Data, products, and services from the USGS 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 Federal 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. The USGS magnetic observatory network is part of the global INTERMAGNET network. The 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.

In 2020, the USGS will build on previously completed preliminary models of the induced electric field in the crust due to geomagnetic storms. This work is part of a National Science and Technology Council working group for coordinating Space Weather Operations Research and Mitigation (SWORM) across multiple Federal agencies. These results will help power-grid companies improve the resilience of their systems to magnetic storms, as required by the Federal Energy Regulatory Commission. Power grid operators will use these results to design mitigation strategies for geomagnetic storms, and the space weather alerting agencies will use the resulting electric field model to issue improved forecasts and nowcasts for space weather alerts.

In 2020, the USGS will continue to operate 11 geomagnetic observatories, delivering data to the NOAA Space Weather Prediction Center, the US Air Force 557th Weather Wing, and numerous other customers.

Coastal/Marine Hazards and Resources Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Coastal/Marine Hazards and Resources	**40,510**	**40,510**	**146**	**-**	**(158)**	**40,498**	**-12**
Research for Coastal, Wetland, and Estuarine Restoration	*5,186*	*5,186*			*(158)*	*[5,028]*	
FTE	**207**	**207**			**0**	**207**	**0**

Program Description

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 areas. 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.

2020 Activities

The 2020 budget request supports:

- Conducting marine geological and geophysical investigations to provide Federal, State, and local users with improved assessments of hazard sources (earthquakes, tsunami, and submarine landslides) and their potential impacts on offshore operations, coastal communities, and infrastructure.
- Conducting field and laboratory studies with other Federal and academic partners to characterize marine methane systems and sea-bed processes to understand their energy resource potential; the hazard they represent to offshore operations; and their role in carbon storage and cycling including within marine seep communities.
- Contributing analyses and expertise to delineate the U.S. Extended Continental Shelf consistent with international law and applying unique USGS expertise to understanding the occurrence and potential of deep-sea mineral resource.
- Providing 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.
- Developing and delivering 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 for priority coastal locations.

- Applying available resources to engage partners and key stakeholders and users in evaluating and improving the delivery of coastal change hazard products. Existing and potential new products and delivery services will be evaluated to increase program responsiveness to user needs; to enhance application of information and research products by users; and to more effectively translate USGS science through capacity sharing with other agencies.

2020 Program Change Summary

The 2020 budget request for the CMHRP is $40,522,000 and 207 FTE, which includes:

- Research for Coastal, Wetland, and Estuarine Restoration (-$158,000 and 0 FTE)

Program Overview

The CMHRP characterizes the hazard and resource potential of the Nation's offshore and coastal landscapes. CMHRP information and tools help public trust managers anticipate and reduce risks from natural hazards and coastal change, and to responsibly manage marine and coastal resources. As the only Federal science program focused on the geology and processes of coastal and marine landscapes, the CMHRP investigates a wide range of issues, in locations ranging from shallow waters of estuaries to the deep sea.

The CMHRP responds to immediate local and regional priorities across these environments, while addressing the Nation's needs for coastal and marine science-based products on a national scale. The unique capabilities and expertise of the CMHRP are applied in support of the mission objectives of Interior and other Federal, State, and local agencies; non-governmental organizations; and, ultimately, the public. The CMHRP serves Federal, State, and local users with assessments of hazard sources (earthquakes, tsunami, submarine landslides) and their potential impacts on offshore operations, coastal communities, and infrastructure, to improve bureau-wide hazard assessments reliant upon, for example, marine investigations of subduction zone processes and hazards. The CMHRP characterizes 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.

The CMHRP contributes analyses and expertise to delineate the U.S. Extended Continental Shelf consistent with international law, an effort led by the U.S. Department of State that expands U.S. sovereignty over resources on and beneath the seafloor. The CMHRP provides unique Federal expertise on deep-sea mineral resources, including rare-earth and other critical minerals, in support of the broad natural resource mission of the USGS.

The CMHRP provides real-time forecasts of erosion and inundation due to coastal storms, including hurricanes. CMHRP long-term forecasts allow coastal communities and resource managers to anticipate

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 coasts and the consequences of coastal change on communities, infrastructure, and resources.

The USGS will, during 2019, participate in a multi-institution field program on the "Timing, Characteristics, and Fate of Methane Emissions from Seafloor Seeps" along the Northern U.S. Pacific Margin, with analyses and publication of results planned for FY 2020. CMHRP support for marine field investigations of energy and mineral resources will, in FY 2020, focus on collaborative surveys, with NOAA and BOEM, of deep-sea mineral forming hydrothermal systems off northern California, a prospective location for critical minerals.

In 2020, the CMHRP will continue to aid the response to incoming major hurricanes and their aftermaths along the Atlantic and gulf coasts, providing forecasts of coastal erosion and elevated water levels. Storm forecasts, as well as data characterizing protective dunes and beaches, are delivered through the USGS Coastal Change Portal and USGS/NOAA experimental Total Water Level and Coastal Change Viewer covering more than 3,000 km of the Nation's coasts, allowing early responders to better understand flooding and erosion risks.

Beginning in FY 2019, and continuing through FY 2020, the CMHRP will support development and delivery of nationally consistent tools to forecast and plan for coastal change hazards due to extreme events and long-term erosion and sea-level rise. Activities in 2020 will include development of improved methodologies, utilizing new data sources, to collect, analyze and deliver shoreline change data as a national resource that covers not only sandy but also coral and wetland shorelines. Leveraging those data resources and through enhancement of existing models, the CMHRP will extend forecasts and projections of shoreline position to span time scales from single storms to the end of the current century across diverse coastal settings.

Water Resources

Water Resources

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Water Resources[1]	**217,445**	**217,554**	**689**	**12,398**	**(50,719)**	**179,992**	**(50,030)**
FTE	*1,234*	*1,234*	*-*	*59*	*(233)*	*1,060*	*(233)*
Water Resources Availability Program	**[110,907]**	**[110,907]**	**348**	**110,907**	**(36,397)**	**74,858**	**(36,049)**
FTE	*[695]*	*[695]*	*-*	*695*	*(195)*	*500*	*(195)*
Water Observing Systems Program	**[112,545]**	**[112,545]**	**341**	**112,545**	**(7,822)**	**105,064**	**(7,481)**
FTE	*[597]*	*[597]*	*-*	*597*	*(37)*	*560*	*(37)*
Water Resources Research Act Program	**6,500**	**6,500**	**-**	**-**	**(6,500)**	**-**	**(6,500)**
FTE	*1*	*1*	*-*	*-*	*(1)*	*-*	*(1)*
Water Availability and Use Science Program	**46,052**	**46,052**	**-**	**(46,052)**	**-**	**-**	**-**
FTE	*331*	*331*	*-*	*-331*	*-*	*-*	*-*
Groundwater and Streamflow Information Program	**74,173**	**74,173**	**-**	**(74,173)**	**-**	**-**	**-**
FTE	*293*	*293*	*-*	*-293*	*-*	*-*	*-*
National Water Quality Program	**90,829**	**90,829**	**-**	**(90,829)**	**-**	**-**	**-**
FTE	*609*	*609*	*-*	*-609*	*-*	*-*	*-*

[1] *The amounts shown for 2018 and 2019 represent the old structure, in the new structure, the 2018 Actual and 2019 CR would be $229,952.*

The 2020 budget request for the Water Resources Mission Area is $179,922,000 and 1,060 FTE.

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 information and tools provided by the USGS allow first responders, the public, water managers and planners, policy makers, and other decision makers to:

- Minimize loss of life and property as a result of water-related natural hazards, such as floods, droughts, landslides, and chemical spills.
- 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 the effective development and conservation of the Nation's water resources for the benefit of present and future generations.

The 2020 budget makes targeted enhancements to the USGS water observing systems and strategic investments in modeling and assessments that support the advancement of the Nation's water prediction capabilities. To address higher priorities, the USGS is not requesting funds for the Water Resources Research Act Program. The Water Resources Mission Area will focus on the following water science priorities:

- ***Delivering integrated water availability assessments (IWAAs).*** These multi-extent, stakeholder-driven assessments are designed to provide information to meet the goals of the National Water Census as established through the SECURE Water Act. When fully implemented, IWAAs will: evaluate current water supply and demand, quality, and use; evaluate long-term trends in water availability; provide seasonal to decadal forecasts of availability; and inform water resource decisions through development of socioeconomic tools.
- ***Upgrading the USGS water observing systems.*** By coupling the high-fidelity, real-time data on water quantity and quality with the National Water Model and other advanced modeling tools, the USGS will provide state-of-the-art flood and drought forecasts and drive decisions support systems for water emergencies and daily water operations.
- ***Modernizing the National Water Information System (NWIS).*** The USGS is the authoritative source for consistent water information for the Nation. To ensure the NWIS continues to meet the needs of water science priorities, the NWIS data systems that house the water information will be modernized to upgrade to the newest technology. NWIS modernization will maximize data integrity, reliability, accessibility while simplifying data delivery to the general public.
- ***Building prediction capabilities for water quality.*** The USGS will use and advance the USGS observational network to guide the development of water-quality prediction capabilities. Efforts will be accomplished through collaborations with Federal partners and academia and will advance the prediction of temperature, surficial and in-channel transport processes, as well as improve existing hydrological process predictions from the National Water Model.

Cooperative Matching Funds

The cooperative matching funds (CMF) 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 2020 request includes a total of $57,710,000 of these funds across the mission area.

