Status and Progress of the U.S. Geological Survey's National Cooperative Geologic Mapping Program Through Fiscal Year 1999

Secretary of the Interior

Bruce Babbitt

CONTENTS

National Geologic Mapping Act of 1992 and National Geologic Mapping Reauthorization Act of 1997

The availability and effective utilization of natural resources is fundamental to sustain human existence on planet Earth. A basic requirement for identification, delineation, and sustained use of earth resources, including water, mineral and biologic resources, is the availability of detailed geologic mapping. Unfortunately, less than 20 percent of the United States is adequately mapped to meet these needs and an even smaller fraction is mapped using digital technology.

Growing concern over effective stewardship of our environment is producing a myriad of rules and regulations directed toward maintaining and improving our habitat. The ultimate repository of our waste products is the earth, and geologic maps are needed to identify and delineate the rock units that are capable of containing them effectively.

As the population of the earth continues to increase, the effects of natural hazards loom even greater. The identification and mitigation of such phenomena require the use of detailed geologic maps. Increasingly, digital technology is needed to interpret three-dimensional geologic map data and to expedite decisions on the use of earth resources. Geologic maps are being integrated into digital Geographic Information Systems (GIS) that display the location and abundance of earth resources, risks from natural hazards, and the susceptibility of the surface and buried aquifers to contamination. As used in GIS, geologic maps constitute the basic earth materials framework on which all other information layers are built.

An assessment during the 1980's by the Association of American State Geologists (AASG) found that only 11,000 (18 percent) of the 59,000 7 1/2-minute quadrangles covering the U.S. have been mapped in sufficient detail to be useful in addressing State needs for resource development, environmental protection, and natural hazard identification and mitigation. Only one State, Kentucky, has been completely mapped at a scale of 1:24,000, and even in that State revisions are needed. The latter point illustrates the need to not only complete the coverage of the nation, but also for an ongoing commitment to update and maintain the nation's geologic map information.

For these and a myriad of other reasons, the AASG in concert with the U.S. Geological Survey (USGS) began a planning process in 1988 to develop a geologic mapping program that would produce complete coverage of surficial and bedrock geologic mapping for the nation in a reasonable time frame.

At the outset, it was recognized that the nation has substantial but declining capability in geologic mapping. While the USGS and the state geological surveys are publishing detailed surficial and bedrock geologic maps, the rate of production will not provide adequate coverage of the needed areas in any realistic span of time. Furthermore, the numbers and capability of geologic mappers in the U.S. are clearly on the decline. In recent years, colleges and universities have decreased their attention to field training, with many eliminating such requirements for a geology degree.

Based on these conditions, a plan was developed to introduce an authorizing bill to Congress to mandate production of complete surficial and bedrock geologic map coverage at a scale that would meet national and regional needs for resource development, environmental protection, and identification and mitigation of natural hazards. The nominal mapping scale that was adopted was that of the standard topographic quadrangle map (1:24,000).

The proposed authorizing bill placed the national management responsibilities in the USGS, with advisory support from other involved Federal agencies, state geological surveys, academia, and the private sector. The proposed program consisted of four mapping components: a Federal mapping component, a Federal mapping support component, a state mapping component, and university field training component.

The Federal mapping component recognizes the current Federal mapping program that addresses national needs for geologic map coverage by the USGS and other Federal agencies.

The Federal mapping component encompasses the ongoing efforts of the USGS to develop and maintain related databases in stratigraphy, geochronology, paleontology, geophysics, and other areas. In addition, this component recognizes the need for the development of digital methods for managing and using geologic map data.

The state-mapping component is directed toward meeting those needs for detailed geologic maps at the State and local level. It is recognized that such needs carry some responsibility for State support as well. Thus, the state mapping component was established as a matching-funds program with one-half of the funding to be obtained from non-Federal sources.

The university field training support component is designed to address the national decline in geologic field training. Grants to academic institutions for augmenting graduate and undergraduate field training will be provided with the expectation of increasing the number of field geologists who are qualified to meet the needs of the expanded national geologic mapping program.

It was recognized at the outset that the passage of a bill authorizing the establishment of a national geologic mapping program would require the support of a broad constituency. While the USGS and the AASG have compiled impressive statistics concerning the needs and the status of detailed geologic mapping in the U.S., efforts at passage of such legislation would undoubtedly fail without a public response to support those identified needs.

To develop this public support, the AASG, through the state geological surveys, launched a major effort to identify companies, organizations, and individuals at the national, regional, State, and local levels. The results were impressive, and played a key role in passage of the authorizing legislation.

