

GEOLOGICAL SURVEY

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From the point of view of the geologists of this continent, the important event of the year was the meeting in Washington, in July, of the sixteenth session of the International Geological Congress. The only other session held in the United States was the fifth, in 1891.

The technical sessions were held during the week July 22-29. They were preceded and followed by excursions to points of geologic interest east and west, two of them crossing the continent to the Pacific and back. One hundred interesting and valuable papers dealing with the geology and mineral resources of various parts of the world were presented and discussed. Nine of these papers were presented by members of the Survey staff. Leading geologists from all the principal nations were present and participated, 34 foreign countries being represented by official delegates. The total enrollment included 1,181 scientists and scientific institutions, about one-third of them from abroad. The various geologic institutions and individual geologists of the United States shared in the duties of host, served as officers of the Congress here and as guides on the geologic excursions, and participated in the preparation of the guidebooks for these excursions. In all these activities the staff of the Survey participated. Two principal publications arising out of the activities of the Congress are in course of publication—the report containing the proceedings of the Congress and a volume on the “Copper resources of the world.”

The Geological Survey hastened the issue of its new geologic map of the United States, which had been in preparation for a number of years, so that it appeared in time for the meeting.

The year has been one of adaptation to altered conditions of government. The new agencies and services have made many and varied demands upon the facilities and the staffs of the Survey. Its specialists and their specialized knowledge in problems of water supply, mapping, geology, engineering, and land classification have been in embarrassing demand. Difficult adjustments were necessary at the beginning of the year. Economy legislation had reduced regular appropriations to a point where many separations from the service were necessary and many important projects had to be suspended. Later the Public Works Administration allocated funds which completely absorbed the available engineers of the Survey staffs and per-

mitted the employment of many hundreds of unemployed technical men in undertaking or advancing important projects, such as topographic mapping, the suppression of mine fires, the plugging of abandoned oil wells on the public domain, and a survey of some of the more important mineral resources of the Eastern and Southern States. The Survey is thus enabled to continue to apply its specialized technical services in valuable ways during the emergency. Its activities for the time being are somewhat out of normal balance, the greatest present loss, which it is hoped is temporary, being in facilities and funds for publication. A summary of the activities of the year follows.

The appropriations made directly for the work of the Geological Survey for the fiscal year 1934 included 11 items, amounting to \$1,992,500. Principally because of economy measures by the administration, which restricted the use of these funds, the balances of these appropriations unexpended as of June 30, 1934, totaled \$346,287.23, of which \$248,000 was continued available for expenditure during the fiscal year 1935. In addition, \$9,345.80 was allotted from appropriations for the Interior Department for miscellaneous supplies.

A detailed financial statement is given at the end of the report.

GENERAL SUMMARY OF THE YEAR'S ACTIVITIES

Geologic work.—The geologic field work done during the year included a continuation of surveys of phosphate and oil shale in Wyoming, oil in California, coal in New Mexico, and metal-mining districts in Colorado, Idaho, and New Mexico, also work under allotments from the Public Works Administration in 19 States east of the Rocky Mountains, on projects involving mineral-resources and land-classification surveys. The work in the metal-mining districts was aided by cooperative funds provided by the States, and continuation of the volcanologic work in Hawaii was made possible by contributions from the Hawaiian Research Association. A survey of the mineral resources of the Boulder Dam region in Nevada, Arizona, and California was made for the Bureau of Reclamation, and reservoir dam sites in several Western States were examined for the Bureau of Reclamation and the Indian Service. During the year 4,259 examinations were made by the section of chemistry and physics, including 1,109 tests or identifications of specimens for persons not officially connected with the Survey.

Explorations in Alaska.—In the field season of 1933 4 field projects in Alaska were undertaken, 2 of which were primarily topographic and 2 primarily geologic. One of the topographic projects was carried on in cooperation with the Navy Department, and one of the geologic projects in cooperation with the Alaska Railroad. The usual general survey of recent mining developments and the collection of mineral statistics were continued. Seven field projects for the season of 1934 had been started at the end of the fiscal year and will be continued throughout the open season. One of these projects is carried on in cooperation with the Alaska Railroad. In addition to these field projects, work was continued throughout the year in the preparation of base maps from the aerial photographs taken in 1926 and 1929 by the Navy Department. For part of the time this cooperative work was carried on in the Washington office, but for the greater part of the year it was done in Juneau, Alaska, with an enlarged staff.

Topographic mapping.—The area mapped topographically during the year amounted to 21,534 square miles, and the total area now mapped exclusive of Alaska is 1,394,266 square miles. Ten States, the District of Columbia, and Hawaii are completely mapped, and the percentages in the other States range from 9.4 in Florida to 88.9 in Virginia. Of the continental United States exclusive of Alaska, 46.1 percent has been mapped. Cooperative funds furnished by the States for topographic mapping during the year amounted to \$181,692.24 and came from 12 States and 1 county. Cooperative aid was also extended to the Division of Subsistence Homesteads.

At the request of the Bureau of Public Roads, through the use of transferred funds, the preparation of a transportation map of the United States was begun. The plan provides for a series of 439 rectangular sheets on a uniform scale of 1:250,000, covering the entire country but to be issued in State units. The maps will show the routes of travel and transportation by land, water, and air.

Aerial photographs were furnished by the Air Corps, United States Army, covering 7,961 square miles, and by commercial firms covering 23,522 square miles, for use in the compilation of topographic base maps, both with and without contours.

Investigation of water resources.—The work on water resources is done largely in cooperation with Federal bureaus, with State, county, municipal, and other governmental agencies, and with permittees and licensees of the Federal Power Commission. The funds made available by States and municipalities for cooperative work during the year amounted to \$467,226.35. In addition, data valued at over \$145,000 were furnished by cooperating officials. Investigations of surface water were carried on in the 48 States, the District of Columbia, and Hawaii, and 2,941 regular gaging stations were being maintained at the end of the year. In this work 41 States and Hawaii cooperated. About 65 investigations relating to ground water were in progress during the year in 28 States and Hawaii. In the hydrologic laboratory 383 samples of water-bearing material were analyzed. The work on quality of water involved the analysis of 1,226 samples from surface and underground sources. The investigations of power resources included the preparation of monthly and annual reports on the production of electricity for public use and the fuel consumed in generating it, a report on the developed water power of the United States, and a report on the capacity of water wheels in water-power plants in the United States. Investigations of problems affecting the utilization and control of the waters of streams were continued.

Classifying and leasing public land.—The classification of public and quasi-public lands with respect to mineral, water-power, and agricultural value and the technical supervision of mineral and power development on such lands were continued in 22 States and Alaska. The number of cases involving land classification acted on during the year was 10,464, and the results accomplished include the classification of 482,840 acres as coal land, 593,834 acres as noncoal land, with a net reduction of 936,433 acres in outstanding coal withdrawals. At the end of the year the total area classified as mineral in character was 37,487.759 acres in 14 States and Alaska, and the outstanding mineral withdrawals amounted to 49,985,402 acres in 14 States. Definitions of "known geologic structure" covered 15,395 acres in 3 States, and at the end of the year the areas so defined amounted to 960,346 acres in 7 States. Investigations to obtain basic information as to the water-power resources of public lands covered about 1,400 linear miles of streams in 11 States and included studies of foundation material and conditions at 6 dam sites in 3 States. There was a net increase of 117,561 acres in the existing power reserves, making a total of 6,800,371 acres in 22 States. The areas designated as subject to the stock-raising homestead act had a net reduction to 119,339,332 acres in 20 States, and the area designated as subject

to the enlarged-homestead act had a net reduction to 294,413,685 acres in 14 States. There was a net increase in public water reserves, to 494,728 acres in 13 States. Federal properties subject to the mineral-leasing laws under supervision at the end of the year numbered 7,122 in 19 States and Alaska and involved a total of 9,541,487 acres. Leases, licenses, and prospecting permits were issued for 1,247 properties and terminated for 368 properties. The mineral production from lands under leases, licenses, and permits amounted to 25,055,175 barrels of petroleum, 57,866,857 cubic feet of natural gas, 87,728,595 gallons of gas gasoline, 2,688,687 tons of coal, 289,837 tons of potassium, 45,830 tons of sodium, and 43,067 tons of phosphate. The revenue accrued from these operations in the form of royalty, rent, or bonus amounted to \$3,991,571. Technical supervision of mineral development on Indian lands and of operations for the production of oil and gas in naval petroleum reserves was continued. The work undertaken with funds allotted by the Public Works Administration covered 49 projects in nearly all the public-land States. The allotments for these projects amounted to \$889,964. Most of the projects were planned for continuance during a period of 18 months and were not completed at the end of the year.

Publications.—The publications of the year consisted of 47 books and pamphlets in the regular series, covering 6,602 pages, 91 new or revised maps, and 157 reprinted maps. In addition to these publications, 46 brief papers in mimeographed form were issued as memoranda for the press. The publications distributed numbered 774,927, of which 1,358 folios and 457,965 maps were sold for \$36,723.30.