Water Resources Availability Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Water Resources Availability Program	**0**	**0**	**348**	**110,907**	**(36,397)**	**74,858**	**(36,049)**
Transfer from Toxic Substances Hydrology Program (EMEH)	*[12,398]*	*[12,398]*		*12,398*			
Transfer from Water Availability and Use Science Program	*[46,052]*	*[46,052]*		*46,052*			
Transfer from National Water Quality Program	*[52,457]*	*[52,457]*		*52,457*			
Mississippi Alluvial Plain Aquifer Assessment	*[4,000]*	*[4,000]*			*(2,797)*	*[1,203]*	
U.S.-Mexico Transboundary Aquifer Assessment	*[1,000]*	*[1,000]*			*(1,000)*	*[0]*	
Water Use Data and Research	*[1,500]*	*[1,500]*			*(1,500)*	*[0]*	
Cooperative Matching Funds - Water Use Research	*[2,000]*	*[2,000]*			*(1,000)*	*[1,000]*	
Water-Use Unconventional Oil and Gas	*[250]*	*[250]*			*(250)*	*[0]*	
Regional Water-Quality Assessments[1]	*[4,100]*	*[4,100]*			*(4,100)*	*[0]*	
Water-Quality Trends[2]	*[10,072]*	*[10,072]*			*(635)*	*[9,437]*	
Harmful Algal Blooms	*[4,202]*	*[4,202]*			*(1,350)*	*[2,852]*	
Constituent and Contaminant Hydrology	*[10,848]*	*[10,848]*			*(10,848)*	*[0]*	
National Park Service Water-Quality Partnership	*[1,743]*	*[1,743]*			*(1,743)*	*[0]*	
Shallow and Fractured Bedrock Groundwater Research	*[300]*	*[300]*			*(300)*	*[0]*	
Research and Development to Advance Water Science[3]	*[16,889]*	*[16,889]*			*(10,874)*	*[6,015]*	
Cooperative Matching Funds[4]	***[21,397]***	***[21,397]***			***[-1,000]***	***[20,397]***	***[-1,000]***
FTE	**0**	**0**		**695**	**(195)**	**500**	**(195)**

Program Description

The USGS Water Resources Availability Program (WRAP) fulfills the goals established by Congress in the SECURE Water Act (Public Law (P.L.) 111-11, Section 9508) by investing in research and assessments that improve the Nation's understanding of water availability. Specifically, the WRAP supports the National Water Census, an activity of the USGS designed to systematically provide information that will allow resource managers to assess the supply, use, quality, and availability of the Nation's water. WRAP will focus on conducting national and regional water availability assessments, inclusive of quantity and quality, for both human and ecological uses; developing methods to estimate water budgets, including water

[1] Formerly referred to as Regional Stream Quality Assessments
[2] Formerly part of NAWQA Status and Trends Assessments
[3] Formerly the National Research Program
[4] Cooperative Matching Funds are used to support research, data collection, and assessments activities across the Water Resources programs, and therefore are shown as a non-add component within the Mission Area.

withdrawals and consumptive uses; evaluating trends in water availability; and, developing new techniques to evaluate factors that limit water availability, the models and infrastructure that support assessments, and the tools that resource managers use to support resource planning activities.

2020 Activities

The 2020 budget request supports:

- Conducting research on water availability; synthesizing, predicting, and reporting information at regional and national scales; enhancing the Nation's water modeling and prediction capability; and compiling and reporting water information in ways that are useful to States.
- Continued development and delivery of the National Integrated Water Availability Assessment (IWAA), a near-real time census of water resources that will evaluate water availability for human and ecological use, infrastructure, security, and economic optimization.
- Continuing work on a pilot Regional IWAA in the Delaware River Basin focused on the impacts of severe drought on water availability for human and ecological uses.
- Incorporating models of current and projected water quality, including changes in nutrients, sediment, pesticides, and emerging toxins like those produced by harmful algal blooms (HABs), into National and Regional IWAAs.
- Continued evaluation of water availability indicators and trends, inclusive of both quantity and quality, and the factors driving observed trends in water availability.
- Continued development and application of models estimating withdrawal related to water use.
- Operationalizing field-scale evapotranspiration (ET) estimation techniques; developing new techniques to evaluate ecological flows in headwater streams; and, continued focus on drought research, including determining the changing importance of snowmelt in the hydrologic cycle.
- Continued development and application of field and modeling tools to better understand groundwater and surface-water interactions and to support evaluations of conjunctive management of these resources.
- Continued studies at Water Science Centers across the Nation in cooperation with State, local, regional, and Tribal partners that provide the data and tools necessary for resource managers to make management decisions regarding water availability now and into the future.

2020 Program Change Summary

The 2020 budget request for the Water Resources Availability Program (WRAP) is $74,858,000 and 500 FTE, which includes:

- Mississippi Alluvial Plain Aquifer Assessment (-$2,797,000 and -12 FTE)
- U.S.-Mexico Transboundary Aquifer Assessment (-$1,000,000 and -4 FTE)
- Regional Water-Quality Assessments (-$4,100,000 and -28 FTE)

- Water Use - Unconventional Oil and Gas (-$250,000 and -1 FTE)
- Cooperative Matching Funds - Water Use Research (-$1,000,000 and 0 FTE)
- Water Use Data and Research (-$1,500,000 and -1 FTE)
- Water-Quality Trends Assessments (-$635,000 and -5 FTE)
- National Park Service Water-Quality Partnership (-$1,743,000 and -12 FTE)
- Shallow and Fractured Bedrock Groundwater Research (-$300,000 and -2 FTE)
- Research and Development to Advance Water Science (-$10,874,000 and -72 FTE)
- Constituent and Contaminant Hydrology (-$10,848,000 and -49 FTE)
- Harmful Algal Blooms (-$1,350,000 and -9 FTE)

Program Overview

The National Water Census (NWC): The USGS NWC is designed to systematically provide information on water availability that allows resource managers to assess the supply, use, and quality of the Nation's water resources. Through development of advanced techniques and new accounting methods, the WRAP strives to provide resource managers with more accurate and finer scale information to support near-real time management decisions related to water availability.

In efforts to further fulfill the requirements of the SECURE Water Act (P.L. 111-11, Section 9508), the USGS will re-prioritize NWC activities in 2020 to deliver National and Regional Integrated Water Availability Assessments (IWAAs). An IWAA is a multi-extent, stakeholder driven, near real time census and seasonal prediction of water availability for both human and ecological uses. When fully implemented, IWAAs will: (1) evaluate current water supply and demand, quality, and use; (2) evaluate long-term trends in water availability, inclusive of water quantity and quality; (3) provide seasonal to decadal forecasts of availability; and (4) inform water resource decisions through development of socioeconomic tools. It is these National and Regional IWAAs, in conjunction with efforts to provide overall Water Resources Trends and Forecasts, that will make up the major lines of work within the NWC.

National Integrated Water Availability Assessment: The WRAP supports the NWC through activities to improve our understanding of the quantity and quality of water resources in the United States. Traditionally, the USGS has done this as part of separate activities, not a fully coordinated effort. Through the National IWAA, the USGS will deliver a truly integrated assessment of water availability nationally that is inclusive of quantity, quality, and use. The National IWAA will convey current conditions, and National trends, regarding the quantity and quality of water available providing a basis to evaluate where limits to availability exist or may develop for human and ecological uses. The National IWAA assimilates the components above at nationally available scales and data and information gained from regional IWAAs (discussed below). The National IWAA is designed to provide periodic snapshots of water availability across the U.S. based on regional constraints in an evolving simulation as regional IWAAs are completed. In 2020, the WRAP will deliver a near-real time census of water availability as part of the National IWAA for quantity and begin implementation of models that will allow for the inclusion of quality by 2021.

Regional Integrated Water Availability Assessments: The USGS conducts assessment activities focused on individual factors that impact regional water availability: quantity, quality, and use. In 2020, work will continue to complete ongoing assessment activities. As these activities are completed, the USGS will begin integrated regional studies, referred to as Regional IWAAs that will address water availability using a suite of predictive and modeling tools. In 2020, the USGS will continue work on a Regional IWAA pilot in the Delaware River Basin evaluating the impact of severe drought under current water supply and demand restrictions. This pilot will serve as a proof of concept and will help inform next-generation data collection, integrated model development, and provide feedback needed to refine the Regional IWAA framework for future pilot basins. A second pilot will be identified in 2020 in the West.

Water Resources Trends and Forecasting: The USGS monitors, collects, and estimates a wide array of surface water, groundwater, water quality, and water use data. The core goal of the WRAP is understanding how changes in water withdrawal, land use, climate, management actions, infrastructure, security, and economics have impacted and may potentially impact water availability, for both quantity and quality. In order to meet that goal, WRAP supports analyzing long term trends in floods and droughts and developing tools to allow visualization of change over time; evaluating short and long-term (decadal) trends in water-quality in streams, rivers, and aquifers across the Nation; and, evaluating trends in long-term water withdrawal for eight categories of water use.

In 2020, the WRAP will continue to focus on evaluating trends in water availability driven by human activities. These efforts will include exploring techniques to conduct integrated trend evaluations as part of IWAAs.

Factors that Influence Water Availability: Water availability is influenced by a number of natural and human factors that can limit both the quantity and quality of water available for human and ecological uses. Drought reduces baseflow and recharge, and groundwater level declines can be exacerbated by increased withdrawal for use. Water resources affected by extreme drought may take decades to recover. Surface and groundwater resources throughout the Nation are subject to impaired water quality conditions caused by natural processes and human activities on the landscape. Nutrients, sediment, pesticides, and emerging contaminants such as algal toxins associated with harmful algal blooms (HABs) can pose a risk to human and ecosystem health and treatment, if possible, can be costly. Understanding how these, and other factors, limit water availability will be critical to fully implementing National and Regional IWAAs in evaluating the availability of existing resources for human and ecological use, infrastructure, security, and economic optimization.

In 2020, the USGS will continue to conduct monitoring, modeling, and forecasting studies across the country, including an additional year of data collection for a large-river HABs pilot project started in 2017. In 2020, drought research will focus on determining the importance of snowmelt in the hydrologic cycle, and the USGS will work with the National Weather Service to incorporate seasonal climate forecasts into model predictions.

Model Development, Infrastructure, and Information Delivery: The USGS uses research and studies at the national and regional extent to support development of coordinated, comprehensive, and consistent

hydrologic modeling frameworks (Surface Water, Groundwater and Water Quality) for the conterminous United States. These modeling frameworks support implementation of IWAAs through evaluation of water availability nationally, but also reduce initial costs for regional and local studies that use the infrastructure to build more refined models. The USGS has been a leader in the development and application of surface-water, groundwater, and water-quality modeling software; integration of these tools will be an important component of providing a complete assessment of water availability at both the National and Regional extents.

In 2020, the USGS will continue to collaborate with partners like the National Weather Service and National Center for Atmospheric Research to develop and improve national-scale prediction of surface water-groundwater interaction, stream water temperature, erosion and sediment transport, and selected water-quality constituents. Additionally, model development efforts will be focused on integrating these disparate systems into one fully integrated National Hydrologic prediction framework.