The authorizing bill was introduced in the Senate by Senators Johnston (Dem., LA), Bingaman (Dem., NM) and Craig (Rep., ID) on May 23, 1991, and in the House of Representatives by Congressmen Rahall (Dem., WV), Vucanovich (Rep., NV), Brewster (Dem., OK) and McCurdy (Dem., OK) on June 25, 1991. The state geologists, working through various state-Ievel groups, were able to enlist a large number of co-sponsors for the House and Senate versions of the bill. At passage, the Senate bill (S. 1179) had 22 co-sponsors, and the House bill (H.R. 2763) had 48 co-sponsors. The result was that, following successful hearings, the bill passed both houses by unanimous consent and was signed into law on May 18, 1992, as Public Law 102-285, The National Geologic Mapping Act of 1992.

Public Law 102-285 authorized the first four years of the National Cooperative Geologic Mapping Program ("the Mapping Program"). Authorization and appropriation levels are listed in the table below. Authorization for the Mapping Program ended in FY 1996. A reauthorization bill for FY 1997 -2000 was passed by the House and referred to the Senate, but the bill died in the closing hours of the 104th Congress. Recognizing the value for cooperative geologic mapping, the President's budget request for FY 1997 included funding for the Geologic Mapping Program under the general funding authority for the USGS at the base level for FY 1997 ($21.8 M).

The President's budget request for FY 1998 again specified funding for the Mapping Program, albeit at a reduced level ($20.1 M, an 8% reduction). The 104th Congress restored the proposed reduction for FY 1998 and funded the Mapping Program at $22.2 M, a slight increase over the previous year. Intense constituent interest in reauthorization of the Mapping Act was expressed early in the 105th Congress. Representative Cubin (Rep., WY) introduced a reauthorization bill for FY 1998- 2000 on February 12, 1997. Following a positive hearing before the House Resources Committee, Subcommittee on Energy and Mineral Resources, the bill was passed by the House on March 11, 1997, and referred to the Senate. The bill was passed by unanimous consent on July 23, 1997, and signed by the President on August 5, 1997, as Public Law 105-36, the National Geologic Mapping Reauthorization Act of 1997.

Activities of the Federal Advisory Committee (1996-1998)

The National Cooperative Geologic Mapping Program's Advisory Committee ("the Committee") first met on April 24-25, 1996, to review the status of the Mapping Program and its Implementation Plan, discuss plans for the future, and to form working groups. During the year, the working groups made recommendations for the future of the Mapping Program, revised the Implementation Plan and evaluated the state and university Requests for Proposals. The Implementation Plan and the Annual Report for FY 1996 were submitted through the USGS and the Secretary of the Interior to the Committee on Resources of the House of Representatives and the Committee on Energy and Natural Resources of the Senate, as stipulated in the Mapping Act.

The Advisory Committee determined that except for an increase in funding, all components of the Mapping Program, as authorized by Public Law 102-285, had been implemented. Future plans focused on increasing partnerships between Federal, State, university, and private-sector groups in the production of geologic maps and in the construction of the National Geologic Map Database. Recommendations were made on how to integrate national, state, and local priorities in the selection and funding of projects, and on ways to address the shortage of trained geologic mappers. Each of these efforts was directed at increasing the effectiveness of geologic mapping and providing geologic map information for the solution of earth science problems that are critical to public safety, and in balancing resource, environmental, and land-use issues.

The Committee met again on April 3, 1997, for the annual review of the progress of the Mapping Program and to review the Mapping Program's new five-year plan, which was outlined at a planning workshop with constituents during February 1997. The Committee heard updates on the status of the National Geologic Map Database, on progress of the matching-funds programs with the state surveys and universities, and on Federal and support mapping activities. The Committee also provided written comments on the Mapping Program's five-year plan during the following year. The comments were incorporated in the revised five-year plan, which is used as the basis for setting priorities and for reporting progress under the Government Performance and Results Act.

The Committee met most recently on April 15-16, 1998 to review the Mapping Program Implementation Plan and progress made during the previous year. In addition, the Committee reviewed the National Geologic Mapping Reauthorization Act of 1997 and planned improvements to the Mapping Act in anticipation of reauthorization for fiscal years 2001-2005. The Committee also commented on revisions to the Mapping Program's five-year plan to bring the plan into alignment with the USGS Geologic Division's new Science Strategy, and with Department of Interior priorities. The Committee also discussed how the Mapping Program could better meet the needs of other Federal agencies, the States, the private sector and academia. The 1998 recommendations of the Committee are summarized in this report.