GEOLOGIC BRANCH

SUMMARY

At the beginning of the fiscal year the geologic branch faced a reduction of 37½ percent from the inadequate funds available for the preceding year. Field work was still further curtailed, though four small parties already in the field, surveying phosphate and oil shale lands in Wyoming, oil in the San Pedro Hills of California, and coal in northwestern New Mexico, were continued in field service for varying brief periods. With the aid of cooperative funds contributed by the States, work was also continued in the metal-mining districts of Colorado, Idaho, and New Mexico.

Geologists unable to undertake field investigations devoted their energies largely to completion of reports on field surveys of previous years. Office work was reduced, however, by the extended administrative furloughs that were necessary for members of the branch's professional staff. Volcanologic work in Hawaii could not have been continued without the help of the local voluntary Hawaiian Research Association, which contributed a large proportion of the salaries of the three employees and the expenses of the observatory on Kilauea.

Early in January 1934 the Public Works Administration allocated \$276,000 for mineral-resource and land-classification surveys by the geologic branch in 19 States east of the Rocky Mountains, from New York and North Dakota on the north to Florida and Texas on the south. Work was begun on these projects almost immediately in the South and extended northward as climatic conditions per-

mitted. It will be continued on most of the projects through a considerable part of the next fiscal year. The progress of the work on each of them is summarized under the heading "Work of the year, by States." While giving employment to more than 150 unemployed geologists, engineers, technical assistants, and laborers, these projects have necessarily been under the direct supervision of trained members of the branch's regular staff.

Members of the geologic branch were also detailed to conduct a survey of the mineral resources of the Boulder Dam region in Nevada, Arizona, and California for the Bureau of Reclamation, and to assist in Public Works projects under the conservation branch in Oklahoma and under the water-resources branch in Georgia, New Jersey, Colorado, Utah, and Arizona. Geologists have also been assigned to the examination of reservoir dam sites for the Indian Service and the Bureau of Reclamation in several Western States.

WORK OF THE YEAR, BY STATES

Alabama.—Reports on the brown iron ores of the Russellville district and the iron ore of the Red Mountain formation, in northeastern Alabama, cooperative projects with the Geological Survey of Alabama, are in preparation. Projects in the State financed by the Public Works Administration were begun by parties supervised by members of the Geological Survey, with 26 temporary employees. Mapping of the Woodstock brown iron ore area was done under project 157. Project 161 provided for investigations in the Russellville district to determine the reserves of brown iron ore; a study of gold and tin resources, comprising a reconnaissance through the mineralized areas in northern Alabama, with mapping of the Hog Mountain and other gold-mining districts, and an examination of tin prospects resulting in a brief paper on "Tin deposits of Alabama"; explorations for bleaching and other high-grade clays; and a survey of bauxite deposits.

Arizona.—Reports are in preparation on the geology and ore deposits of the Ajo copper district, the geology of the Tucson quadrangle, and manganese deposits near Artillery Peak. The Boulder Dam investigation is noted under California.

Arkansas.—Under Public Works project 163, field studies were made of coal and gas resources of the Arkansas Valley in Sebastian County and adjacent areas in Crawford, Franklin, and Scott Counties; detailed topographic and geologic mapping of the southern Arkansas quicksilver district and investigations of supposed cinnabar occurrences outside the main district were carried on; and a preliminary reconnaissance to determine areas for prospecting for bauxite was conducted in Pulaski, Saline, and Hot Springs Counties. These surveys, which gave employment to 16 temporary assistants, were all still in progress at the end of the year. A paper on enargite and wulfenite in ore deposits of northern Arkansas was transmitted for outside publication, and a paper on the origin of lead and zinc deposits of northern Arkansas was prepared for presentation before the Geological Society of Washington. Other projects and reports are noted under Oklahoma.

California.—Work was continued on the general report on the Kettleman Hills oil and gas field, on a paper on faulted folds and the formation of arcs of the North Dome of this field, and on core and outcrop samples from the region, and an advance edition of a geologic and structure map of the area was issued.

Field work in connection with the study of source rocks of oil was continued in the vicinity of Los Angeles and other areas, and, aided by a grant from the Geological Society of America, samples were collected from many localities in the State in connection with the study of the calcium carbonate content of fine-grained clastic sediments. A paper on the source beds for petroleum in the Mesozoic rocks on the west side of the Sacramento Valley was completed for publication in the Bulletin of the American Association of Petroleum Geologists, and work was continued on a report on salinity compared with temperature as a factor affecting the calcium carbonate content of sediments. Field work in the San Pedro Hills was completed, and office work was begun on the compilation of data for a report on the geology and mineral resources of the area. Studies of the lithium pegmatites of San Diego County were resumed. A survey of the Nevada City mining district was begun with aid from the Geological Society of America. Continued field and office work was done in connection with the preparation of reports on the San Andreas Rift and Cajon Pass and the southern portion of the Death Valley region, and progress was made on reports on the geomorphology of the upper San Joaquin Basin, on the Monterey siliceous rocks, on the Grass Valley mining district, and on chromite deposits in northern California.

By the aid of a transfer of \$10,000 from a fund of \$25,000 allotted by the Public Works Administration to the Bureau of Reclamation for a resource and industrial survey of the Boulder Dam region, 6 geologists of the Geological Survey devoted from 6 weeks to 4 months each to the field study of the mineral resources that lie in Arizona, California, Nevada, and Utah within 200 miles of the Boulder Dam. A reconnaissance survey was made of the principal ferrous and nonferrous metal deposits and most of the nonmetallic mineral deposits of the area, and a somewhat more detailed study was made of the magnesite resources of the Muddy Mountains, Nevada. A preliminary report on this survey is about ready for transmission, and the final report will be completed soon. Drafting work toward the completion of the geologic map of California was carried on under Public Works project 153, and a new building for the volcanologic station at Mineral was completed under project 151.

Colorado.—Investigations of the mining regions of the State have been carried on for several years in cooperation with the Geological Survey Board of Colorado and the Colorado Metal Mining Fund. Field work was continued in the Ouray, Red Mountain, and Sneffels districts of the San Juan region and in the Nederland tungsten district of Boulder County and other parts of the Front Range and was completed in the Jamestown district, Boulder County, and in the Snowmass district, Pitkin County. The smaller mining districts of Chalk Creek, Granite, Frisco, and Tenmile were examined, and stratigraphic studies of several sections were made. A press memorandum on the Red Arrow gold discovery, in the La Plata Mountains of Montezuma County, was issued; the report on Paleozoic stratigraphy was nearly completed; some progress was made on a general report on the geology and ore deposits of the State and on a report on the Cripple Creek district. Two papers resulting from these investigations were published by the Colorado Scientific Society—"Vein system of Arrastre Basin and regional geologic structure of the Silverton and Telluride quadrangles" and "A recent rock slide near Durango, in La Plata County"—and several other papers were submitted for publication through unofficial mediums.

At the request of the Public Works Administration, examinations were made in the Cripple Creek district with special reference to a proposed deep drainage tunnel and at the town of Englewood with reference to the adequacy of the artesian water supply. An examination of the Douglas Creek diversion tunnel was made for the State engineers.

Florida.—Areas of reserved public lands in Marion and Polk Counties are being prospected for phosphates under Public Works project 164, by a party in which 10 temporary assistants are employed. Reports were in progress on the Tampa limestone, on Choctawhatchee gastropods from the Allaqua Creek Valley, and on Pelecypoda of the Alum Bluff formation. Reports on a new species of *Pecten* from the Oligocene near Duncan Church, Washington County, and on the pelecypod genus *Vulsella* in the Ocala limestone of Florida and its bearing on correlation were submitted for publication in a scientific journal.

Georgia.—Work on the gold and associated economic minerals of Georgia, by parties working under Public Works projects 158 and 165, consisted of detailed mapping in the Dahlonega district of Lumpkin County, examination of mines of McDuffie County, a reconnaissance of all the active gold properties and most of the old mines of the State in the gold belt, and a reconnaissance of kyanite and vermiculite in northern Georgia. Field reports and maps have been prepared.

Idaho.—Cooperation with the Idaho Bureau of Mines was continued in the mining districts of the Boise Basin, Thunder Mountain, Yellow Pine, and the western part of the Nez Perce National Forest. Work was continued in the office on the compilation of data for a report on the geology and ore deposits of the Bay-horse region, Custer County; a general report on southeastern Idaho; and a report on the Idaho mining districts (a revision of the Idaho portion of Bulletin 507). Reports by geologists of this Survey on the Dome mining district, Butte County, and on gold-bearing gravel of the Nez Perce National Forest were published as Pamphlets 39 and 40, respectively, of the Idaho Bureau of Mines. Preparation of a report on the geology and mineral resources of the Paradise Valley and Ammon quadrangles was continued.