The National Water Information System (NWIS): The NWIS is a delivery system that is funded through both the WRAP and the Water Observing Systems Program. As a part of overall model development, infrastructure, and information delivery activities, the WRAP supports modernization, development, implementation, and maintenance of reliable systems that deliver real-time and historic information. The NWIS is the central USGS water information system, providing current conditions related to streamflow, floods, drought, water-quality conditions, and water-use data. The WRAP supports activities that ensure this system functions at peak efficiency and effectiveness, especially during hazard events. In 2020, the USGS will continue to upgrade its information technology resources to ensure computing capacity and data services can support integrated model performance and IWAAs.

Water Observing Systems Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Water Observing Systems Program	**0**	**0**	**341**	**112,545**	**(7,822)**	**105,064**	**(7,481)**
Transfer from Groundwater and Streamflow Information Program	*[74,173]*	*[74,173]*		*74,173*			
Transfer from National Water Quality Program	*[38,372]*	*[38,372]*		*38,372*			
Research and Development to Advance Water Science[5]	*[2,467]*	*[2,467]*			*(1,540)*	*[927]*	
Urban Water Federal Partnership (CMF)	*[717]*	*[717]*			*(717)*	*[0]*	
Cooperative Matching Funds - Tribal Water	*[1,000]*	*[1,000]*			*(500)*	*[500]*	
National Groundwater Monitoring Network	*[3,929]*	*[3,929]*			*(2,395)*	*[1,534]*	
Groundwater Quality Monitoring Networks[6]	*[5,231]*	*[5,231]*			*(1,094)*	*[4,137]*	
National Atmospheric Deposition Program	*[1,576]*	*[1,576]*			*(1,576)*	*[0]*	
Cooperative Matching Funds[7]	***[38,530]***	***[38,530]***			***[-1,217]***	***[37,313]***	***[-1,217]***
FTE	**0**	**0**		**597**	**(37)**	**560**	**(37)**

Program Description

Monitoring networks that generate data on the quantity and quality of the Nation's water resources are the foundation for situational awareness and understanding the Nation's water resources. The Water Observing Systems Program (WOSP) encompasses the Water Resources Mission Area's objectives to collect, manage, and disseminate consistently high-quality and reliable water information in real-time and over the long-term, both of which are critical for managing the Nation's water resources and anticipating and responding to water hazards that can result in loss of life and property. Serving as the largest water data holder in the world, the USGS partners with more than 1,600 Federal, regional, State, Tribal, and local agencies to maintain and manage its water monitoring networks. Furthermore, the WOSP is increasingly using integrated monitoring for multiple parameters at a single location providing continuous real-time water data used for decisions such as emergency response, flood forecasting, reservoir management, water-use restrictions, drinking water deliveries, permit compliance, water-quality studies, and recreational safety. The long-term data supplied by the program are a critical component to sustaining the viability of industries such as agriculture, fishing, and outdoor recreation and are used for decisions related to water-supply planning, aquifer storage and recovery, infrastructure design, floodplain and ecosystem management, energy development, and resolution of water disputes. In addition, the WOSP promotes the development and application of information and tools to minimize the loss of life and property due to hazards, including

[5] formerly the National Research Program
[6] formerly a part of NAWQA Groundwater Status and Trends Assessments
[7] Cooperative Matching Funds are used to support research, data collection, and assessments activities across the WOSP, and therefore are shown as a non-add component within the Program

support for flood forecasting, informing drought and post-fire conditions, and monitoring debris flows and storm surge during hurricanes and floods.

2020 Activities

The 2020 budget request supports:

- Collection, management, and dissemination of high quality and reliable integrated hydrologic information in real time and over the long term for flood and drought planning, warnings, and forecasting; designing water infrastructure; operating waterways for power production and navigation; managing water rights issues; and assessing safety conditions for water recreational activities.
- A unified National Streamflow Network of more than 8,200 real-time streamgages operated year-round, including 3,460 Federal Priority Streamgages that support strategic Federal responsibilities.
- Long-term, nationally consistent monitoring of sediment, nutrients, and pesticides at 113 stream sites located on large inland and coastal rivers, as well as in small agricultural, urban, and minimally disturbed reference watersheds. These sites are used to track changes in the amounts of contaminants delivered to important receiving waters and how contaminant concentrations and loads are changing over time.
- Work to develop, refine, and apply 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.
- Data collection and dissemination during hydrologic hazards (floods, droughts, hurricanes) and deployment of information tools for water managers to minimize loss of life and property.
- Improvement of flood forecast predictions, drought management, and development of National water prediction capabilities.

2020 Program Change Summary

The 2020 budget request for the Water Observing Systems Program (WOSP) is $105,064,000 and 560 FTE, which includes:

- Research and Development to Advance Water Science (-$1,540,000 and -10 FTE)
- Cooperative Matching Funds - Tribal Water (-$500,000 and -3 FTE)
- Cooperative Matching Funds - Urban Waters Federal Partnership (-$717,000 and -6 FTE)
- National Groundwater Monitoring Network (-$2,395,000 and -2 FTE)
- Groundwater Quality Monitoring Networks (-$1,094,000 and -6 FTE)
- National Atmospheric Deposition Program (-$1,576,000 and -10 FTE)

Program Overview

The USGS Streamgaging Network: The USGS operates one of the largest streamgaging enterprises in the world. Water levels are measured at more than 10,000 streamgages across the Nation. Of these streamgages, streamflows are monitored year-round at about 8,200 sites, which are considered part of a National Streamflow Network (NSN) that is used in countless ways by governmental organizations, private industries, and the general public. Information provided through the NSN forms the scientific basis for decisions related to protecting life and property from water-related hazards, such as: flood response and drought planning; designing bridges, roads, and water-treatment plants; efficiently managing freshwater for drinking, irrigation, energy, industry, recreation, and ecosystem health; and promoting national, State, Tribal, and local economic well-being. The USGS makes approximately 80,000 streamflow measurements each year to ensure the accuracy of the streamflow data. The latest streamgage data is readily available through the National Water Information System: Web Interface (NWISWeb). Data can also be provided as alerts to users (*http://water.usgs.gov/waternow/*) by e-mail or text message and as real-time stream conditions (*http://waterdata.usgs.gov/nwis/rt*) updated at intervals of one hour or less. Annually, the USGS serves more than 670 million requests to NWISWeb for streamflow information.

In 2020, the USGS will continue needed infrastructure improvements and enhancements to the current monitoring networks with efforts focused on the Delaware River Basin, as a pilot watershed for implementing the USGS next-generation water observing system. The project on the Delaware River provides a model for the IWAAs and addresses a complex interstate river system that is both ecologically diverse and critical to the regional economy. These advancements will modernize the National Water Information System and enhance the monitoring infrastructure to advance modeling and water-prediction capabilities. In 2020, the USGS would continue to modernize data delivery (NWIS) and expand the type and temporal and spatial extent of its monitoring infrastructure.

Approximately 70 percent of the funding for the USGS Streamgaging Network is from reimbursable funding from local, State, and Tribal cooperators through jointly funded agreements (50 percent) and reimbursable funding from other Federal agencies (20 percent). The partnerships with 1,410 Federal, State, local, and Tribal stakeholders reflect widespread recognition of the Network's critical role and USGS's primary responsibility for collecting, analyzing, managing, and delivering streamflow information for the Nation.

The Streamgaging Network and Federal Priority Streamgages: One of the highest goals of the USGS is to maintain long-term stability of a "Federal needs backbone network" for long-term tracking and forecasting/modeling of streamflow conditions in response to changes in land use, water use, and climate. Specifically, consistent and systematically-collected information is paramount to meet the full gamut of Federal water priorities and responsibilities over the long term related to: forecasting extreme hydrologic events (floods and droughts); interstate agreements, compacts, court decrees and other legal obligations; streamflow tracking in major river basins and across borders; long-term streamflow forecasts that account for changes in population, land use, water use, and climate; and water-quality assessments on sources, transport, and fate of contaminants in rivers and estuaries.

To meet these strategic long-term Federal priorities and responsibilities, the USGS has identified 4,760 sites for a "Federal Priority Streamgage" (FPS) network. In 2020, the USGS will work with partners to support approximately 3,460 of these streamgages.

The Streamgaging Network and Cooperative Matching Funds (CMF): The remaining streamgages in the Network are also integral to the USGS mission and national water priorities and are used to facilitate management decisions, operations, and responsibilities by other Federal agencies, States, localities, Tribes, regional commissions, industry, and non-governmental organizations. Most streamgages provide information to stakeholders serving more than one use, related to, for example:

- Water resource appraisals, allocations, and diversions (water supply/water use/water budgeting).
- Infrastructure planning and design for reservoirs, bridges, roads, culverts, and treatment plants.
- Operation of reservoirs, power plants, flood-control systems, and navigation locks and dams.
- Instream flow requirements for ecosystems and habitat.
- Management of groundwater pumping and depletion.
- Floodplain mapping and planning.
- Tide monitoring and prediction.
- Recreational safety and enjoyment.

Federal agencies rely on streamflow information to meet their respective obligations. This includes the National Weather Service for predicting floods using information from more than 3,600 streamgages; the Federal Emergency Management Agency for identifying flood-prone areas; the Bureau of Reclamation for dam and water conveyance systems operations; the National Park Service and the U.S. Fish and Wildlife Service for managing water resources and ecosystems; and the U.S. Army Corps of Engineers for operation of locks and dams.

Enhancing Water Monitoring Capabilities for Hazards Response: A critical application of Network data is its use in safeguarding communities from natural hazards. The WOSP promotes the development and application of information and tools to minimize the loss of life and property from hazards, including support for flood forecasting, storm surge monitoring during hurricanes and floods (using storm tide sensors and Rapidly Deployable Streamgages, known as RDGs), drought, debris flows, and fires. The USGS Flood Event Viewer (https://water.usgs.gov/floods/FEV/) provides a one-stop application for partners and the public to view flood data for current and past events, including USGS flood response, streamflow information, and high-water marks. A Floods Web page (http://water.usgs.gov/floods/) also provides access to a range of tools and data for flood events.

The WOSP continues to expand the use of storm-tide sensors and RDGs to prepare for and respond to floods and hurricanes. These sensors are part of a mobile network of rapidly deployable instruments that are used to observe and document the timing, extent, and magnitude of hurricane-induced storm-surge, waves, and tides. This network, known as the SWATH (http://water.usgs.gov/floods/swath/), consists of water-level and meteorological monitoring devices that are set up in the days and hours prior to a potential

storm-surge event, and then retrieved shortly after. High-water marks collected after flood events, and data from storm-tide sensors and RDGs are used by emergency managers, first responders, NWS forecasters, and others as they make decisions related to flood response and public safety, determine flood insurance maps and building codes, and to calibrate hurricane inundation models. To enable the USGS to more quickly deploy sensors in advance of future storm events, the USGS is installing storm tide sensor housings along U.S. coastlines. By 2022, the USGS would provide national coverage of sites along coastlines with capacity to temporarily install sensors and RDG's prior to major storms or tsunamis.