The Matching-funds components: STATEMAP and EDMAP

The matching-funds program components with state geological surveys (STATEMAP) and with universities (EDMAP) were fully implemented in FY 1996. Federal funding for the STATEMAP component increased in FY 1996 to approximately $4.4M, more than three times the funding level in FY 1995. The distribution of funds between the Federal and matching-funds components followed the allocation set out in the Mapping Act. The EDMAP matching-funds cooperative with universities was implemented for the first time in FY 1996, with the mandated funding level of approximately $440K. Funds were derived through decreases to the Federal mapping program component (FEDMAP). Funding was maintained at these levels in FY 1997, and increased slightly in FY 1998 as a small increase was distributed according to the provisions in the Mapping Act.

The number of state geological surveys participating in the STATEMAP component has increased each year. In 1998, matching funds were provided for approximately 150 geologic mapping projects in 43 States. State Mapping Advisory Committees are in place in all participating States and are composed of more than 500 geologic map users from the public and private sectors. These committees set priorities for geologic mapping within each State and rank the top geologic mapping project proposals to forward to a national awards panel managed by USGS. The awards panel, which consists of representatives from the state surveys, universities, and the USGS, evaluates proposals for matching funds awards. Since 1996, forty-eight States have participated in STATEMAP, with well over 200 geologic mapping projects receiving matching funds. Many of these mapping projects have produced multiple geologic maps, thus contributing hundreds of new geologic map products. Likewise, since 1996, sixty-eight universities have received matching funds from EDMAP to train over 130 graduate students to produce geologic maps. Similarly, participation in EDMAP has increased during the first three years of implementation. In 1998, 52 graduate students at 40 universities in 26 States received matching funds from EDMAP. All EDMAP proposals are endorsed by and coordinated with state geological surveys or USGS projects that have a geologic mapping component. Matching funds are awarded by the USGS on the basis of recommendations of an annual awards panel. The panel consists of representatives from universities, state geological surveys, and the USGS.

Issues addressed by STATEMAP and EDMAP projects are well aligned with priority needs for geologic mapping as identified by map users in the State, and include mapping in support of: ground-water resources, land-use planning, aggregate and other mineral resources, and natural hazards, as shown in the charts that follow. A larger proportion of the EDMAP projects address basic research issues, such as the resolution of questions about the geologic framework of various regions of the nation. This focus is consistent with the overall training mission of the EDMAP component, that is, to address the shortage of well-trained field geologists by providing experience in geologic mapping.

Each year, the national awards panels for STATEMAP and EDMAP make recommendations for changes to these program components. When appropriate, changes are made to the annual Request for Proposals (RFP). Recent changes include: revision of the EDMAP RFP to emphasize the training mission of the component, as specified in the Mapping Act; changes in the language of the STATEMAP RFP to encourage state surveys to limit overhead charges to eighteen percent or less; and changes recommended for the FY 1999 RFP to extend eligibility to Senior undergraduates for matching funds to support geologic mapping as components of senior thesis work. The Federal Advisory Committee reviewed each of these changes prior to implementation.

The Federal mapping and support components: FEDMAP

The focus and scope of FEDMAP geologic mapping projects changed dramatically during the 1990s. These changes were based on assessment of stakeholder needs for maps and followed recommendations of a National Research Council study that took place in 1985, and the steps outlined above that led to the National Geological Mapping Act. Federal project evolution continues and incorporates annual recommendations from the Federal Advisory Committee. Additional input was obtained from map users and stakeholders at a National Geologic Mapping Forum and five-year Planning Workshop with stakeholders in 1997 and at three Regional Geologic Mapping Forums that brought clients and stakeholders together with project personnel during 1997. New projects are developed in partnership with partners from other DOI and Federal agencies (e.g., NPS, DOE, EPA, and others), and with state surveys. Ongoing projects are undergoing mid-term reviews by program managers, senior scientists, and external partners. A council consisting of USGS managers and scientists, and representatives from state surveys and the National Park Service reviewed all FEDMAP projects on a regional basis in

1996. In June of 1998, representatives from state surveys, universities, and the private sector participated in the annual FEDMAP program council, where priorities for ongoing projects and new Federal mapping proposals were evaluated. As illustrated in the chart that follows, FEDMAP projects address multiple issues, with geologic mapping as the framework for understanding water and hazard issues receiving the highest funding priority.