Papers on recent block faulting in Idaho, on contact phenomena associated with the Cassia batholith, on the composition of a part of the Idaho batholith, Boise County, on silver mineralization in the Banner district, Boise County, and on the correlation and interpretation of Paleozoic stratigraphy in south-central Idaho and an abstract of a paper on stratigraphic correlation by heavy minerals in Paleozoic beds in Idaho were transmitted for outside publication.

Illinois.—Work on the Pottsville flora of the Eastern Interior Basin was continued in cooperation with the Illinois Geological Survey. Under Public Works project 166 an investigation of the fluorspar reserves in southern Illinois was begun by a party of four temporary assistants under the supervision of a geologist of the United States Geological Survey.

Indiana.—Office work was continued on a report on new crinoid genera from the Mississippian, Devonian, and Silurian.

Iowa.—Work was continued on a paper on the typical Kinderhook fauna.

Kansas.—Under Public Works project 167 a survey of the coal resources of Cherokee, Osage, Labette, and Crawford Counties was begun by a party which included three temporary junior geologists, and geologic mapping and examination of mines were carried on in southeastern Kansas as part of a study of lead and zinc in the tri-State district (Oklahoma, Kansas, and Missouri).

Kentucky.—Public Works project 168 provided for detailed mapping of the coal field in Pike County, in which 8 temporary junior geologists were employed, and for a survey of the deposits of bleaching and other high-grade clays of western Kentucky by a temporary junior geologist, with 2 rodmen, under supervision of Survey geologists. Work is still in progress.

Maryland.—A study of the sand and gravel resources of the area tributary to Washington and Baltimore is being made under Public Works project 169 by a geologist with one assistant and has covered areas in Prince Georges and Montgomery Counties.

Massachusetts.—Work on the geology of the Taconic quadrangle was continued.

Michigan.—See Minnesota.

Minnesota.—A report on the pre-Cambrian rocks of the Lake Superior iron-ore region is in process of publication by the Survey as Professional Paper 184.

Mississippi.—Public Works project 171 provided for an investigation of the bleaching and other high-grade clays of Mississippi, and reconnaissance examinations in several countries of south and central Mississippi, with detailed examination of some more promising deposits in Smith County, were made by 2 geologists and 3 assistants. A brief examination of bauxite in the vicinity of Ripley, Pontotoc, New Albany, and Oxford was made. A paper on the volcanic and structural history of the Jackson anticline is in preparation.

Missouri.—In connection with investigations under Public Works project 172 for a study of the tri-State lead and zinc area, stratigraphic studies, mapping of underground structure, and examination of the principal mines were made by a party of three temporary employees working under the supervision of a Survey geologist, in the Joplin, Waco, Jet, and Carthage districts, Jasper County, and the Diamond district, Newton County. This project also provided for investigation of the manganese deposits of southeastern Missouri, the field work for which was completed.

Some progress was made on reports in preparation on the Pleistocene diversion of the Mississippi River across Crowleys Ridge, in southeastern Missouri, on the Warsaw fauna of the Boone limestone from the Joplin district, and on the fauna of the Louisiana limestone of northeastern Missouri.

Montana.—Reports on the lignite field of McCone County and on the Mizpah coal field of Custer County were completed for Survey publication, and reports on the geomorphology and glacial geology of western Montana, fossil plants from the Fort Union and associated formations, the geology and mineral resources of parts of Liberty Hill and Chouteau Counties, the Pioneer gold district, and the phosphate near Maxville, Philipsburg, and Avon, Granite County, were in preparation. A report on the geology and ore occurrences in the Flathead mine and vicinity, Flathead County, was transmitted to the Montana Bureau of Mines for publication. Mapping of the geology and ore deposits of the Libby quadrangle was continued. A report on gold quartz veins south of Libby was issued as Circular 7.

Nevada.—Reports are in progress on the Tonopah, Tuscarora, Gold Range, Searchlight, and Delamar mining districts. A report on the Contact district was completed and transmitted for publication, and a number of papers prepared as byproducts of the official reports were submitted to scientific and technical journals.

New Mexico.—Field studies on the east side of the San Juan Basin, in Rio Arriba County, were continued with special reference to the coal and oil possibilities of the region. The report on the La Ventana-Chacra Mesa coal field, lying partly in McKinley, Sandoval, and San Juan Counties, was completed for publication as part 3 of the bulletin on the geology and fuel resources of the southern part of the San Juan Basin, and work was continued toward the preparation of a detailed report on the Mount Taylor coal field. Studies have been carried on in cooperation with the New Mexico Bureau of Mines and Mineral Resources in the Central mining district and the Virginia mining district of the Lordsburg area, and a report on the Bayard area of the Central mining district was completed. A report on the geology and ore deposits of the Magdalena district is in preparation. Economic and petrographic studies of cores from Government potash tests were made.

New York.—A survey of the gas resources of south-central New York under Public Works project 173 was in progress in Allegany, Cattaraugus, Chemung, and Steuben Counties, by 2 geologists, with 7 temporary assistants.

North Carolina.—The gold-bearing regions of North Carolina, including the principal gold-placer areas, were examined by several parties directed by Survey geologists under an allotment from the Public Works Administration (projects 158 and 174). One party consisting of a temporary geologist with assistance of a rodman completed geologic mapping and examination of mines and mining localities in the slate belt extending from Anson County to Davidson County; and another party made a reconnaissance of the gold-bearing regions of the western part of the State, with detailed studies of the mines and prospects in Gaston and Mecklenburg Counties. Reports on these investigations were well advanced.

North Dakota.—The Public Works Administration under project 159 provided for an investigation of the coal resources of the Minot district, and work was begun in May and continued to the end of the fiscal year by a Survey geologist and two temporary assistants. Mapping of the Minot and Sawyer quadrangles and the northern part of the Benedict quadrangle was accomplished.

Oklahoma.—A study of the lead and zinc of the tri-State district (Oklahoma, Missouri, and Kansas) was financed by the Public Works Administration, the work in Oklahoma being a part of project 175. Before detailed work was begun a preliminary reconnaissance of the district was made by two Survey geologists. For several months a Survey geologist with four field assistants has been engaged upon a study of the structural features of certain typical mines of the region, including those near Picher, with a general stratigraphic examination of the area. Project 175 also provided for a study of the coal and gas in the Henrietta-Eufaula-Stone Bluff area of eastern Oklahoma. A party under the direction of 2 Survey geologists employing 2 junior geologists and 3 field assistants mapped an area in northern Pittsburg, western Haskell, and western Latimer Counties.

Office work on reports on the following subjects was continued: The Howe-Wilburton coal district of southeastern Oklahoma, the Pennsylvanian flora of the coal fields of eastern Oklahoma, the Moorefield fauna, the fauna of the Sycamore limestone, and the Radiolaria from Arkansas novaculite and from the Bigfork chert of Oklahoma and Arkansas; and the report on the geology and coal resources of the McAlester district, Pittsburg, Atoka, and Latimer Counties, was completed for official publication. Papers on the correlation of the Pennsylvanian strata in the Arkansas and Oklahoma coal fields, the Carboniferous rocks of the Ouachita Mountains, the relation of the Ouachita belt of Paleozoic rocks to the oil and gas fields of the Midcontinent region, and the age of the Jackfork and Stanley formations of the Ouachita geosyncline as indicated by plants were submitted for publication by the American Association of Petroleum Geologists.

Oregon.—Reports on the geology and mineral resources of the Baker quadrangle and on nonmetallic mineral resources of eastern Oregon have been submitted for publication. Circular 8, on the beach placers of the Oregon coast; Bulletin 846-A, on some mining districts of eastern Oregon; and Bulletin 846-B, on the geology and ore deposits of the Takilma-Waldo district, including the Blue Creek district, were issued.

Pennsylvania.—The report on the geology and mineral resources of the Butler and Zelenople quadrangles was completed, and work was continued on reports on the geology and mineral resources of the Reading, Boyertown, Hanover, York, Honeybrook, and Phoenixville quadrangles and on the lower Kittanning coal bed of western Pennsylvania.

South Carolina.—The report on the geology of the Coastal Plain of South Carolina was completed. Under Public Works projects 158 and 176, a reconnaissance of the gold belt of the State was made, and later a survey of the gold-

bearing rocks and associated economic minerals was carried on in York and Cherokee Counties by a temporary junior geologist and one assistant under the supervision of a geologist of the Survey.

Tennessee.—Under Public Works project 177, 2 geologists of the Survey with a temporary junior geologist and 5 field assistants made a reconnaissance of the zinc areas of eastern and northern Tennessee and did areal mapping in the Mascot-Jefferson City and White Pine districts, studied the Felkner and Grasselli zinc mines, made examinations in the Powell-Clinch River belt and the Sweetwater barite district, and visited the Coker Creek gold district.