Water Data for Hazards Planning: At the opposite end of the hydrologic spectrum, information from over 5,000 long-term record streamgages is used by the USGS and partners to determine the extent, duration, and severity of droughts and to allocate water for critical uses. As the USGS strives to provide the data and science needed by communities to plan for, rather than react to, hydrological droughts, this information is necessary for decision makers to manage and mitigate the effects of drought. In addition, the USGS, in collaboration with Federal agencies, consulting firms, and universities, has developed new national flood flow frequency guidelines. Flood-frequency analysis provides quantitative, scientific information about the magnitude and frequency of flood discharges, which is used by water resource planners in the planning, design, and management of infrastructure along river corridors.

National Water Quality Network (NWQN) for Streams and Rivers: The NWQN is the only nationally designed monitoring network for tracking the quality of the Nation's rivers and streams with consistent and comparable methods at all sites. In 2020, the USGS would operate 113 NWQN sites located on large inland and coastal rivers, as well as in small agricultural, urban, and minimally disturbed reference watersheds. The USGS also augments its existing streamgage infrastructure with multi-sensor "Super Gages," which can deliver near-real-time data on flow, basic water-quality properties, and an increasing number of water-quality constituents that are measured directly or by surrogate measures such as nutrients and suspended sediment. This information can be used to identify sources of contaminants, monitor the effects of floods and other extreme hydrologic events on water quality, and to forecast harmful algal blooms and episodes of hypoxia in receiving waters.

Groundwater Data Collection: The quantity and quality of groundwater in an aquifer are important factors in determining water availability. The USGS works in collaboration with States, Tribes, universities, and localities to provide groundwater quality and level data through the National Groundwater Monitoring Network Data Portal, which supports a national understanding of groundwater availability. The Data Portal provides a valuable resource to water resource managers and other decision makers across the Nation as they plan, manage, and develop groundwater resources by providing access to historical groundwater well data. In addition, the WOSP supports a nationwide network of 690 groundwater monitoring sites called the Climate Response Network (CRN) that was established to specifically understand the effects of drought and other climate variability on long-term trends in groundwater levels across the Nation. An enterprise of 134 groundwater-quality monitoring networks are also maintained in strategically selected critical aquifers across the Nation to provide the data needed to answer the question: "*What is the status of the Nation's water quality, and is it getting better or worse?"*

The National Water Information System (NWIS): The NWIS is a delivery system that is funded through both the WOSP and the Water Resources Availability Program. The WOSP supports the development,

implementation, and maintenance of reliable systems for real-time and historic information delivery to stakeholders. At the center of the USGS water data products lies the NWIS, providing current conditions related to streamflow, flood and high flow, drought, and groundwater levels, in addition to water-quality and water-use data. WOSP funds ensure this system functions at peak efficiency and effectiveness, especially during hazard events. In 2020, the USGS would continue to enhance and modernize its water data management and delivery infrastructure and provide capabilities for managing real-time streamflow, water level and other field-transmitted data with a centralized platform meeting the Federal Cloud First Computing Strategy.

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Core Science Systems

Core Science Systems

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Core Science Systems[1]	**[219,288]**	**[219,288]**	**481**	**102,986**	**(12,576)**	**207,193**	**(12,095)**
FTE	*451*	*451*	*-*	*193*	*(21)*	*623*	*(21)*
National Geospatial Program	**67,854**	**67,854**	**177**	**-**	**(177)**	**67,854**	**-**
FTE	*263*	*263*	*-*	*-*	*-*	*263*	*-*
National Cooperative Geologic Mapping Program	**24,397**	**24,397**	**71**	**-**	**(71)**	**24,397**	**-**
FTE	*99*	*99*	*-*	*-*	*-*	*99*	*-*
Science Synthesis, Analysis and Research Program[2]	**[25,972]**	**[25,972]**	**74**	**1,921**	**(59)**	**25,987**	**15**
FTE	*89*	*89*	*-*	*13*	*-*	*102*	*-*
National Land Imaging Program[3]	**[101,065]**	**[101,065]**	**159**	**101,065**	**(12,269)**	**88,955**	**(12,110)**
FTE	*[180]*	*[180]*	*-*	*180*	*(21)*	*159*	*(21)*

[1] The amounts shown for 2018 and 2019 represent the new structure. In the old structure, the 2018 Actual and 2019 CR would be $116,302.
[2] The amounts for 2018 and 2019 represent the new structure. In the old structure, the 2018 Actual and 2019 CR would be $24,051.
[3] The amounts for 2018 and 2019 represent the new structure. In the old structure within Land Resources, the 2018 Actual and 2019 CR would be $93,094 in the Land Resources, National Land Imaging program and $7,971 in the Land Resources, Land Change Science Program.

The 2020 budget request for the Core Science Systems Mission Area is $207,193,000 and 623 FTE.

The 2020 President's budget request for the Core Science Systems (CSS) Mission Area funds priority high-resolution elevation, hydrographic, geologic, and biogeographic mapping activities; remote sensing satellite operations; remote sensing imagery availability; land cover change and classification applications; high performance computing and modeling activities; science data analysis and synthesis; and geoscientific asset preservation (e.g., drilling cores and rock samples).

With the proposed budget, these programs would continue to coordinate geospatial data requirements with partners and leverage Federal funds with matching partner funds to eliminate duplication (i.e., pay to collect data once and use the results many times over for multiple applications). The USGS would also continue to develop the Landsat 9 ground and flight systems in collaboration with the National Aeronautics and Space Administration (NASA) to meet a planned launch date in fiscal year 2021.

The 2020 President's budget request ensures that the USGS continues to provide:

- Light detection and ranging (lidar), and interferometric synthetic aperture radar (IfSAR–in Alaska), elevation data for critical minerals assessments, infrastructure management, flood risk determination, land navigation safety, and precision farming.
- Up-to-date topographic and hydrographic maps for the State of Alaska and the rest of the United States in support of recreation, critical minerals assessments, and emergency response to natural disasters.
- Landsat 9 ground systems development to meet a scheduled launch date by fiscal year 2021, ensuring that the USGS will continue to provide useful long-term imagery that supports land cover change analyses, drought and water use assessments, and agricultural research.
- Operation of Landsat 7 and 8 flight operation and data systems, and other satellite-related operations support including coordinating the acquisition of remotely-sensed data and distributing images and geospatial information products to aid in disaster response operations.
- The National Hydrography Dataset, a nationwide, scalable hydrographic referencing system (i.e., an address system for America's inland waterways and catchment areas that drain into streams) to enable flood forecasting at the local, neighborhood level.
- Detailed geologic maps to: assess the availability of critical minerals in Alaska and the rest of the United States; aid in locating commercial sand and gravel, crushed stone, and clay for infrastructure; assess energy and groundwater resources accurately; and provide information on the safest and most economical locations to build new bridges, roads, and dams.
- High-performance computing for data-intensive model processing for applications such as airborne electromagnetic surveys for critical mineral resource assessments, earthquake early warning systems, and daily models to predict coastal erosion and forecast hazards.
- Continued support to the National Land Cover Database, which serves as the definitive Landsat-based, high-resolution, land cover database for the Nation.
- Data science, information delivery, and biodiversity analytics for identifying low-conflict habitat areas for energy exploration, hazard mitigation, and urban planning. Assessments and decision-support tools characterizing risk levels for communities and ecosystems to hazard events.
- Preserved geoscientific assets (e.g., drilling cores and rock and sediment samples) that provide foundational information to industry for discovering or rediscovering valuable natural resource deposits.
- Continued expansion of the online USGS Library through optimized technology and processes.
- Continued support for Federal Geographic Data Committee (FGDC) activities for the Office of the FGDC Secretariat, for the development of the Nation's geospatial data and infrastructure; and for the implementation of the Geospatial Data Act of 2018, and the GeoPlatform Shared Services in support of the President's Management Agenda and the Federal Data Strategy.

- Research to study the spatial patterns, processes, relationships, and consequences of changes in climate, land uses and land cover, and research to contribute to the science basis needed to develop sustainable resource management strategies.

All of these activities support Interior's coordinated mission functions of recreation, collaborative conservation, land and natural resources management, and permitting to better serve the American public; as well as the Administration's goals for critical minerals and energy assessments, economic development, public safety, and emergency preparedness.

National Geospatial Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
National Geospatial Program	**67,854**	**67,854**	**177**	**-**	**(177)**	**67,854**	**0**
Program Operations					(177)		
FTE	**263**	**263**			**0**	**263**	**0**

Program Description

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—a compilation of the foundational data layers for the entire Nation, maintained in the public domain. The USGS supports the Interior's responsibilities for national geospatial coordination and carries out the USGS's governmentwide leadership responsibilities for elevation, hydrography and watershed boundaries, and geographic names. As one of the cornerstones of the USGS, The National Map has many uses ranging from recreation to scientific analysis to emergency response. The National Map is easily accessible for display on the Web, as products and services, and as downloadable data. The American people rely on the USGS's publicly available enhanced data and mapping to remain informed and to stay healthy and safe.

2020 Activities

The 2020 budget request:

- Continues to collect high-resolution light detection and ranging (lidar) elevation data, to achieve the first-ever cycle of national coverage with high quality data by 2026, and high-resolution interferometric synthetic aperture radar (IfSAR) elevation data for Alaska, with coverage completion by 2021. Coordinates interagency elevation data collection through the 3D Elevation Program.
- Supports the objectives of Secretarial Order 3359 and Executive Order 13817 (Critical Minerals) by providing advanced topographic data needed to locate U.S. critical mineral resources to inform management of private-sector domestic development, reduce dependence on foreign sources, and support job creation and technological innovation.
- Revises 92 percent of topographic maps for Alaska by the end of 2020, using the updated elevation and hydrography data. These new maps and data are used in a broad range of applications including infrastructure planning, recreation, navigation safety, hazards mitigation, and Arctic wildlife assessments.