The FEDMAP component has developed a new focus in near-surface geologic mapping, hydrogeology, and surficial geology. The Mapping Program's emphasis on basement mapping has decreased, although this type of mapping continues where appropriate to define the framework for resource, hazards, and environmental issues. This change in focus came about as a consequence of tracking and responding to map user needs. Strong partnerships with state geological surveys, growth of cooperative mapping projects with USGS Water District offices, and advice from stakeholders directed the Mapping Program into the near surface. Several projects within the Federal mapping program have conducted regional forums for geologic map users to obtain independent feedback on customer needs. Mapping Program managers are also participating in a bureau-Ievel customer service pilot study, which will be part of the USGS 1998 Customer Service Report.

The National Geologic Map Database, as mandated by the Mapping Act, was implemented as a digital database beginning in 1996. The initial phase of the database is an internet-based catalog of printed maps and mapping-in- progress in the USGS, state surveys, academia, and industry. The index is on the Internet and is being populated with metadata (as of 5/98 the catalog indexes approximately 50% of USGS holdings). The second phase of the project is to provide access and delivery of digital map data on the Internet. In order to deliver digital map data in a form that facilitates GIS use, standards and data models are being developed in partnership with a variety of USGS programs, with state surveys, and with the Geological Survey of Canada.

In order to better serve Department of Interior needs for geologic information, FEDMAP is the primary partner with the National Park Service (NPS) in the "Science in the Parks" initiative. Priorities for mapping projects to address NPS issues were determined by NPS in 1995. An initial suite of more than a dozen mapping projects, with a total funding level of $2M, were selected by a joint NPS-USGS panel and were begun in 1996. This funding level has been maintained in 1997 and 1998 as new projects have been started each year. These Science in the Parks projects are coordinated with NPS, through NPS-USGS liaisons at the Mapping Program and field operations levels. Geologic mapping projects are providing unbiased framework information on issues that range from potential impacts of lead mining on ground water in the Ozark Mountains to habitat preservation in Death Valley.

FEDMAP has dramatically increased its interactions and leveraged its resources with state agencies and other USGS programs. This is perhaps most evident in cooperative project work with the Ground Water Resources, National Research (NRP) and Cooperative Research programs of the Water Resources Division (WRD), and with the Bureau Ecosystem program. Cooperative projects include: 1) the Middle Rio Grande Basin Project (with the WRD District office in Albuquerque, NRP, Ground-water Resources, New Mexico Bureau of Mines and Mineral Resources, City of Albuquerque, and others), 2) the Southeast Coastal Plain Project (with the South Carolina WRD District and the SC-DNR), 3) the Southern California Areal Mapping Project (with the California Division of Mines and Geology, WRD Djstrict Office, and Mojave Water Agency), 4) the Las Vegas Urban Corridor Project (with the Las Vegas WRD sub-District), and 5) the South Florida Ecosystem Project (with the Florida state survey, and with a variety of USGS and other Federal and state partners). Strong cooperation with other Divisions and with Geologic Division programs is also a major factor in the success of several FEDMAP projects, such as the Urban Hazards in Puget Sound, Ozarks Scenic River project (with Mineral Resources and the MO-WRD- District), and infrastructure project and mapping areas of urban expansion and land subsidence in Colorado (with the Mineral Resources Program and the

Colorado Geological Survey). In addition, cooperation with a variety of USGS programs and Divisions is ongoing (e.g., Climate History, Mineral Resources, and Biological, Water, and National Mapping Divisions) in developing the USGS Mojave ecosystem initiative. The initiative-driven efforts have a demonstrated need for geologic mapping and a need for earth science work that addresses multiple issues. Consequently, they provide opportunities for growth of joint work involving all program components and with partners within MSG and other agencies.

Federal mapping projects in the San Francisco and Los Angeles areas led to strong cooperation with the USGS Landslides and Earthquakes programs, as well as with state and county agencies, in responding to hazards related to the 1997 -98 El Ninio weather pattern. This, and ongoing joint work with the Landslides program in the Appalachians, suggests that a new landslides initiative could be developed with stakeholders and partners. Cooperative work with the Minerals Program is improving the assessment of the economics of aggregate resources and their relation to urban growth in the Washington- Baltimore urban corridor.

FEDMAP is also contributing to the new Center for Earth Science Information Research (CESIR), a cooperative effort with Stanford University and other partners that began in 1996. The mission is to develop geologic and economic methods to assess the value of earth science information. CESIR grows out of an effort performed on behalf of the Office of Management and Budget in 1991 to assess the value of geologic map information. This initial response resulted in the publication of "Societal Value of Geologic Maps", USGS Circular 1111. Since 1992, more than 10,000 copies have been distributed. New partnerships and joint studies have been established with a number of projects and programs in USGS as a result of a series of short courses on the value of earth science information held during 1997. These range from assessing the economic consequences of ground shaking and liquefaction during earthquakes in California (with the California Division of Mines and Geology) to studies of the economic impacts of ground water contamination.