In connection with a study of the high-grade clays of the State of possible economic importance, also provided for under project 177, examinations were made of the bleaching and ball clay deposits in Carroll, Hardeman, Henry, and Madison Counties, in western Tennessee, and of the fire clays in the eastern part of the State, particularly in Cumberland County.

Texas.—Public Works project 178 included allotments for a study of the Terlingua and Shafter mining districts, the bleaching clays of the San Antonio area, the brown iron ores of northeastern Texas, and the oil, gas, and coal resources of part of north-central Texas. The examinations in the Terlingua quicksilver district, Brewster County, and the Shafter silver district, Presidio County, have given employment to three additional men. A progress report on the Terlingua district was issued by the Texas Bureau of Economic Geology. A party composed of 2 geologists, 4 assistants, and 5 laborers is engaged in a survey of the brown iron ore area, which includes detailed studies in Cass, Marion, and Morris Counties and a reconnaissance of small deposits in Gregg, Harrison, Rusk, and Upshur Counties. The study of the clays of the San Antonio area, made by a Survey geologist with three assistants, included prospecting for fuller's earth and ceramic clays in Bexar and Medina Counties and examination of clay localities in Atascosa and Wilson Counties. Geologic mapping has been carried on in Young, Stephens, Coleman, and Brown Counties in connection with the study of the oil, gas, and coal resources of parts of north-central Texas and gave employment to seven temporary assistants.

The compilation of the cooperative State geologic map and the revision of the cooperative monograph of fossils from the Navarro formation of Texas progressed. Further field and office studies of Permian rocks in the Diablo Plateau region were made. Studies of core material from Government potash tests in Texas were completed.

Utah.—The report on the geology of the Monument Valley-Navajo Mountain region, San Juan County, was completed and transmitted for publication as a bulletin of the Survey. Manuscripts of reports on a geologic and geographic reconnaissance of southeastern Utah, on the geology and mineral resources of the Randolph quadrangle, and on the Book Cliffs coal field southeast of Sunnyside were nearing completion, and progress was made on the reports describing the geology of the Green River Desert and the eastern flank of the San Rafael Swell and on the stratigraphy and structure of the region between the Green and Colorado Rivers, Grand and San Juan Counties. A report on the geology and ore deposits of the Cottonwood-American Fork mining region has been revised by the authors.

Vermont.—Field and office work in continuation of a study of the geology of northwestern Vermont was carried on, and a paper on the Ordovician-Silurian relations in Vermont was in course of preparation.

Virginia.—A study of the zinc deposits of an area in the vicinity of Wytheville, in Wythe and Smyth Counties, which is an extension of the zinc-lead region under examination in eastern Tennessee, was conducted by a geologist with one assistant and was financed by Public Works project 158.

The titanium deposits of Nelson and Amherst Counties were investigated in connection with a report on the titanium minerals of Virginia in preparation. Lands in an area proposed as an addition to the Monongahela National Forest were examined by a Survey geologist, and a report submitted to the Forest Service.

West Virginia.—Study of the manganese ores of eastern West Virginia under Public Works project 179 was made by a Survey geologist and one assistant. The examinations extended over portions of Morgan, Berkeley, Mineral, Hampshire, Grant, Hardy, Pendleton, Pocahontas, Greenbrier, Monroe, Mercer, and Jefferson Counties. A report was made to the Forest Service in connection with the proposed addition to the Monongahela National Forest.

Wisconsin.—See Minnesota.

Wyoming.—Field study of the oil-shale deposits of the Fossil and Washakie Basins of southwestern Wyoming was continued, and office work on reports on the Tertiary rocks and the oil shale of the Green River Basin were in progress. Field mapping was also continued in a portion of the Afton quadrangle in connection with the detailed study of the geology and mineral resources of this area, and an examination was made of the Washakie dam site, on the Wind River, for the Office of Indian Affairs.

WORK IN CHEMISTRY AND PHYSICS

The work in chemistry and physics includes the chemical analysis of rocks, ores, and minerals collected by geologists, tests necessary to identify specimens received by the Survey, the development of new tests and methods of analysis required by the expanding use of natural resources and the rarer elements, descriptive mineralogy, including studies of the physical properties of rocks and minerals, and geophysical investigations covering such subjects as deep earth temperatures, the formation of sedimentary deposits, radioactivity, and geologic time.

Among the materials analyzed in the laboratory during the year were a rubidium-bearing biotite from South Dakota, a radioactive microlite from Colorado (the age of which can be computed from the analysis), magnesite from California, hydromagnesite from Nevada, native lead and bismuth from Alaska, over 30 igneous rocks, a great many clays, ores, phosphates, and several new minerals.

During the year 4,259 examinations were made by the section of chemistry and physics. In addition to 1,109 specimens tested or identified for persons not officially connected with the Survey, 951 chemical analyses were made for geologists or in aid of geologic projects, 778 analyses were made in connection with methods of analysis and with geochemical studies relating to the formation of ores and minerals and their alteration under natural conditions, and 1,421 identifications of minerals in potash cores, well cuttings, and similar samples were made by petrographic methods or other tests.

ALASKAN BRANCH

The Geological Survey work in Alaska is concerned primarily with the investigation of the mineral resources of the Territory and comprises field examination of the various factors that pertain to the character, distribution, and development of these resources and laboratory and office studies by which these field observations are analyzed and coordinated and the results made available to the public through reports, maps, and other media. In addition to the funds regularly appropriated by Congress for this work, Public Works Administration funds were granted to supplement those for a general project (Federal project 162) and to enable the Geological Survey to carry on certain special work (Federal project 69). Cooperation was also continued with the Alaska Railroad, and some work was done in cooperation with the Navy Department. Insufficient funds necessitated disbanding early in July 1933 the personnel that for several years had been attached to local Alaska field offices to maintain technical supervision over the oil and coal prospecting permits and leases granted by the Government. For the rest of the year this supervision was carried on by the personnel engaged in similar work in the States proper.

Manuscripts and publications.—During the year 16 reports and 2 maps have been published, and 3 maps were issued in preliminary photolithographic editions. In addition, 12 manuscript reports (including maps) and 1 separate manuscript map have been completed by their authors and are in various stages of critical review, proof, or preparation for publication. At the end of the year 6 manuscript reports and 4 manuscript maps were partly completed.

Work of the year.—In addition to the routine duties of handling all matters relating to the Geological Survey's part in the development of Alaskan mineral resources, 7 principal projects, 4 of which involved new field work, were carried on during the season of 1933. The field projects included 2 that were primarily geologic and 2 that were primarily topographic. The geologic projects were a reconnaissance of the principal mining camps in the Ruby-Kuskokwim region of central Alaska and reconnaissance investigations of the potential lode resources of the Willow Creek-Kashwitna district of the Cook Inlet-Susitna region—an area contiguous to the Alaska Railroad in central southern Alaska—in which the Geological Survey cooperated with the Alaska Railroad. The 2 topographic projects were the continuation of surveys in southeastern Alaska to extend the mapping northward from the Wrangell district to include areas adjacent to Sumner Strait, and a detailed survey of part of the chain of the Aleutian Islands in cooperation with an expedition sent by the Navy Department for special examinations. The 3 projects not directly involving new field work were the annual canvass for the collection of statistics regarding mineral output, as a basis for the Geological Survey's annual report on the progress of the mineral industry; the continuation of the compilation of a drainage map of southeastern Alaska from aerial photographs taken some years before by the Navy Department at the request of the Geological Survey; and the preparation of a comprehensive report

on a large area in the central part of the Copper River region, so as to coordinate and make current the various observations and investigations that had been in progress in this area for more than 30 years. Although listed above as one of the nonfield projects, it should be noted that the work of compilation from aerial photographs was carried on for more than 8 months in Juneau, Alaska, with a drafting force that had been assembled mainly in that locality. Toward the later part of the field season of the chief Alaskan geologist was temporarily relieved of his Survey duties, and for nearly 5 months he served as representative for Alaska of the Federal Emergency Administration of Public Works, spending all of that time in the Territory.

Owing to the allotment of funds from the Public Works Administration it was possible to expand somewhat the Alaska program of the Geological Survey in the winter of 1933-34 and to send out the parties for the season of 1934 more adequately manned. As a result 9 principal projects, 7 of which involved new field work, were started during that period, though all of them will extend over into the next fiscal year. Of these field projects, 5 were primarily concerned with geologic investigations and 2 with topographic mapping. The projects involving new geologic field work were located in the area adjacent to Ketchikan in southeastern Alaska; part of the Alaska Range, including the headwater region of the Copper River Valley and parts of the Tanana Valley; the Kaiyuh Mountains, which lie south and east of the Yukon River in the region west of Ruby and southeast of Kaltag; the northern and eastern part of Kodiak Island, in southwestern Alaska; and the coal fields adjacent to Eska, in the Matanuska district of the Cook Inlet-Susitna region. The Eska work was financed by and carried on at the request of the Alaska Railroad and mainly in its interest. The topographic projects include the mapping of an extensive tract of Admiralty Island and adjacent parts of the Juneau district, in southeastern Alaska, and mapping of parts of the Alaska Range at the head of the Copper River, especially in the vicinity of Mentasta Pass and Suslota Lake. The two projects not directly involving new field work were the continuation of the compilation of drainage maps of southeastern Alaska from the airplane photographs taken by the Navy Department and the annual canvass of mineral production.