- Completes 84 percent of the Nation's NHDPlus High Resolution (NHDPlus HR) data by the end of 2020, to deliver a networked geospatial framework of stream reaches, catchment areas, and flow surfaces to improve stream network analysis and support water modeling and assessments for emergency responders.
- Provides foundational geospatial data supporting The National Map, topographic mapping, emergency response and mitigation efforts to support public safety after major natural disasters.
- Continues to support Interior's effort to fulfill its leadership role to advance the next National Spatial Data Infrastructure (NSDI) Strategic Plan.

2020 Program Change Summary

The 2020 budget request for the **National Geospatial Program** is $67,854,000 and 263 FTE, which includes:

- Program Operations (-$177,000)

Program Overview

The USGS's 3D Elevation Program (3DEP) acquires high-resolution, three-dimensional elevation data for the Nation, including high-resolution IfSAR elevation data for the State of Alaska. Geospatial liaisons from across the United States help to coordinate requirements with Federal, State, local, and Tribal governments, and private industry to acquire data. The NGP's annual Broad Agency Announcement process effectively leverages funds appropriated to the USGS with matching partner funds (approximately four partner dollars for each dollar invested from the USGS appropriations), to speed national elevation data coverage completion in support of the management of energy resources and critical minerals assessments, natural resources conservation, public safety, and job creation.

The NHDPlus HR will provide a single, scalable hydrography framework for the Nation that contains 10 times more detail than currently available data. This new framework is a step forward in providing the next generation of hydrography data and will underpin a host of national hydrography-based applications including flood prediction and chemical spill response. Federal, State, Tribal, and local partners use the NHDPlus HR 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 US Topo map product is a georeferenced digital map produced from National Map data. The American public can use US Topo maps like the traditional 7.5-minute quadrangle paper topographic maps for which the USGS is well known. The USGS hosts and distributes all vector GIS data products, along with raster digital elevation models, National Aerial Imagery Program, land cover and US Topo maps from the cloud. US Topo maps now provide modern technological advantages that support faster, wider public distribution and basic, onscreen geospatial analysis.

The Federal Geographic Data Committee (FGDC) is an interagency coordinating committee focused on implementing cross-government geospatial initiatives (including the Geospatial Platform and the National Spatial Data Infrastructure (NSDI). The FGDC Office of the Secretariat provides executive, administrative, and technical support to the Committee. The FGDC coordinates implementation of the Geospatial Data Act of 2018, the NSDI Strategic Plan, and integrates geospatial data, shared services and portfolio management practices into the Federal Data Strategy as identified in the President's Management Agenda.

National Cooperative Geologic Mapping Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
National Cooperative Geologic Mapping Program	**24,397**	**24,397**	**71**	**-**	**(71)**	**24,397**	**0**
Program Operations					(71)		
FTE	**99**	**99**			**0**	**99**	**0**

Program Description

The National Cooperative Geologic Mapping Program conducts scientific (geologic) investigations and produces geologic maps in the United States through collaboration with State Geological Surveys and university partners. The resultant accurate digital geologic maps and three-dimensional geologic framework models and visualizations are used by Federal and State decision-makers to help mitigate natural hazards, conduct energy and mineral assessments at county and regional scales, and assess hydrogeology and groundwater availability, all of which sustain and improve the quality of life and economic vitality of the Nation.

2020 Activities

The 2020 budget request:

- Continues to design, build, and interpret a seamless three-dimensional geologic framework for the Nation based on new and prior geologic mapping at regional to local scales to improve mineral, energy, earthquake and landslide hazards assessments, ground water analyses, and infrastructure development.
- Supports the objectives of Secretarial Order (SO) 3359 and Executive Order (EO) 13817 (Critical Minerals) by continuing to collect geologic data and provide advanced geologic maps needed to locate U.S. critical mineral resources to inform management of private-sector domestic development, reduce dependence on foreign sources, and support job creation and technological innovation. Building a seamless geologic 3-D framework model for the Nation based on new and prior geologic mapping at regional to local scales will advance the objectives of SO 3359 and EO 13817.
- Makes available through the National Geologic Map Database (NGMDB) new detailed geologic maps covering 40,000 square miles of the continental United States (reaching 54.6 percent coverage), in partnership with State Geological Surveys in support of the goal of making 55.2 percent coverage of the United States available in the NGMDB by 2022.

2020 Program Change Summary

The 2020 budget request for the National Cooperative Geologic Mapping Program remains $24,397,000 and 99 FTE, which includes:

- Program Operations (-$71,000)

Program Overview

The program represents over two decades of successful cooperation among Federal (FEDMAP), State (STATEMAP), and university (EDMAP) partners to deliver digital geologic maps for a wide range of public and private sector customers. Each of these three components has a unique role, yet all work cooperatively to select and map high-priority areas for new geologic maps.

The USGS 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 derivative research (i.e., representing the map information in an understandable format for non-geologist decision-makers), in support of the responsible use of land, water, energy, and mineral 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. The USGS's vision is to create an integrated, three-dimensional, digital geologic framework of the United States and its territories to address the Nation's rapidly changing natural resource needs.

A hallmark of the program, the National Geologic Map Database, is a major collaborative effort with the Association of American State Geologists. This national database provides rapid access for the public, scientists, and decision makers to well-documented and standardized Federal and State geoscience information that can be used to support research, understanding, and decisions in response to a number of societal needs. The USGS's National Geologic Map Database leads national-level information exchanges and the development of more efficient methods for digital mapping, cartography, geographic information system analysis, and information management.

The FEDMAP component provides oversight for 18 regional geologic mapping and synthesis projects that cross jurisdictional boundaries. Through FEDMAP projects, the current program has accelerated research into geologic specialties, including subsurface geophysical methodology and modeling, three-dimensional geologic modeling, age-dating, petrology and geochemistry, hydrogeology, and paleo-environmental study while still maintaining core geologic mapping expertise.

The STATEMAP component oversees the geologic mapping studies conducted by approximately 44 State Geological Surveys through a competitive cooperative agreement program that matches every Federal dollar with a State dollar. This program effectively leverages Federal funds with State partners and continues to be effective at balancing the diverse needs of the Nation and individual States. The State-matched grants to State Geological Surveys focus on producing new geologic maps that address societally relevant issues identified by the States including: water, mineral, and energy resources; earthquake, flood,

sinkhole, volcanic, and landslide hazards; soil conditions; coastal erosion and flooding; and urban and infrastructure development.

The EDMAP component provides oversight for competitive grants to universities and colleges for undergraduate and graduate students to conduct geologic mapping across the Nation. The objective of the program is to mentor the next generation of geoscientists in the science of modern geologic mapping and its application to field and laboratory based geologic problems. EDMAP projects typically involve one season of fieldwork and require a one-to-one match of Federal dollars from the university.

Science Synthesis, Analysis, and Research Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Science Synthesis, Analysis and Research Program	**24,051**	**24,051**	**74**	**1,921**	**(59)**	**25,987**	**15**
Transfer from Land Change Science	*[1,921]*	*[1,921]*		*1,921*			
Program Operations					(59)		
FTE	**89**	**89**		**13**	**0**	**102**	**0**

*Transfers for 2018 and 2019 are for display purposes and are non-add.

Program Description

The Science Synthesis, Analysis, and Research Program 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.

2020 Activities

The 2020 budget request:

- Enhances the USGS's high performance computing capabilities to support Interior's computational and management challenges, and enable more timely data transfer, analysis, and delivery of completed research results to support smart decisions on Secretarial priorities related to natural resource assessment and use.
- Reaches the goal of having 765 total scientists using the USGS high performance computing capability through intensive outreach and training.
- Maintains the Hazard Exposure Reporting and Analytics (HERA) dynamic Web application, a platform that makes research on community exposure to coastal-flooding hazards influenced by sea-level rise accessible to planners, decision makers, and the public.
- Supports Interior priorities by maintaining biogeographic science activities (e.g., species occurrence and distributions) to inform decisions on critical habitat conservation (e.g. sagebrush), hunting and fishing, invasive species, recreation, energy siting, and fire management.
- Supports the development of the USGS's National Biogeographic Map to provide analytical tools for the examination of selected species, habitats, protections, and habitat conditions.

- Continues to increase access, discovery, understanding and reuse of the USGS science data and information to improve the USGS ability to process and produce new science.
- Continues to expand the online USGS Library through optimized technology and processes.
- Continues to preserve, expose, and provide access to valuable physical geoscience samples (e.g., drilling cores and rock and sediment samples) and data (e.g., borehole logs, GIS databases, and maps) for industry, academia, and the public.
- Provides support for approximately 30 State data preservation projects through the National Geological and Geophysical Data Preservation Program.
- Continues to support risk analysis as a part of the Science Application for Risk Reduction (SAFFR) project that is focused on earthquake analysis including scenario assessments, damage estimation, early warning, and protective actions.
- Expands how the USGS characterizes societal impacts to coastal hazards, specifically communicating the influence of a changing world (e.g., sea level rise, changing wave climates, urbanization).
- Expands the role of land-change modeling into projecting future societal vulnerability to natural hazards.

2020 Program Change Summary

The 2020 budget request for the Science Synthesis, Analysis, and Research Program is $25,987,000 and 102 FTE, which includes:

- Transfer from Land Resources, Change Science ($1,921,000 and +13 FTE)
- Program Operations (-$59,000)

Program Overview

The program includes the Science Analytics and Synthesis Program (SAS); the National Geological and Geophysical Data Preservation Program; the Core Research Center CRC); the USGS Library; and the J.W. Powell Center for Analysis and Synthesis (Powell Center). The USGS also develops quantitative, qualitative, and geospatial methods and decision-support tools characterizing the Nation's vulnerability to hazard events and assessing the impacts of land cover change on ecosystem services. These activities provide an integrated suite of essential data, services, and applications to empower the USGS and its collaborators to effectively manage, steward and analyze key scientific data and materials.

The USGS strives to accelerate research and decision-making through data science, information delivery, high performance computing, and biodiversity analytics. The USGS also maintains an Advanced Research Computing Framework to execute complex computational models required to quickly and efficiently process large quantities of data including high-resolution elevation datasets, integrating elevation and hydrography data, and three-dimensional geologic datasets.

The USGS provides technical and financial assistance to State geological surveys and Interior bureaus to support preservation, exposure, and reuse of valuable physical geoscience samples (e.g., drilling cores and rock and sediment samples) and data (e.g., borehole logs, GIS databases, maps, field notebooks, etc.). Preserving endangered and unique geological and geophysical collections reduces duplicative collection costs and can unearth natural resources that may have been previously unknown.