FEDMAP projects are also garnering significant outside funding to supplement existing funds where priorities are well aligned with program goals. The Mapping Program has long had a strong partnership with the Department of Energy at the Nevada Test Site and Savannah River Site. This effort was shrinking in 1995, but has rebounded and grown in 1997 and 1998. FEDMAP projects have been charged with developing new sources of funding in order to maintain a healthy balance between appropriated and outside funds, while maintaining a commitment to unbiased science. Through numerous funding agreements with the geologic mapping teams, outside funding amounts to approximately 15% of the FEDMAP budget. Funding for international mapping opportunities is also being explored.

FEDMAP is aggressively developing new opportunities for Federal, state, and academic partnerships through the DOl Initiative process. Starting in 1996, program managers and FEDMAP scientists met with state geologists and their staffs from the Great Lakes States to begin developing an initiative for geologic mapping and hydrogeology. Also in 1996, FEDMAP managers began work with the USGS Water Resources Division on a cooperative initiative to address national and local issues related to hydrogeology and ground water resources. Both of these efforts continue to grow. The Great Lakes Geologic Mapping Coalition is a result of a public forum on geologic mapping needs held during 1997 in Indianapolis and attended by 190 participants from 70 agencies. The coalition is now a partnership between the USGS and the state surveys of Indiana, Illinois, Ohio, and Michigan, and includes an ongoing 5-survey pilot project. The Coalition has prepared a prospectus and a draft USGS Circular for a long-term geologic mapping partnership in the region, has briefed Congressional delegations from the four states, and sponsored a workshop with managers of Region V, EPA. Coalition partners continue to consult with state and local map users and partners. Recent meetings with the University of Indiana and Purdue University, which included participation by the Federal Advisory Committee academic representative, indicate an interest among the upper Mid-West universities in designing a training program in surficial geology and GIS to complement the Coalition effort.

Cooperation with the USGS Ground-Water Resources Program led to a new initiative for expanded work in FY 2000, as well as mutual coordination of the FEDMAP component of the Middle Rio Grande Basin project and cooperation in developing other projects of mutual interest. Promising areas for future USGS-state coalition work include geologic mapping and hydrogeologic studies of basins in the Southwest, studies of hydro-stratigraphy and salt-water intrusion in the Southeastern Coastal Plain, and integrated geologic studies of river corridors. Program-managers also participated in the development of a plan to address geologic issues along the nation's river corridors and are planning the first steps in the development of a digital mapping initiative.

FEDMAP has been an active partner with the Florida Geological Survey and a variety of other partners in supporting subsurface geologic mapping and paleo-ecological studies as part of the sustainable ecosystem study of South Florida. In addition, the Mapping Program has participated in planning and GIS development for work in the Yellowstone National Park ecosystem and assumed a primary role in describing surface processes and their connections to biologic processes in the new Mojave ecosystem initiative. Finally, in addition to providing coordination for the Geologic Division, FEDMAP projects are contributing national-scale geologic map information for basement and surficial materials to the National Atlas of the United States.

Status and Progress of the U.S. Geological Survey's National Cooperative Geologic Mapping Program Through Fiscal Year 1999

Secretary of the Interior

Bruce Babbitt

CONTENTS

Members of the Committee

Federal Members

Patrick Leahy, Chair, Chief Geologist
U.S. Geological Survey
911 National Center
Reston, VA 20192
703-648-6600
pleahy@usgs.gov

John S. Pallister, Vice Chair
National Coop. Geologic Mapping Program
U.S. Geological Survey
908 National Center
Reston, VA 29192
703-648-6960
jpallist@usgs.gov

Beverly K. Hartline,
Office of Science & Technology Policy
Old Executive Office Building
17th Street & Pennsylvania Avenue
Washington, D.C. 20502
202-456-6130
bhartline@ ostp .eop. gov

Jo Lynn Traub,
U.S. EPA, Water Division, Region V
W-15J, 77 West Jackson Boulevard
Chicago, IL 60604
312-353-2147

Edith Allison, FE-32, Program Manger
Reservoir Characterization
Natural Gas & Petroleum Tech. Program
U.S. Department of Energy
1000 Independence Avenue SW Washington, DC 20585
202-586-1023
edith. allison@hq. doe. gov