TOPOGRAPHIC BRANCH

GENERAL OFFICE WORK

Necessary office work incidental to the field work of the topographic branch consisted in the inking, inspection, and editing of the completed topographic field sheets prior to their submission for reproduction and the computation and adjustment of the results of control field work.

The status of topographic surveys shows that the country as a whole is now 46.1 percent mapped, the year's increment amounting to 0.5 percent. The area covered by topographic base maps without contours and prepared from aerial photographs after field examinations continued large. The resurveys in large part covered areas previously surveyed on a smaller scale.

New topographic surveys of the United States, July 1, 1933, to June 30, 1934, and total area surveyed in each State

State	Publication contour interval (feet)	Mapped in fiscal year (square miles) (engraved publication unless otherwise stated) for publication on scale of 1 to—					Total area mapped in fiscal year (square miles)			Total area mapped to June 30, 1934 (square miles)	Percentage of total area of State mapped to June 30, 1934	Spirit levels (miles)	Transit traverse (miles)	Triangulation stations occupied	
		12,000 or larger	24,000	31,680	48,000	62,500	125,000	Revision	Resurvey						New survey
Alabama	20					310			238	72	21,563	41.5	295	253	
Arizona	25, 50				36	1,069			245	452	59,747	52.4	1,224		82
Arkansas	10, 20, 50		1 52			749				295	23,139	43.4	335	468	
California	2, 4, 5, 25, 50, 100	1 1 3	298	141		401	1,666		306	1,747	132,593	83.8	815		60
Colorado	20, 50, 100			5	1 103	261				103	56,608	54.5	430	354	10
Connecticut											4,965	100.0	27		
Delaware	10					54				54	2,370	100.0	48		
District of Columbia											70	100.0			
Florida	10, 20					785				785	5,503	9.4	625	593	
Georgia	5, 20	1 1 9				248			242	15	24,952	42.1	301	242	
Iowa	10, 25, 50, 100		1 65			20	200		65	220	32,904	39.2	479		39
Illinois	5, 10, 20					1,351		44	212	1,095	37,696	66.5	19		
Indiana	20					17				17	3,685	10.1	208	75	
Iowa											13,167	23.5	185	130	
Kansas	10			191		96				287	64,446	78.4	263	236	4
Kentucky	20					296				296	26,916	66.3	154	274	
Louisiana	5, 20			1 2,190		508				1,397	11,330	23.4	475	127	
Maine	20					211				211	20,984	63.5	61		
Maryland	20					184			184		12,327	100.0	243	267	
Massachusetts	10			224		8			224		8,266	100.0	1,039		
Michigan	5			1 291					5		14,069	24.3	50	168	
Minnesota	20					57				57	8,214	9.7	119	262	
Mississippi	20					256				256	7,010	15.0	177	154	
Missouri	5, 10, 20		82	364		2,186		650	1,982	1,897	48,775	70.3	1,220	1,222	
Montana	25, 100					56	20			76	43,528	29.6	178		14
Nebraska	10					235				235	27,352	35.3	230	297	
Nevada	50, 100					22	362			384	53,718	48.5	450		31
New Hampshire											9,302	100.0			
New Jersey	5, 10	1 1 5		5					10		8,224	100.0	96	109	
New Mexico	20, 50			16		1,016			272	760	43,677	35.6	661		58
New York	20					221			221		49,204	100.0	43	116	

1 Lithographic publication. Final publication 1:62,500.

2 Lithographic publication only.

3 Mapped on scale of 1:4,800.

4 Mapped on scale of 1:9,600.

5 Includes 1,301 square miles of culture, drainage, and woodland prepared from aerial photographs, after field examination. Contours not added.

6 Includes 286 square miles of culture, drainage, and woodland prepared from aerial photographs, after field examination. Contours not added.

North Carolina	1, 2, 5, 10, 50	(2 7)		295		259			554		19,040	36.3	547			
North Dakota	5		1 20			20					13,168	18.6	73	164	37	
Ohio	5			59					59		41,040	100.0	107	119		
Oklahoma	5, 10, 20		1 86								41,927	59.8	228	203		
Oregon	50, 100					554					147	36,932	38.2	160		
Pennsylvania	20					216	403			472	38,760	85.9	419	560		
Rhode Island	20					657				532	1,248	100.0	49			
South Carolina	10, 20										836	14,573	47.0			
South Dakota	20					112				112	19,355	24.9	159	252		
Tennessee	1, 5, 15, 50	(2 3) 1 1 6		68		111				6	23,633	56.2	284	42		
Texas	20, 50					930		92	179	838	89,331	33.6	514	558	7	
Utah	5, 20, 100		1 59							159	19,981	23.5	427		85	
Vermont	20					107	100			107	8,246	86.2	199			
Virginia	10, 20, 50			164		569			839		37,897	88.9	657	247	194	
Washington	25, 50, 100		1 106			204	182			386	37,601	54.4	15	21		
West Virginia	5		1 1 2								24,170	100.0	2	13		
Wisconsin	20					82			2		19,237	34.3				
Wyoming	5, 50, 100	1 0 2				18	215		20		31,823	32.5	86			
Total continental United States (exclusive of Alaska)			27	768	4,013	139	15,284	3,148	687	7,453	13,494	1,394,266	46.1	14,376	7,526	669
Hawaii												6,435	100.0			
Puerto Rico													238			82

1 Lithographic publication only.

2 Mapped on scale of 1:9,600.

3 138 acres mapped on scale of 1:1,200.

4 6 acres mapped on scale of 1:4,800.

5 Mapped on scale of 1:2,400.

6 Mapped on scale of 1:4,800.

FIELD SURVEYS

Through the use of regularly appropriated funds and of funds made available by the Federal Emergency Administration of Public Works and by the Tennessee Valley Authority topographic mapping was undertaken in most of the States. Public Works projects and Tennessee Valley projects are indicated below by the initials "P.W." and "T.V.A." Cooperation with States was continued on a smaller scale than in recent years, and some projects begun under cooperative or Federal allotments were completed by Public Works funds.

Alabama.—The survey of the Blocton 15' quadrangle (P.W.) was completed, and that of the Palos, Basham, and Mount Hope 15' quadrangles (P.W.) was begun.

Arizona.—The survey of the Quartzsite No. 3 quadrangle was completed for the Office of Indian Affairs. The survey of the Castle Dome Peak No. 2 15' quadrangle (P.W.) and an extension of the Petrified Forest National Monument (P.W.) was completed, and that of the Castle Dome Peak No. 3, Payson No. 1, Payson No. 2, Payson No. 3 15' quadrangles (P.W.) and Grand Canyon National Monument (P.W.) was begun.

Arkansas.—For the Forest Service the survey of the Mount Judea 15' quadrangle was completed, and that of the Swain 15' quadrangle was begun. For the Forest Service the survey of the Ozone 15' quadrangle (P.W.) was completed. The survey of the Magazine Mountain No. 3 15' quadrangle (P.W.) was completed, and that of the Watalula 15' quadrangle (P.W.) and the Alexander No. 1 7½' quadrangle (P.W.) as a part of the Alexander 15' quadrangle (P.W.) was begun.

California.—In cooperation with the State engineer of California the survey of the Eureka and Lakeport 15' quadrangles, the Halls Flat, Yreka, and Bogus 30' quadrangles, and the Cucamonga No. 1 7½' quadrangle was completed, and that of the Sebastopol 15' quadrangle was begun. In cooperation with the county surveyor of Los Angeles County the survey of the Glendora, La Verne, Sunland, Mount Lowe, Azusa, La Crescenta, Sierra Madre, Little Tujunga, Camp Baldy, and Evey Canyon 6' quadrangles was completed, and that of the Mount Wilson, Chileno Canyon, Camp Rincon, Acton, and Camp Bonita 6' quadrangles was begun. The survey of the Parkfield No. 1 and Dudley No. 2 7½' quadrangles (P.W.) was completed, and that of the Paynes Creek and Burney 30' quadrangles (P.W.) and the Yosemite Valley National Park (P.W.) was begun.

Colorado.—At the request of the Forest Service the survey of the Mount Powell No. 2 15' quadrangle was completed and the survey of the Mount Powell No. 1 15' quadrangle (P.W.) was completed. The survey of the Como No. 2 15' quadrangle (P.W.) was continued, and that of the Cherry Creek area (P.W.), Black Canyon National Monument (P.W.), and Colorado National Monument (P.W.) was begun.