The Core Research Center (CRC) is an archive for the preservation of rock cores for use by scientists and educators from government, industry, and academia. Since the establishment of the CRC, billions of dollars have been saved through new discoveries, and by not re-drilling and replicating collections.

National Land Imaging Program

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
National Land Imaging Program[1]	**[101,065]**	**[101,065]**	**159**	**101,065**	**(12,269)**	**88,955**	**(12,110)**
Transfer from National Land Imaging Program (LR)	*[93,094]*	*[93,094]*		*[93,094]*		*[80,922]*	
Transfer from Land Change Science Program (LR)	*[7,971]*	*[7,971]*		*[7,971]*		*[8,033]*	
Research and Investigations					*(5,949)*	*[3,607]*	
Remote Sensing State Grants					*(1,215)*	*[0]*	
Satellite Operations					*(10,905)*	*[41,432]*	
Landsat 9 Ground System Development					*5,800*	*[32,000]*	
FTE[2]	**[180]**	**[180]**		**180**	**(21)**	**159**	**(21)**

[1] *The amounts shown for 2018 and 2019 represent the new structure within Core Science Systems. In the old structure within Land Resources, the 2018 Actual and 2019 CR would be $93,094 in the Land Resources, National Land Imaging program and $7,971 in the Land Resources, Land Change Science Program.*

[2] *The amounts shown for 2018 and 2019 represent the new structure. In the old structure within Land Resources, the 2018 Actual and 2019 CR would be 134 FTEs in the Land Resources, National Land Imaging program and 46 FTE in the Land Resources, Land Change Science Program*

Program Description

The National Land Imaging Program delivers remote sensing observation capacity, data, and research to inform U.S. land and resource managers and advance understanding of how landscapes and associated natural resources are changing at local, regional, and global scales. Continuous monitoring of the Earth's continents, islands, and coastal regions helps to understand land surface change. The USGS plays a leading role in land surface observations through its Landsat satellite missions that are designed and implemented in collaboration with NASA. Through its funding of the USGS Earth Resources Observation and Science (EROS) Center, the USGS ensures the efficient archiving, processing, and distribution of a wide range of land-imaging data and derived products to users across the Nation, and the advancement of world-class land science research and applications.

2020 Activities

The 2020 budget request:

- Develops Landsat 9 systems in collaboration with NASA for overall mission integration in support of a fiscal year 2021 launch.
- Operates the Landsat 7 and Landsat 8 satellites and the EROS National Archive to deliver high-quality data to government, commercial, and academic users.
- Continues future mission formulation and related system development activities in partnership with the National Aeronautics and Space Administration (NASA), including a new mission Annex under the NASA-USGS Sustainable Land Imaging interagency agreement—a concept of operations, a formal program-level requirements document, and an acquisition strategy.
- Continues toward full deployment and enhancement of the Land Change Monitoring, Assessment, and Projection (LCMAP) suite of land cover change and classification image products and services.
- Leverages cloud services and technologies to advance operational efficiencies toward Landsat data processing, distribution, archiving, product development, and data science.
- Continues National Civil Applications Center and unmanned aircraft systems operations for disaster risk reduction and environmental monitoring, in close collaboration with government and industry stakeholders.
- Supports innovative land remote sensing applications to advance the Nation's economic, environmental, and scientific interests.
- Initiates the next National Land Cover Database update, including substantial efforts to automate land cover change estimation in cooperation with the LCMAP project.

2020 Program Change Summary

The 2020 budget request for the National Land Imaging Program is $88,955,000 and 159 FTE, which includes:

- Transfer from Land Resources, National Land Imaging ($93,094 and 134 FTE)
- Transfer from Land Resources, Land Change Science ($7,971 and 46 FTE)
- Research and Investigations (-$5,949,000 and -17 FTE)
- Remote Sensing State Grants (-$1,215,000 and 0 FTE)
- Satellite Operations (-$10,905,000 and -4 FTE)
- Landsat 9 Ground System Development (+$5,800,000 and 0 FTE)

Program Overview

The USGS delivers remote sensing observation capacity, data, and research to inform the Nation's land and resource managers and improve understanding of how landscapes and associated natural resources are changing at local, regional, and global scales. The USGS operates satellites and Unmanned Aircraft Systems (UAS) and collects, archives, processes and distributes a broad array of data from its own and partners' remote sensing systems. The USGS also manages a partnership with NASA for the Sustainable Land Imaging (SLI) program, ensuring that both agencies work together to maintain the Nation's long-term moderate-resolution land remote sensing capabilities.

The USGS operates 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 short-wave infrared sensors, used extensively in water resource and agricultural management. These sensors allow users to monitor water use, discriminate moisture content of soils and vegetation, and estimate heat temperatures in urban areas. A 2013 report of the USGS estimated the annual economic benefit of Landsat data to the Nation to be $1.79 billion.

Landsat 9 is the follow-on mission to Landsat 8. It is the direct replacement for Landsat 7, and will extend the Landsat observational record to more than five decades of coverage of the Earth's land surfaces. Together, these satellites will continue to support near-weekly Landsat revisit for hundreds of land cover applications, supporting tens of thousands of government, commercial, and academic users across the Nation. The USGS intends to continue operating Landsat 7 until Landsat 9 is commissioned in FY 2021 (approximately three months after launch). If the Landsat 9 launch is delayed, the USGS expects to operate Landsat 7 until July 2021 (at the latest), when fuel limitations will force the initiation of satellite decommissioning, a three-month process that includes lowering its orbit and safeguarding its systems.

As with previous missions, Landsat 9 is being developed and operated through a longstanding partnership between NASA and Interior/USGS. Under this partnership, NASA develops the space segment and launch segment, and Interior/USGS develops the ground segment to collect, archive, process and distribute the data, and operates the satellite following NASA's on-orbit checkout. When designing Landsat missions, the USGS and NASA collaborate on user requirements and advances in technology, review mission needs while ensuring continuity with the archived land record and establish scientific objectives and instrument specifications.

In FY 2018, Interior/USGS and NASA chartered a second SLI Architecture Study Team (AST 2019). The team will execute a study for the design and implementation approach for the second phase of a sustainable and evolvable spaceborne system to provide global, continuous Landsat-quality multispectral and thermal infrared measurements for approximately a fifteen-year period beginning in the FY 2026 timeframe. The AST 2019 will provide architecture options that Interior/USGS and NASA will utilize to provide a recommendation for an SLI architecture beyond Landsat 9 to the Executive Office of the President by the end of FY 2019.

The USGS's Earth Resources Observation and Science (EROS) Center performs the Landsat satellite operations and image data collection, archiving, processing, and distribution. In its National Satellite Land

Remote Sensing Data Archive, EROS houses more than 8 million Landsat satellite scenes acquired globally since 1972. In its Long Term Archive for aerial photos and geospatial data, EROS houses over 6.5 million high-definition aerial mapping photos of U.S. sites, some dating to 1937.

The Land Change Science (LCS) Program provides land and natural resource managers, policy makers, and stakeholders with data, tools, and scientific information products that support land use and management decisions relevant to the safety of communities, economic prosperity, and condition of natural resources across the Nation. The science improves understanding of the forces that shape landscapes and their potential uses and provides data to help distinguish between land surface change resulting from natural forces and those associated with land management. Delivered research provides critical data needed to understand how natural disturbances (such as droughts, fire, flooding, and sea level change) and land use decisions (such as urbanization, agriculture, ecosystem stewardship, and water management) affect the composition, distribution, and functioning of land and natural resources. Research products and technical methods produced by the USGS 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. The data on drivers, interactions, and consequences of land change support the development of tools needed by resource managers, policy makers, and the public to forecast future resource conditions and availability.

Science Support

Science Support

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Science Support	**102,828**	**102,828**	**615**	**-**	**(533)**	**102,910**	**82**
FTE	*505*	*505*	*-*	*-*	*(44)*	*461*	*(44)*
Administration and Management	**80,881**	**80,881**	**572**	**-**	**(490)**	**80,963**	**82**
FTE	*442*	*442*	*-*	*-*	*-*	*398*	*-*
Information Services	**21,947**	**21,947**	**43**	**-**	**(43)**	**21,947**	**-**
FTE	*63*	*63*	*-*	*-*	*-*	*63*	*-*

The 2020 budget request for Science Support is $102,910,000 and 461 FTE.

The Science Support Activity provides the core functions that make it possible for the USGS to conduct science. These business and information services and systems include acquisitions and grants, finance, internal controls, communications, budget and performance, monitoring and evaluation of science quality and integrity, information assurance, information management and technology services, and human capital. Science Support also includes the executive leadership and management that provide guidance, direction, and oversight for all of the USGS science activities.

The 2020 request continues support for the reorganization of the Department of the Interior with funding to stand up the unified regions, relocate certain headquarters staff and functions as appropriate, and improve operations through the use of technology, shared services, and consistent practices. Activities include:

- Support and participate in standing up the unified regions, including collaboration across bureaus.
- Transition internal business operations to the new regional structure.
- Relocate selected functions closer to Interior's assets, customers, and mission areas out West to provide more responsive service.
- Implement shared service solutions to improve delivery of one or more of human resources, information technology, and acquisition services.

Administration and Management

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Administration and Management	**80,881**	**80,881**	**572**	**-**	**(490)**	**80,963**	**82**
Administration and Management					*(6,690)*		
DOI Reorganization					*6,200*	*[6,200]*	
FTE	**442**	**442**			**-44**	**398**	**-44**

Program Overview

The offices and personnel in this subactivity are comprised of the Office of the Director; Senior Executive Leadership; Budget, Planning, and Integration; Communications and Publishing; Science Quality and Integrity; International Programs; Diversity and Equal Opportunity; and Administration.

2020 Activities

The 2020 budget request supports:

- Conducting mandatory and high priority activities and preserving core capabilities providing the framework for the science mission.
- Enhancing and promoting an ethical culture throughout the USGS by employing Ethics Counselors outside of the National Center to allow walk-in access in other USGS locations.
- Continuing implementation of the USGS laboratory Quality Management Systems informed by a report from the National Academies.
- Establishing a training curriculum for all employees targeted at addressing the top findings in the USGS's Work Environment Survey and areas of concerns identified through other sources.
- Administering a survey or assessment similar to the Work Environment Survey to assess the effectiveness of the USGS Anti-Harassment Action Plan.