Carla Kertis, USDA,
Natural Resources Conservation Service

1400 Independence Ave., SW, Rm. 6243
P.0. Box 2890
Washington, DC 20013
202-720-5381 202-690-3266
carla.ketis@usda.gov

State Members

Donald M. Hoskins,
Pennsylvania State Geologist Pennsylvania Geological Survey Bureau of Topographic and Geologic Survey
P.O. Box 8453
Harrisburg, PA 17105-8453
717-787-2169
hoskins. donald@ al. dcnr .stae .pa. us

Charles J. Mankin,
Oklahoma State Geologist
Oklahoma Geological Survey
100 East Boyd, Room N-131
Norman, OK 73019-0628
405-325-3031
cjmankin@ou.edu

Private Sector Member

Susan M. Landon,
Thomasson Partner Associates
1100 Stout Street, Suite 1400
Denver, GO 80204
303-436-1930
susanlandon@worldnet. att. net

Academic Member

Robert D. Hatcher, Professor
University of Tennessee
Department of Geological Sciences
306 G & G Building
Knoxville, TN 37996-1410
423-974-6565
bobmap@utk.edu

Reauthorization Act of 1997 and plans for reauthorization for FY 2001

On April 16, 1998, the Federal Advisory Committee reviewed the National Geologic Mapping Act of 1992, as amended by the National Geologic Reauthorization Act of 1997, to determine if revisions should be made prior to the next reauthorization of the Act for the period starting in FY 2001. The Committee made a series of suggestions as listed below and keyed to the sections of the 1992 Act:

Section 2 -Findings of Congress: The Committee determined that the basic findings remain valid. It was noted, however, that the Act does not adequately address the importance of geologic maps in maintaining sustainable resources of all types (minerals, energy, water, and biologic resources). The Committee recommended that this concept be incorporated, and that geologic map information must be integrated with other geospatial information to maximize usefulness. The Committee also felt that the Act should stress the need to increase efforts in surficial geology and in use of emerging technologies for digital map production.

Section 2, Subsection (b) -Purpose of the Act: The Committee had several suggestions. 1) The purpose of the Act should be moved to an earlier point in the document. 2) The Mapping Program should expand the definition of the term "database" to include Geographic Information Systems. 3) The USGS role as the coordinator of national standards for geologic maps and for meta-data should be explained in more detail. 4) Emphasis should be added on the role of the Act for stewardship of mapping and for education.

Section 4, Subsection (b) -Responsibilities of the Survey: The Committee recommended that the section should be rewritten to specify that the USGS responsibilities for reporting be met within the first year of reauthorization, or on an annual basis, as appropriate, rather than specifying time limits of 300 days, 90 days, and 210 days.

Section 4, Subsection (b), Paragraph (1) Subparagraph (A) -Responsibilities of the Secretary; Lead Agency: The Committee recommended that the terms "five-year plan" be substituted for "annual" and "national" plan, but that an annual review would be appropriate. It was recommended that the five-year plan be compatible with the requirements of the Government Performance and Results Act. Section 4, Subsection (b), Paragraph (1), Subparagraph (c) The Committee recommended that items (i.), (ii.), and (iii.) should be revised to be compatible with Subsection b.

Section 4, Subsection (c), -Program Objectives: The Committee found that the Mapping Program is making adequate progress in each of the objectives, within the appropriated funding limits. However, the Committee concluded that appropriated

funding for the Mapping Program is inadequate to meet the demand for geologic mapping.

The Committee found that the Mapping Program is making adequate progress in developing complementary geophysical, geochemical, geochronology, and paleontologic databases; however, performance could be measurably enhanced by improving coordination on both an internal and external basis.

In the application of cost-effective mapping techniques, the Committee found that good progress has been made, but that there are no methods in place to allow a rigorous assessment of cost effectiveness. The Committee recommended that the Mapping Program and its partners develop ways to make geologic maps more widely and easily usable.

In the development of public awareness, the Committee concluded that the Mapping Program and its partners should develop outreach plans that are better coordinated between Federal and State agencies, and academia.

Section 4, Subsection (d), Paragraph (1) Program Components; Federal Component: The Committee found that the criteria for prioritization should be clarified, for example in a five-year plan; however, care should be taken to ensure that the criteria are not so specific as to loose flexibility. Also, the need to coordinate with other Federal agencies was emphasized.

Section 4, Subsection (d), Paragraph (2) Program Components; Support Component: The Committee recommended that the language be updated to show that the FEDMAP and SUPPORTMAP components are already combined and should simply be referred to as FEDMAP .