Delaware.—The survey of the Deepwater Point 15' quadrangle (P.W.) was completed.

Florida.—The survey of the Boggy and West Juniper Creek 15' quadrangles (P.W.) was completed, and that of the Oscar, De Funiak Springs, and Mary Esther 15' quadrangles (P.W.) was begun.

Georgia.—The survey of the Chickamauga-Chattanooga National Military Park (P.W.) was completed, and that of the Bullochville and Thomaston 15' quadrangles (P.W.) was begun.

Idaho.—The Bureau of Mines and Geology of Idaho cooperating, the survey of Grimes Pass and vicinity was completed. The survey of the Dickey 30' quadrangle and American Falls No. 2 and American Falls No. 3 15' quadrangles (P.W.) was begun.

Illinois.—The survey of the Toledo, Hoopston, Metamora, Petersburg, Genoa, Carthage, Dunlap, Lacon, and Mount Vernon 15' quadrangles was completed, and that of the Toluca, Camp Grove, Morrison, Oquawka, and Iuka 15' quadrangles was continued in cooperation with the Department of Registration and Education of Illinois, Geological Survey. The survey of the Sycamore 15' quadrangle (P.W.) was continued and that of the Shabbona 15' quadrangle (P.W.) was begun.

Indiana.—The survey of the Heltonville, Oolitic, and Porter 15' quadrangles (P.W.) was begun.

Kansas.—The survey of the Waldron No. 1, Waldron No. 4, Armourdale No. 2, Armourdale No. 3, Armourdale No. 4, and Olathe 1-a 7½' quadrangles (P.W.) was completed, and that of the Armourdale No. 1 7½' quadrangle (P.W.) and the western part of the Waldron 15' quadrangle (P.W.) was begun.

Kentucky.—The survey of the Sadieville 15' quadrangle (P.W.) was completed, and that of the Munfordville and Cecilia 15' quadrangles (P.W.) was begun.

Louisiana.—The Louisiana Board of State Engineers cooperating, the ground control, field examination, and preparation from aerial photographs of culture, drainage, and woodland was completed for topographic base maps without contours for the 7½' quadrangles within the Hackberry, Bayou Bois Courier, Johnsons Bayou, Grand Lake West, Lake Charles, Orange, Redfish Point, Port Arthur, Pecan Island, Grand Lake East, Sabine Pass, AAA, BBB, and CCC 15' quadrangles and begun for the 7½' quadrangles within the Mount Airy, Donaldsonville, Bonnet Carre, Spanish Fort, Crowley, and Lafayette 15' quadrangles. For the Louisiana Board of State Engineers the survey for the contours of the 7½' quadrangles within the Hackberry, Bayou Bois Courier, Johnsons Bayou, and Grand Lake West 15' quadrangles (P.W.) was completed. The survey of the Pollock and Colfax 15' quadrangles (P.W.) was completed.

Maine.—In cooperation with the Public Utilities Commission of Maine, the survey of the Rangeley 15' quadrangle was completed.

Maryland.—The survey of the Prince Frederick, Leonardtown, and Patuxent No. 2 15' quadrangles (P.W.) was begun.

Massachusetts.—In cooperation with the Department of Public Works, Division of Waterways, the survey of the Sagamore, Manomet, Springfield No. 1, Mitineague, and Long Meadow 7½' quadrangles was completed, and that of the Plymouth No. 2, Springfield No. 2, and Northampton No. 3 7½' quadrangles was begun.

Michigan.—In cooperation with the Department of Conservation of Michigan, Geological Survey, the ground control, field examination and preparation from aerial photographs of culture, drainage, and woodland was executed in 7½' quadrangles for topographic base maps without contours for the Mesick 15' quadrangle and the Wexford County part of the Tustin 15' quadrangle. The survey of the Sanford 15' quadrangle and the Toledo No. 1 and Maumee Bay No. 2 7½' quadrangles (P.W.) was begun.

Minnesota.—At the request of the Forest Service the survey of the Ely 15' quadrangle was completed. The survey of the Fountain City 15' quadrangle (P.W.) was begun.

Mississippi.—The survey of the Raymond 15' quadrangle (P.W.) was completed, and that of the Edwards 15' quadrangle (P.W.) was begun.

Missouri.—In cooperation with the Geological Survey and Water Resources of Missouri the survey of the West St. Louis No. 1, West St. Louis No. 2, West

St. Louis No. 3, West St. Louis No. 4, Independence 4-c, Camp Clark, and Blue Springs 7½' quadrangles and the Red Bird, Celt, Marble Hill, Marquand, Steelville, and Sleeper 15' quadrangles was completed; that of the Upalika, Greenville, Stone Hill, Grove Spring, Big Piney, Gatewood, Berryman, Topaz, Zanoni, Manes, and Fordland 15' quadrangles and the Springfield No. 4, Sullivan No. 3, Sullivan No. 4, and Versailles No. 4 7½' quadrangles was continued; and that of the Van Buren and Fielden 15' quadrangles and the Stockton No. 3, Stockton No. 4, Kimmswick No. 1, Independence 3-a, Independence 3-c, Independence 4-b, and Independence 4-d 7½' quadrangles was begun. The survey of the Canaan 15' quadrangle (P.W.) and Harrisonville 2-b and Olathe 1-a 7½' quadrangles (P.W.) was completed, and that of the Lynn 15' quadrangle (P.W.) and the Armourdale No. 4 7½' quadrangle (P.W.) was begun.

Montana.—The survey of the Thompson 30' quadrangle (P.W.) and of the Dupuyer No. 2 15' quadrangle (P.W.) was begun.

Nebraska.—The survey of the Seward No. 1 and Seward No. 2 15' quadrangles (P.W.) was begun.

Nevada.—The survey of the Skelton 30' quadrangle and of the Gold Creek No. 4 15' quadrangle (P.W.) was begun.

New Hampshire.—The survey of the Whitefield 15' quadrangle (P.W.) was begun.

New Jersey.—The survey of the Morristown National Historical Park (P.W.) was completed, and that of the Ramapo No. 4 7½' quadrangle (P.W.) was begun.

New Mexico.—At the request of the Office of Indian Affairs the survey of the Shiprock No. 2 and Carrizo Mountains No. 1 15' quadrangles (P.W.) was completed. The survey of the Shiprock No. 1 and Shiprock No. 3 15' quadrangles (P.W.) and the Carlsbad Cavern National Park (P.W.) was completed, and that of the Carrizozo No. 4 and Arabela No. 3 15' quadrangles (P.W.) was begun. In preparation for geologic mapping the survey of the Queen No. 3 15' quadrangle was begun.

New York.—The survey of the Catskill 15' quadrangle was completed, and that of the Rhinebeck 15' quadrangle was continued in cooperation with the Department of Public Works of New York. The survey of the Binghamton 15' quadrangle (P.W.) was begun.

North Carolina.—The survey of the Guilford Courthouse National Military Park (P.W.) was completed, and that of the Corundum and Farner 15' quadrangles (P.W.) was begun. For the Forest Service the survey of the Ranger 15' quadrangle (P.W.) was continued; that of the Table Rock No. 2, Old Fort No. 2, Montreat No. 1, and Democrat No. 4 7½' quadrangles (T.V.A.) was completed, and that of the Spruce Pine No. 1, Spruce Pine No. 2, Spruce Pine No. 3, Spruce Pine No. 4, Bakersville No. 1, Bakersville No. 2, Bakersville No. 3, Bakersville No. 4, Elk Park No. 1, Elk Park No. 2, Elk Park No. 3, and Blowing Rock No. 2 7½' quadrangles (T.V.A.) was begun.

North Dakota.—The survey of the Grand Forks No. 1 7½' quadrangle (P.W.) as a part of the Grand Forks 15' quadrangle (P.W.) was begun.

Ohio.—The survey of the Maumee Bay No. 1 7½' quadrangle (P.W.) was completed, and that of the Maumee Bay No. 2 and Toledo No. 4 7½' quadrangles (P.W.) was begun.

Oklahoma.—The survey of the Norman and Moore 15' quadrangles (P.W.) and of the Moore 7½' quadrangle (P.W.) was completed, and that of the Edmond 15' quadrangle (P.W.) and the Edmond 7½' quadrangle (P.W.) was begun.

Oregon.—For the Forest Service the survey of the McKenzie Bridge 30' quadrangle (P.W.) was begun. The survey of an extension of the Crater Lake National Park (P.W.) was continued for the National Park Service. The survey of the Disston 30' quadrangle (P.W.) was begun.

Pennsylvania.—In cooperation with the Department of Internal Affairs of Pennsylvania, Topographic and Geologic Survey, the survey of the Smethport and Coudersport 15' quadrangles was completed, and that of the Kane and Allentown 15' quadrangles was begun. The survey of the Mifflintown 15' quadrangle (P.W.) was begun.