2020 Program Change Summary

The 2020 budget request for the Administration and Management subactivity is $80,963,000 and 398 FTE, which includes:

- Administration and Management (-$6,690,000 and -44 FTE)
- DOI Reorganization (+$6,200,000 and 0 FTE) – At the 2020 request level of $6,200,000, the USGS will support implementation of the 12 unified regional boundaries, relocation of certain headquarters staff and functions West, and modernization of Interior's administrative services. The request will support:
    - Implementation of Unified Regions. Funds will support bureau planning and implementation needed to transition to the new regions and implement shared service solutions.
    - Relocation and Regional Stand Up. This request helps relocate some staff closer to assets and customers.
    - Modernizing Interior's Business. Deployment of common shared service solutions to improve delivery of human resources, information technology, and acquisition services.

Program Description

Administration and Management, within Science Support, 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.

Information Services

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Information Services	**21,947**	**21,947**	**43**	**-**	**(43)**	**21,947**	**0**
Information Services					*(43)*		
FTE	**63**	**63**			**0**	**63**	**0**

Program Description

The offices and personnel in this subactivity include the Office of the Associate Chief Information Officer, Chief Technology Officer, Information Management Technology (IMT) Strategic Planning, Information Security, Enterprise Services, End User Services, and Information Management and Delivery.

2020 Activities

The 2020 budget request supports:

- Securing science data assets to ensure the integrity of science.
- Providing access to advanced technologies such as artificial intelligence, and high performance computing to enable science.
- Developing convergent IMT architecture by providing cloud hosting solution advancements that move information technology infrastructure into the cloud.
- Providing bandwidth capabilities to meet expanding Federal scientific technological needs.
- Providing the critical IMT foundation for the USGS science mission through IMT operations, FITARA compliance, records management, and IT applications development.
- Supporting IMT initiatives funded through the Interior Working Capital Fund Central and Direct Bills.

2020 Program Change Summary

The 2020 budget request for the Information Services subactivity is $21,947,000 and 63 FTE, which includes:

- Information Services (-$43,000)

Program Description

The subactivity provides the critical Information Management and Technology (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. The subactivity supports numerous IMT services, such as the USGS information assurance program; infrastructure and cloud services; applications and customer support; information investment, management, and delivery programs; and supports the Interior IMT activities through the DOI Working Capital Fund Central and Direct bills.

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Facilities

Facilities

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Facilities	**120,091**	**120,091**	**8,602**	**-**	**(7,397)**	**121,296**	**1,205**
FTE	*79*	*79*	-	-	-	*79*	-
Rental Payments and Operations & Maintenance	**104,927**	**104,927**	**8,602**	**-**	**(208)**	**113,321**	**8,394**
FTE	*79*	*79*	-	-	-	*79*	-
Deferred Maintenance and Capital Improvement	**15,164**	**15,164**	**-**	**-**	**(7,189)**	**7,975**	**(7,189)**
FTE	-	-	-	-	-	-	-

The 2020 budget request for Facilities is $121,296,000 and 79 FTE.

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 rent; basic facility operations; security; facility maintenance, in compliance with Federal, State, and local standards; and provide a safe, sustainable working environment for employees, visiting partners, and customers.

Rental Payments and Operations and Maintenance

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Rental Payments and Operations & Maintenance	**104,927**	**104,927**	**8,602**	**-**	**(208)**	**113,321**	**8,394**
GSA Rent Adjustment and Support for Relocation of Menlo Park					*682*	*[12,454]*	
Rental Payments and Operations & Maintenance					*(890)*	*[92,265]*	
FTE	**79**	**79**			**0**	**79**	**0**

Program Overview

This program provides the USGS with funding needed to pay for annual recurring rent and operations and maintenance. Rental payments are to the General Services Administration (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 the GSA to meet those needs, including modern laboratory space.

2020 Activities

The 2020 budget request supports:

- The USGS move from Menlo Park, CA, to NASA Ames, Moffett Field, Mountain View, CA.
- Coordination of facility planning with science planning to provide safe, high-quality workspace aligned with science needs.
- Development of Asset Business Plans to meet asset management goals, continue annual surveys, and cyclic condition assessments.
- Reduction of energy intensity by 2.5 percent annually.
- Cost savings initiatives through space consolidations.

2020 Program Change Summary

The 2020 budget request for the Rental Payments and Operations and Maintenance subactivity is $113,321,000 and 79 FTE.

Program Description

The Rental Payments component provides rental payments for space occupied by the USGS to the GSA, other Federal sources, private lessors, and cooperators. The USGS has unique facility requirements for supporting science functions and relies primarily on GSA to meet those needs, including modern laboratory space. Operations and Maintenance funding provides for basic facility operations, security, and facility maintenance. Maintenance involves the upkeep of USGS-owned facilities, structures, and capitalized equipment necessary to maintain the useful life of the assets.

The USGS occupies approximately 3.87 million square feet of rentable space in about 163 GSA buildings nationwide, making the USGS one of the largest users of GSA space within Interior. Only 21.1 percent of the USGS space is owned; the remaining 78.9 percent of the USGS space is provided through GSA, direct leases with the private sector, and cooperative and interagency agreements with State and local governments, universities, and other Federal agencies.

In the Operations and Maintenance component, maintenance involves the upkeep of the USGS owned facilities, structures, and capitalized equipment, necessary to maintain the useful life of the asset. To protect important resources, ongoing investments in annual and cyclic maintenance, repair, revitalization, and disposal of assets must be considered as part of a long-term operations and maintenance program. Operations of the USGS owned facilities include costs such as utilities, janitorial and pest services, waste management, and salaries for staff responsible for the day-to-day operations of the facility.

The cost of rent and, operations and maintenance (O&M) are only partially covered by this Subactivity; science programs cover the remaining balance. In 2018, the science programs funded $5.1 million of rent and O&M. In 2020, the USGS estimates that science programs will fund $11.1 million in rent and O&M.

Deferred Maintenance and Capital Improvement

Dollars in Thousands	2018	2019	2020				
	Actual	CR Annualized	Fixed Costs	Internal Transfers	Program Changes	Request	Change from 2019
Deferred Maintenance and Capital Improvement	**15,164**	**15,164**	**0**	**-**	**(7,189)**	**7,975**	**(7,189)**
Deferred Maintenance and Capital Improvement					*(7,189)*	*[7,975]*	
FTE	**0**	**0**			**0**	**0**	**0**

Program Description

This program provides the USGS with funding for deferred maintenance and repair activities on USGS-owned assets and assets where the USGS has deferred maintenance responsibility (buildings, structures, and equipment). Funding is provided to the highest priority facility and equipment requirements, including stewardship responsibilities for unique mission equipment such as: hazard warning networks, river cableways, and stream gaging stations, all of which require maintenance and capital investments to preserve their functionality.

2020 Activities

The 2020 budget request supports:

- Slowing the growth of the deferred maintenance backlog by renovating and constructing buildings and other facilities to replace assets that are no longer cost effective to operate.
- Continuing an effective maintenance program at each owned facility to meet industry best practices.
- Increasing co-location and consolidation consistent with science program objectives.
- Achieving departmental and management goals for sustainability, energy, and water reduction.

2020 Program Change Summary

The 2020 budget request for the Deferred Maintenance and Capital Improvement subactivity is $7,975,000 and 0 FTE.

Program Overview

The Deferred Maintenance and Capital Improvements subactivity enables the USGS to address critical facility needs, helping to slow the growth in the USGS deferred maintenance backlog. At the end of fiscal

year 2018, the USGS had a deferred maintenance backlog of $133.2 million for both owned assets and assets for which the USGS pays operations and maintenance in lieu of rent.

Facilities projects reflect comprehensive evaluations conducted by independent architectural and engineering firms. These installation-wide assessments help establish core data on the condition of the 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 Facility Condition Index 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 the USGS. Through the asset management planning process, the USGS identifies real property assets that are candidates for disposal. 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.

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USGS Working Capital Fund

Working Capital Fund

The Working Capital Fund (WCF) was made available for expenses necessary for furnishing materials, supplies, equipment, work, and services in support of the USGS programs, and as authorized by law, to agencies of the Federal Government and others.

The WCF consists of:

- The WCF Investment Component provides a mechanism to assist the 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.
- 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 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 component was established in 2004 to provide the USGS with this no-year flexibility.

Appropriation Language and Citations

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. This authority expanded the use to partially fund laboratory operations and facilities improvements and to acquire and replace publication and scientific instrumentation and laboratory equipment.

WORKING CAPITAL FUND

Employment Summary

Identification Code 14-4556-0-4-306		2017 Actual	2018 CR Annualized	2019 Request
	Reimbursable:			
2001	Civilian full-time equivalent employment	117	117	117

USGS Accounts

USGS Accounts

Appropriations Language

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; $983,467,000, to remain available until September 30, 2021; of which $73,432,000 shall remain available until expended for satellite operations; and of which $7,975,000 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 2019 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2019 (Division C of P.L. 115-245, as amended). The amounts included for 2019 reflect the annualized level provided by the continuing resolution.

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.

Appropriations Language 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

Expiring Authorizations

Expiring Authorization Citation	
Bureau/Office Name	USGS/Water Resources Mission Area
Program Name	National Streamflow Information Program (included in the Groundwater and Streamflow Information Program)
Citation	P.L. 111-11 42 USC 10367
Title of Legislation	Omnibus Public Land Bill of 2009
Last Year of Authorization	2019
BY Budget Request ($000)	$ 10,000
Explanation of Authorization Requirement for BY	No individual programmatic authorization is necessary for the USGS to continue this effort.
Program Description	As a subset of the National Streamgaging Network, the Federal Priority Streamgages (FPS) Network (previously known as the National Streamflow Information Program) is designed to address long-term Federal information needs (such as supporting National Weather Service flood forecasts, or interstate and international compacts and decrees). Currently about 3,600 of more than 4,700 qualified FPS locations are active. These streamgages are supported through a combination of Federal and partner funding—less than one-quarter are fully funded by the USGS. Information provided through the network forms the scientific basis for decision-making related to the protection of life and property from water-related hazards, such as floods; cost-effective management of freshwater that is safe and available for drinking, irrigation, energy, industry, recreation, and ecosystem health; and national, State, tribal, and local economic well-being. The latest streamflow information is available as alerts to users by email or text message and as real-time stream conditions change, updated at intervals of one hour or less.

On March 12, 2019, the President signed Public Law 116-9 which reauthorized the National Cooperative Geologic Mapping Act of 1992, which had previously expired in 2018.