Section 4, Subsection (d), Paragraph (3) Program Components; State Component: The Committee recommended that this section be rewritten to parallel the construction of the FEDMAP component. It should be pointed out that standards for both FEDMAP and STATEMAP are the same and are being developed jointly by USGS and AASG. It was also recommended that the term "environment" be added to the list of justifications for geologic maps. The Committee further recommended that the Mapping Program should explore the possibility of allowing other Federal agencies to participate in STATEMAP and EDMAP.

Section 4, Subsection (d), Paragraph (4) Program Components; Education Component: The Committee determined that additional funds are needed for this component of the Mapping Program and that it should be emphasized that the prime purpose of EDMAP is to train the next generation of geologic mappers. The Committee also determined that the current requirement for endorsement of projects by state surveys or by USGS is adequate for aligning priorities between program components and that surveys should recognize that the prime role of EDMAP is

education in geologic mapping. Contributing to the national geologic map database and addressing immediate societal needs are secondary goals for EDMAP .

Section 5, Subsection (b) -Advisory Committee; Duties: The Committee recommends that item 1, "review and critique the draft implementation plan" should be revised to be consistent with suggestions for Section 4, Subsection b, Paragraph (1) Subparagraph (A), and to acknowledge that the implementation plan was completed under the original authorization. Substitution of "annual review' should be sufficient.

Section 6- **Geologic Mapping Program Implementation Plan:** As in Section 5, this section should be replaced with a reference to the existing Implementation and 5-year plans.

Section 7 -National Geologic-Map Database: The Committee recommends that, consistent with current USGS Geologic Division Science Strategy, the database should serve as a searchable index for all USGS Geologic Division data, in addition to serving as a distributed database that links to state survey geologic map metadata. The database should also access digital USGS map data, and the database should link to appropriate servers in States and other agencies.

Section 9 -Authorization of Appropriations: The Committee recommended that authorization levels be evaluated in subsequent years to determine if they should be increased under subsequent reauthorizations. The Committee felt that the current manner of setting authorization levels between the Mapping Program components is still appropriate, although the language dealing with increases above the base funding level could be simplified and reviewed for consistency.

Implementation plan

It was noted that the draft Implementation Plan was reviewed and finalized by the Federal Advisory Committee in 1996, and that the final version was submitted to the Secretary of the Interior and the Committees on Resources in the House and Senate at that time. The current advisory committee reviewed the Implementation Plan in the context of additional revisions that are needed under the 1997 reauthorization.

Section III-B-2 -Advisory Committee: This section should be revised to reflect the new composition of the Committee under the 1997 reauthorization. It was further suggested that increased government and private sector representation could be obtained by seeking informal participation by observers.

Section III-B-3- Proposal Review: It was recommended that the FEDMAP program component include representatives from state geological surveys, universities, and the private sector for annual project reviews. In addition, involvement

of representatives from local groups, such as regional planning commissions, may be appropriate for some reviews.

Section IV-B-1 -Geologic Mapping Support Component: The reference under this section that the States can contract for interdisciplinary support services from the Federal support component by "using funds from the STATEMAP component" should be eliminated, as it is in conflict with U.S. government policy on use of grant funds. A similar change should be made on the following page and under section IV-C-3-b. The Committee recommends that alternative means be developed to support these activities in the state and university components.

Miscellaneous: The Committee recommends that the primary function of EDMAP, to train the next generation of geologic mappers, should be added to the Implementation Plan. A section should be added that discusses the framework for developing regional (multi-state and USGS) coalitions for geologic mapping. A section should be added on mechanisms for measuring success of outcomes.

Alignment of Five-year and Implementation Plans with Geologic Division Science Strategy

In 1997 the Advisory Committee reviewed the Mapping Program's five- year plan. In 1998 the Committee reviewed "Geology for a Changing World -A Science Strategy for the Geologic Division" and a five-page "Draft Action Plan, National Cooperative Geologic Mapping Program, Geology for a Changing World, Science Goals, 2000-2010." The latter describes steps that are being taken by the Mapping Program to respond to the Geologic Division strategy.

The Committee noted that the Geologic Division strategy specifies seven principal science goals for the Division and States that geologic mapping is "essential to achieving each of these seven goals." The Committee concluded that the action plan adequately describes how the Mapping Program can respond to the seven goals, but notes that links to Climate Change and Ecosystems should be strengthened.

The Committee suggested that a stronger focus on STATEMAP and EDMAP should be added to the action plan, and that the ability of the Program to bring multi-disciplinary efforts to bear on earth science issues and links to other programs could be emphasized.