South Carolina.—The survey of the Hagood 15' quadrangle (P.W.) was completed, and that of the Wellford, Greenville, Killian, and Camden 15' quadrangles (P.W.) was begun.

South Dakota.—The survey of the Fort Pierre 15' quadrangle (P.W.) was begun.

Tennessee.—The survey of the Shiloh National Military Park including Cherry House (P.W.) was completed, that of the Tellico Plains and Farner 15' quadrangles (P.W.) was begun, that of the Elk Park No. 2 7½' quadrangle (T.V.A.) was completed, and that of the Bakersville No. 1 and Bakersville No. 2 7½' quadrangles (T.V.A.) was begun.

Texas.—In preparation for geologic mapping the survey of the Guadalupe Peak No. 2 quadrangle was completed. The survey of the Wildorado No. 1, Amarillo No. 2, and Dumas No. 3 15' quadrangles (P.W.) was completed, and that of the Longview No. 3 and Dumas No. 4 15' quadrangles (P.W.) was begun.

Utah.—The survey of Salt Lake County (P.W.) was continued, and that of the Theodore 30' quadrangle (P.W.) was begun.

Vermont.—In cooperation with the State geologist of Vermont the survey of the Guildhall 15' quadrangle was completed, and that of the Woodsville 15' quadrangle was begun.

Virginia.—The survey of the Pulaski and Waynesboro 15' quadrangles and the Richmond No. 3 and Richmond No. 4 7½' quadrangles was completed, and that of the Richmond No. 1 7½' quadrangle and the Mount Rogers and Mouth of Wilson 15' quadrangles was begun, in cooperation with the Conservation and Development Commission of Virginia, Geological Survey. The survey of the Fredericksburg-Spottsylvania Battlefield National Monument (P.W.) and the Balcony Falls and Amherst 15' quadrangles (P.W.) was begun.

Washington.—The survey of the Olympia 15' quadrangle (P.W.) was completed, that of the Mount Constance, Eatonville, and Metaline 30' quadrangles (P.W.) was continued, and that of the Fort Simcoe 30' quadrangle (P.W.) was begun.

West Virginia.—In cooperation with the Division of Subsistence Homesteads the survey of the Arthurdale Farm Project, near Reedsville, Preston County, was completed.

Wisconsin.—The survey of the Chippewa Falls 15' quadrangle (P.W.) was continued.

Wyoming.—For the Forest Service the survey of the Savery Creek quadrangle was completed. The survey of the Devils Tower National Monument (P.W.) was completed, and that of the Grand Teton National Park (P.W.) and Grand Encampment 30' quadrangle (P.W.) was begun.

WATER-RESOURCES BRANCH

The importance of water and of records related to the quantity, chemical quality, and availability of both surface and ground waters has become increasingly apparent during the year. The growth of the country in population with consequent increases in demands for water and especially the continued series of dry years which has culminated in the disastrous and widespread drought in 1934 have served to impress on all the people the controlling importance of

water in our surface streams and in underground basins in relation to many of man's activities. The Public Works Administration has found the information with respect to water to be invaluable in its study of projects of all classes and in all sections of the country and has relied on the records of the Geological Survey as a basis for its action on many projects.

Reliable information with respect to these supplies of water and to their fluctuations with variations in rainfall is essential to orderly, stable, and economic development along many lines and, therefore, to the national welfare. The work of the water-resources branch thus assumes a position of great importance in the economic affairs of the Nation.

The water-resources investigations by the branch are conducted largely in cooperation with Federal bureaus; State, county, municipal, and other governmental agencies; and permittees and licensees of the Federal Power Commission. A major part of this cooperation is set forth below.

Federal bureaus.—Investigations were conducted for the following Federal bureaus through advance, transfer, or repay of funds:

Department of Agriculture:

Office of Experiment Stations
Weather Bureau
Forest Service
Bureau of Biological Survey

Department of the Interior:

Division of Subsistence Homesteads
Office of Indian Affairs
Bureau of Reclamation
National Park Service

Department of Justice: Bureau of Prisons

Department of the Navy: Bureau of Yards and Docks

Department of State

Department of War: Office of the Chief of Engineers

Federal Power Commission

Tennessee Valley Authority

Federal Emergency Administration of Public Works

States.—The following amounts were made available by States and municipalities for cooperative surface- and ground-water investigations. In addition to the results obtained directly from cooperation, it is estimated that data valued at over \$145,000 were furnished by cooperating officials.

Cooperative State and municipal funds available for work on water-resources investigations, fiscal year 1934

State	State funds available		Municipal funds available		Total
	Surface water	Ground water	Surface water	Ground water	
Arizona.....			\$3,200.00		\$3,200.00
Arkansas.....	80.13				.13
California.....	25,000.00		17,250.00	\$7,000.00	49,250.00
Colorado.....	16,000.00				16,000.00
Connecticut.....	6,000.00		100.00		6,100.00
Florida.....	3,021.63		1,500.00		4,521.63
Hawaii.....	14,684.08	\$7,091.58			21,775.66
Idaho.....	20,845.33				20,845.33
Illinois.....	5,400.00				5,400.00
Indiana.....	4,000.00		300.00		4,300.00
Iowa.....	5,514.00				5,514.00
Kansas.....	7,037.99				7,037.99
Louisiana.....			415.00		415.00
Maine.....	6,500.00				6,500.00
Maryland.....	8,099.87		1,724.75		9,824.62
Massachusetts.....	5,301.29		1,600.00		6,901.29
Michigan.....	1,800.00	2,294.28			4,094.28
Minnesota.....	5,108.00				5,108.00
Mississippi.....	1,000.00				1,000.00
Missouri.....	8,688.40		326.60		9,015.00
Montana.....	6,000.00				6,000.00
Nebraska.....	12,000.00	3,000.00			15,000.00
Nevada.....	800.00				800.00
New Hampshire.....	3,750.00				3,750.00
New Jersey.....	10,000.00	3,802.60			13,802.60
New Mexico.....	14,819.99	2,772.65			17,592.64
New York.....	15,914.90	2,000.00	5,287.66	4,400.00	27,602.56
North Carolina.....	4,500.00	200.00			4,700.00
North Dakota.....	100.00				100.00
Ohio.....	17,346.98		2,200.13		19,547.11
Oregon.....	24,575.76	1,022.66	866.73	500.00	26,965.15
Pennsylvania.....	20,085.73	1,500.00			21,585.73
South Carolina.....	1,750.00		399.37		2,149.37
Tennessee.....	11,012.52	1,000.00			12,012.52
Texas.....	21,635.87	15,285.95			36,922.82
Utah.....	5,500.00		119.82	6,571.23	12,191.05
Vermont.....	4,184.00				4,184.00
Virginia.....	19,000.00	994.86			19,994.86
Washington.....	11,128.95	300.00	5,846.06		17,273.01
West Virginia.....	3,000.00				3,000.00
Wisconsin.....	7,000.00				7,000.00
Wyoming.....	8,250.00				8,250.00
	366,354.42	41,264.58	41,136.12	18,471.23	467,226.35

Permittees and licensees of the Federal Power Commission.—At the request of the Federal Power Commission, 30 engineers of the branch have been designated as representatives of the commission to perform such field work as may be assigned to them by the commission. The operation of about 320 gaging stations was conducted by the branch or was performed by permittees and licensees under the supervision of the branch in connection with 130 projects of the Federal Power Commission. Engineers of the branch have had general supervision of operations under permits and licenses of the commission in connection with 100 projects. Examination and reports on applications for projects have been made for the commission as requested.

WORK OF THE YEAR BY DIVISIONS

The division of surface water conducts investigations of surface water, which consist of the measurement of the flow of rivers, conducted in the 48 States, the District of Columbia, and Hawaii at selected gaging stations where the volume of water is measured and

records of stage and other data are collected, from which the daily discharge of the rivers is computed. In this work 41 States, the Territory of Hawaii, and several Federal bureaus and individuals cooperated in the maintenance of the 2,941 regular gaging stations that were in service at the end of the year. Records for about 124 additional gaging stations were received, ready for publication, from Federal bureaus and from individuals.

The division of ground water investigates the waters that lie below the surface in the zone of saturation (from which wells and springs are supplied); the source, occurrence, quantity, and head of these waters; their conservation; their availability and adequacy for domestic, industrial, irrigation, and public supplies and as watering places for livestock and desert travelers; and the methods of constructing wells and recovering water from them and of improving springs. Each year surveys are made of selected areas where problems of water supply are urgent, and the results are generally published in water-supply papers that include maps showing the ground-water conditions. The investigations relating to the chemical composition of the water are made in cooperation with the division of quality of water. Projects involving large expenditures for drilling wells to develop water supplies are considered each year by the several departments of the United States Government, and the ground-water division is called upon to furnish information and advice on many of these projects. During the fiscal year about 65 investigations relating to ground water and reservoir sites were in progress, and work was done in 28 States and the Territory of Hawaii, in cooperation with State or local governmental agencies, or on Public Works Administration Federal projects. In the hydrologic laboratory 383 samples of water-bearing material were analyzed.