Summary of Requirements

Activity/ Subactivity/ Program Element	2018	FY 2019 CR		Fixed Costs	Internal Transfers FTE	Internal Transfers $	Program Changes		2020 Request		Change from 2019 CR	
	Amount	FTE	Amount				*FTE*	Amount	FTE	Amount	*FTE*	Amount
Species Management Research Program	-		-	198	345	64,111	(127)	(19,950)	218	44,359	(127)	(19,752)
Land Management Research Program	-		-	163	325	62,473	(125)	(18,843)	200	43,793	(125)	(18,680)
Biological Threats Research Program	-		-	151	147	28,999	-	(154)	147	28,996	-	(3)
Climate Adaptation Science Center	-		-	97	111	44,488	(66)	(20,684)	45	23,901	(66)	(20,587)
Status and Trends	20,473	100	20,473		(100)	(20,473)	-	-	-	-	-	-
Fisheries Program	20,136	117	20,136		(117)	(20,136)	-	-	-	-	-	-
Wildlife Program	46,007	251	46,007		(251)	(46,007)	-	-	-	-	-	-
Environments Program	36,415	175	36,415		(175)	(36,415)	-	-	-	-	-	-
Invasive Species	17,330	82	17,330		(82)	(17,330)	-	-	-	-	-	-
Cooperative Research Units Program	17,371	125	17,371	-	-	-	(125)	(17,371)	-	-	(125)	(17,371)
Ecosystems Total	**157,732**	**850**	**157,732**	**609**	**203**	**59,710**	**(443)**	**(77,002)**	**610**	**141,049**	**(443)**	**(76,393)**
National Land Imaging Program	93,094	134	93,094		(134)	(93,094)						
Land Change Science Program	34,070	148	34,070		(148)	(34,070)						
National and Regional Climate Adaptation Science Centers	25,335	56	25,335		(56)	(25,335)						
Land Resources	**152,499**	**338**	**152,499**	**-**	**(338)**	**(152,499)**	**-**	**-**	**-**	**-**	**-**	**-**
Mineral Resources Program	49,371	301	49,371	241	-	-	5	10,581	306	60,193	5	10,822
Energy Resources Program	30,872	133	30,872	125	-	-	(13)	(5,118)	120	25,879	(13)	(4,993)
Contaminant Biology Program	10,197	58	10,197	-	(58)	(10,197)	-	-	-	-	-	-
Toxic Substance Hydrology Program	12,398	59	12,398	-	(59)	(12,398)	-	-	-	-	-	-
Energy and Mineral Resources, and Environmental Health Total	**102,838**	**551**	**102,838**	**366**	**(117)**	**(22,595)**	**(8)**	**5,463**	**426**	**86,072**	**(8)**	**5,829**
Earthquake Hazards Program	83,403	225	83,403	172	-	-	2	(19,272)	227	64,303	2	(19,100)
Volcano Hazards Program	42,621	142	42,621	97	-	-	(3)	(14,597)	139	28,121	(3)	(14,500)
Landslide Hazards Program	3,538	21	3,538	16	-	-	-	-	21	3,554	-	-
Global Seismographic Network	6,653	11	6,653	8	-	-	-	-	11	6,661	-	-
Geomagnetism Program	1,888	9	1,888	-	-	-	-	-	9	1,888	-	-
Coastal-Marine Hazards and Resources Program	40,510	207	40,510	146	-	-	-	(158)	207	40,498	-	12
Natural Hazards Total	**178,613**	**615**	**178,613**	**439**	**-**	**-**	**(1)**	**(34,027)**	**614**	**145,025**	**(1)**	**(33,588)**
Water Resources Availability Program	-	-	-	348	695	110,907	(195)	(36,397)	500	74,858	(195)	(36,049)
Water Observing Systems Program	-	-	-	341	597	112,545	(37)	(7,822)	560	105,064	(37)	(7,481)
Water Resources Research Act Program	6,500	1	6,500	-	-	-	(1)	(6,500)	-	-	(1)	(6,500)
Water Availability and Use Science Program	46,052	331	46,052	-	(331)	(46,052)	-	-	-		-	-
Groundwater and Streamflow Information Program	74,173	293	74,173	-	(293)	(74,173)	-	-	-		-	-
National Water Quality Program	90,829	609	90,829	-	(609)	(90,829)	-	-	-		-	-
Water Resources Total	**217,554**	**1,234**	**217,554**	**689**	**59**	**12,398**	**(233)**	**(50,719)**	**1,060**	**179,922**	**(233)**	**(50,030)**

Activity/ Subactivity/ Program Element	2018	FY 2019 CR		Fixed Costs	Internal Transfers FTE	Internal Transfers $	Program Changes		2020 Request		Change from 2019 CR	
	Amount	FTE	Amount				*FTE*	Amount	FTE	Amount	*FTE*	Amount
National Geospatial Program	67,854	263	67,854	177	-	-	-	(177)	263	67,854	-	-
National Cooperative Geologic Mapping Program	24,397	99	24,397	71	-	-	-	(71)	99	24,397	-	-
Science Synthesis, Analysis and Research Program	24,051	89	24,051	74	13	1,921	-	(59)	102	25,987	-	15
National Land Imaging Program	-	-	-	159	180	101,065	(21)	(12,269)	159	88,955	(21)	(12,110)
Core Science Systems Total	**116,302**	**451**	**116,302**	**481**	**193**	**102,986**	**(21)**	**(12,576)**	**623**	**207,193**	**(21)**	**(12,095)**
Administration and Management	80,881	442	80,881	572	-	-	(44)	(490)	398	80,963	(44)	82
Information Services	21,947	63	21,947	43	-	-	-	(43)	63	21,947	-	-
Science Support Total	**102,828**	**505**	**102,828**	**615**		**-**	**(44)**	**(533)**	**461**	**102,910**	**(44)**	**82**
Rental Payments and Operations & Maintenance	104,927	79	104,927	8,602	-	-	-	(208)	79	113,321	-	8,394
Deferred Maintenance and Capital Improvement	15,164	-	15,164	-	-	-	-	(7,189)	-	7,975	-	(7,189)
Facilities Total	**120,091**	**79**	**120,091**	**8,602**		**-**	**-**	**(7,397)**	**79**	**121,296**	**-**	**1,205**
Total, USGS	**1,148,457**	**4,623**	**1,148,457**	**11,801**	**-**	**-**	**(750)**	**(176,791)**	**3,873**	**983,467**	**(750)**	**(164,990)**

Fixed Costs

United States Geological Survey
Justification of Fixed Costs and Internal Realignments
(Dollars In Thousands)

Fixed Cost Changes and Projections	2019 Total or Change	2019 to 2020 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 2019 and 2020.	+2,024	+1,832
Pay Raise The 2020 request reflects a pay freeze for civilian employees.	+2,668	+0
Employer Share of Federal Employee Retirement System The change reflects the directed 2.3% increase in the employer contribution to the Federal Employee Retirement System.	+0	+1,147
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.	17,726	+418
Worker's Compensation Payments The amounts reflect changes in the estimated costs of compensating injured employees and dependents of employees who suffer accidental deaths while on duty. Costs for 2020 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.	2,052	-180
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.	492	+22
Rental Payments The amounts reflect changes in the costs payable to 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; which in the case of GSA space are paid to 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.	98,851	+8,562
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 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

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Account and Sundry Exhibits

Account and Sundry Exhibits

Employment Summary

SURVEYS, INVESTIGATIONS, AND RESEARCH

Identification Code 14-0804-0-1-306		2018 Actual	2019 Estimate	2020 Estimate
	Direct:			
1001	Civilian full-time equivalent employment	4,623	4,623	3,873
	Reimbursable:			
2001	Civilian full-time equivalent employment	2,913	2,913	2,913
	Allocation account:			
3001	Civilian full-time equivalent employment	29	29	29

CONTRIBUTED FUNDS

Identification Code 14-8562-0-7-306		2018 Actual	2019 Estimate	2020 Estimate
	Direct:			
1001	Civilian full-time equivalent employment	5	5	5

Employee Count by Grade
(Total Employment)

		2018 Actual	2019 Estimate	2020 Estimate
Executive Level V		1	1	1
SES		15	18	18
	Subtotal	16	19	19
SL – 00		10	12	12
ST – 00		40	36	40
	Subtotal	50	48	52
GS/GM – 15		456	454	407
GS/GM – 14		707	703	631
GS/GM – 13		1,175	1,169	1,049
GS – 12		1,434	1,426	1,280
GS – 11		1,230	1,223	1,098
GS – 10		18	18	16
GS – 9		927	922	827
GS – 8		236	234	210
GS – 7		613	610	547
GS – 6		230	228	205
GS – 5		338	336	302
GS – 4		145	144	130
GS – 3		70	69	62
GS – 2		17	17	15
GS – 1		1	1	1
	Subtotal	7,596	7,556	6,779
Other Pay Schedule Systems		295	295	295
Total employment (actual/estimate)		**7,957**	**7,918**	**7,145**

Section 403 Compliance

This section describes details related to any assessments to, or within, the USGS to support bureau-wide 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.

External Administrative Costs	2020 Estimate ($000)
Department of the Interior Working Capital Fund	
WCF Centralized Billings	*$18,144*
WCF Direct Billings	*$13,446*
Payments to Other Federal Agencies	
Worker's Compensation Payments	*$1,872*
Unemployment Compensation Payments	*$514*
GSA Rental Payments	*$107,413*
Bureau Administrative Costs	
Shared Program Costs	*$13,793*
Internal Bureau Overhead	*$40,000*

External Administrative Costs

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 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 execution based on the enacted appropriation. The following table provides the actual centralized billing to the USGS for 2018, and estimates for 2019 and 2020.

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 2018, and estimated billings and collections for 2019 and 2020.

Bureau Administrative Costs

Shared Program Costs

The USGS maintains an estimated one percent of its budget submission 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.

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.

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 bureau-wide overhead costs in the same proportion as appropriated funding is to total funding. For this reason, bureau-wide overhead costs collected on reimbursable support agreements are deposited within Science Support program areas, as well.

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 USGS does not perform any of the actual work.

At the science center level, because there generally is not a direct appropriated funding source to pay the local overhead (common services) costs, both the direct 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 2018, for the local overhead, totaled $230 million from both direct 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 2018, 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 Associate Director for Administration establishes the USGS bureau special rate for each fiscal year. The special rate for 2019 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.