The Committee suggested that examples of good interactions and coordination with EPA, USDA, DOE, and other Federal agencies should be added.

The Committee found that the seven categories of primary earth science issues addressed by FEDMAP projects are appropriate and align well with the Geologic Division goals.

The Committee noted that many of the Geologic Division goals are focused on impacts of humans and population centers and recommends that the Geologic Mapping program should be driven first by issues, and mapping should focus on geographic areas that require geologic information. Consequently, a focus on "urbanizing" areas and other areas of high environmental impact is appropriate.

The Committee endorses the recent change in the FEDMAP prospectus for FY 1999, in which geologic mapping support for the National Park Service is integrated into the seven primary issue theme areas being addressed by geologic mapping.

The Government Performance and Results Act (GPRA) pilot plan for the Geologic Mapping Program lists six separate goals for the Mapping Program. A single goal that attempts to integrate the six goals has been drafted. This single goal is entitled: "Business Activity 5, Land and Water Use." The Committee reviewed the goals but did not reach consensus. Concern was expressed that having only one goal could put the Mapping Program in jeopardy; however, it was recognized that multiple goals are likely to be impossible to track and to use effectively under GPRA given the size of the Mapping Program.

The Committee endorses the use of regional workshops to assess map- user needs and to develop State-Federal partnerships and regional coalitions to leverage resources and support. In addition, the Committee recommended that input from other Federal agencies be solicited when developing regional coalitions.

The Committee recognized the potential difficulty in communicating the multi-purpose value of geologic maps in the public policy arena. Focusing on a smaller number of high-profile issues may help, but the Committee recommends that a broad range of issues needs to be maintained when describing the uses of geologic maps. Differences in priority issues from one region of the country to another and between Federal, State, and private sectors require this breadth, especially when describing the national-scope of the Mapping Program.

The Committee recognized the value that may accrue from exchange of professional positions from agency to agency, and, to the degree it is mutually acceptable, the Mapping Program should encourage exchanges of staff between the USGS and its state and academic partners.

The Committee is aware of geologic mapping partnerships between program projects and private-sector firms. It is recommended that such partnerships for geologic mapping should only be developed where they are cost-effective and appropriate for the issues. The Mapping Program should also seek to increase its work on behalf of other Federal agencies.

Outreach and information dissemination on the value of geologic mapping

The Advisory Committee believes that the Geologic Mapping Program is relatively effective in communicating the value of geologic mapping to certain segments, such as Congress, but the Mapping Program should improve its outreach to the Department of Interior, the Executive Branch, and the public. A goal for the Program should be to seek ways to align Geologic Mapping priorities that are shared by map users in the public with Executive Branch initiatives. In this manner, the cooperative partnership that is a foundation for the Mapping Program could be effectively used to direct geologic mapping activities toward goals that are common to local, State, and Executive Branch priorities.

Another area for improvement in outreach is the public and the national media. Although many effective outreach activities are ongoing within individual projects, and by program partners, there are few national-level activities that communicate the value of geologic map information to the public and the media. The Mapping Program should explore ways to better communicate this information to the national audience. It is recommended that program managers work with national organizations, such as the American Geological Institute, to improve this outreach component.

Recommendations concerning STATEMAP and EDMAP Requests for Proposals

Several specific recommendations were forwarded to the Advisory Committee on behalf of the STATEMAP and EDMAP awards panels. The panels recommended minor changes to the Requests for Proposals and these proposed changes were endorsed by the Committee.

The Committee endorsed the EDMAP panel recommendation that starting with the FY 1999 funding cycle, seniors in undergraduate colleges may be eligible for matching funds support for geologic mapping projects as part of their senior theses. The EDMAP review panel will consider the undergraduate applicants separately from the graduate student applicants, thus ensuring fair competition. An as yet undetermined, but small, percentage of total EDMAP funds will be allotted to undergraduate mapping on a trial basis.

The Committee also suggested that a mechanism be created to allow EDMAP panel members the opportunity to review the map products from previous years prior to making funding decisions in the current awards year and to provide feedback to the mappers and their faculty advisors.

The Committee also recommended that an endorsement for a student-mapping project by either a state geological surveyor the USGS not be interpreted as committing those organizations to publish the results.

Committee Actions and Plans- FY 1998-1999

In addition to preparing this report, members of the Advisory Committee will be available to provide additional advice to the Director of the USGS and his representatives during the year, either individually or as a group. The next scheduled meeting of the Advisory Committee is set for September 21-22, 1999.