The division of quality of water analyzes water from surface and underground sources with reference to the suitability of the waters for industrial and agricultural uses and for domestic use (not related to questions of health) so far as such use is affected by the dissolved mineral matter. The analysis (partial or complete) of 1,226 samples of water, including some for nearly all the studies of ground water in the different States, was completed during the year.

The work of the division of power resources comprised the preparation of monthly reports on the production of electricity for public use and the consumption of fuel in generating the electricity reported, an annual report containing revised figures of the monthly production of electricity and consumption of fuel in 1933 previously published in the monthly reports, a report on the developed water power of the United States, and compilations of stocks of coal held by public-utility power plants for inclusion in reports of commercial stocks of coal

undertaken quarterly by the Bureau of Mines of the Department of Commerce. The annual report on the capacity of water wheels in water-power plants in the United States was released February 3, 1934, and the final report on the monthly and annual production of electricity for public use in 1933 was released April 30, 1934.

The division of water utilization investigates problems affecting the utilization and control of the waters of streams and performs administrative work relating to supervision and investigation of these problems by the field organization of the water-resources branch and of power projects of the Federal Power Commission and of the Interior Department. The field work is generally conducted by personnel otherwise assigned to the division of surface water.

CONSERVATION BRANCH

The functions of the conservation branch, including the classification of public and quasi-public lands with respect to mineral, water power, and agricultural value, and the technical supervision of mineral and power development on such lands, were increased in volume and scope during the fiscal year. Their performance, however, was seriously impaired by want of adequate funds, by consequent loss of experienced personnel, and by practical cessation of the normal inflow of basic data from field sources.

The following table indicates in part the dependence of public-land administration on land-classification phases of branch work and summarizes activity in the Washington office with respect to specific cases submitted in accordance with departmental procedure for technical report, review, or approval. The terms "gain" and "loss" signify, respectively, decrease and increase in the number of cases pending. Compared with 1933, this tabulation shows increase of 6 percent in cases received, decrease of 17 percent in cases acted on, and increase of 78 percent in cases pending at the end of the year.

General summary of cases involving land classification

Class of cases	Record for fiscal year 1934						Record since receipt of first case	
	Pending July 1, 1933	Received during fiscal year	Total	Acted on during fiscal year	Pending June 30, 1934	Gain or loss during fiscal year	Received	Acted on
General Land Office requests:								
General.....	307	1,208	1,515	1,392	123	+184		
Time extensions.....							2,313	2,313
Oil development.....	10	78	88	77	11	-1	17,294	17,283
Concurrence.....	19	686	705	651	54	-35		
Section 27 cases.....							39	39
Committee cases: Oil and potash.....	3	1,814	1,817	1,687	130	-127	11,232	11,102
Applications for classification as to mineral:								
Oil.....	74	2,344	2,418	2,274	144	-70	26,156	26,012
Miscellaneous.....	7	10	17	16	1	+6	917	916
Applications for mineral permits.....	78	1,813	1,891	1,622	269	-191	59,560	59,291
Applications for mineral leases.....	5	141	146	135	11	-6	2,018	2,007
Applications for patent, potassium.....							124	124
Federal Power Commission cases:								
Preliminary permits.....	17	32	49	47	2	+15	315	313
Licenses.....							28	28
Determinations under section 24.....	22	66	88	81	7	+15	491	484
Applications for classification as to power resources.....	10	18	28	25	3	+7	531	528
Applications for agricultural classification.....	37	132	169	128	41	-4	1,484	1,443
Applications for rights-of-way.....	38	114	152	144	8	+30	6,990	6,982
Irrigation project reports.....	2	3	5	5		+2	938	938
Applications under enlarged homestead acts.....	16	151	167	100	67	-51	57,940	57,873
Applications under stock-raising-homestead acts.....	859	3,023	3,882	2,073	1,809	-950	142,475	140,666
Applications under Ground Water Reclamation Act.....	2	6	8	6	2		987	985
Indian Office requests for information.....		1	1	1			9,548	9,548
	1,506	11,640	13,146	10,464	2,682	-1,176		

MINERAL CLASSIFICATION DIVISION

The work of the mineral classification division was restricted rather closely during the year to office phases indispensable to appropriate departmental action on current applications for public-land use under the mineral-leasing laws or for disposition under the nonmineral-land laws. A few imperative case investigations were made in the field, however, and one regional survey of importance begun in 1933 was completed.

Types of office activity indicated in the general summary of cases involving land classification were increased during the year to include determinations pursuant to departmental circular no. 1303, whether in specific cases the grant of surface rights in Federal lands will tend seriously or substantially to impede prospecting and development under the mineral-leasing laws, and to include the drafting for the departmental committee of its recommendations of action on applications for extension of time for compliance with the terms of outstanding oil and gas prospecting permits and potash permits.

Availability of the results of geologic surveys made prior to 1934 permitted some progress in classifying the vast areas of public land withdrawn more than a quarter of a century ago for mineral examination and classification. Classifications effected include 482,840 acres as coal land, 593,834 acres as noncoal land, with a net reduction of outstanding coal withdrawals by 946,433 acres.

Summary of outstanding mineral withdrawals and classifications, June 30, 1934, in acres

State	Coal		Oil		Oil shale		Phosphate		Potash
	With- drawn	Classified as coal land	With- drawn	Classi- fied as oil land	With- drawn	Classi- fied as oil shale land	With- drawn	Classi- fied as phos- phate land	With- drawn
Alaska.....		56,993							
Ariz.....	139,415								
Ark.....		61,160							
Calif.....	17,603	8,720	1,178,392						90,324
Colo.....	4,142,233	3,082,272	215,370		1,172,778	952,239			
Fla.....							66,796	120	
Idaho.....	11,520	4,603					276,239	270,036	
La.....			466,990	4,233					
Mont.....	6,442,830	19,254,927	1,336,697	67,651			279,944	3,833	
Nev.....	83,673								39,422
N.Mex.....	4,124,578	984,829							9,282,160
N.Dak.....	5,954,364	11,178,286	84,894						
Oreg.....	4,361	18,887							
S.Dak.....		250,093							
Utah.....	3,404,043	1,267,697	1,344,473		2,737,274	2,703,755	277,344	2,937	
Wash.....	691,801	141,444							
Wyo.....	2,260,604	6,741,748	541,777		2,328,370	406,003	989,133	25,293	
	27,277,025	33,051,659	5,168,593	71,884	6,238,422	4,061,997	1,889,456	302,219	9,411,906

1 Includes 3,151 acres of coal land reserved for use of the United States (coal reserve no. 1).

2 Includes 13,578 acres withdrawn as helium reserve.

3 Includes 2,078 acres of coal land reserved for use of the United States (coal reserve no. 2).

Division activity precedent to administration of the mineral-leasing laws included primary findings of pertinent technical fact affecting the adjudication of 1,622 current filings for prospecting permit, of 135 current filings for lease, and of 2,290 conflicts or anticipated conflicts between mineral and nonmineral claimants; the technical review with ultimate concurrence in 651 approvals of assignment and authorizations of mineral lease or license; the preparation for the departmental committee of abstracts and recommendations affecting the grant of time extensions on 1,687 outstanding prospecting permits for oil and gas or potash; and the preparation and promulgation of definitions of the "known geologic structure" of six producing oil and gas fields, as follows:

Definitions of "known geologic structure", fiscal year 1934

State	Field	Date promulgated	Acres
Montana	North Bowes	Aug. 25, 1933	1,880
Do.....	South Bowes.....	Aug. 25, 1933	3,240
Do.....	Dry Creek.....	Jan. 6, 1934	6,081
New Mexico.....	North Eunice (additional).....	Sept. 2, 1933	280
Wyoming.....	Lake Creek.....	Aug. 25, 1933	2,273
Do.....	La Barge.....	Oct. 3, 1933	1,641

The aggregate area of outstanding definitions of the "known geologic structure" of producing oil and gas fields on June 30, 1934, was 960,346 acres in California, Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming.

POWER DIVISION

During the fiscal year 1934 the work of obtaining basic information as to the water-power resources of public lands and of making it available for use in the administration of the public-land laws was directed chiefly to its field phases. Field work made possible by funds allotted by the Public Works Administration was materially expanded, and long deferred surveys of the power resources of important streams were undertaken in Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. These surveys involved about 1,400 linear miles of streams and included supplemental geologic or geophysical studies of foundation material and conditions at six dam sites in Colorado, Oregon, and Utah.

Office activities not indicated in the general summary of cases involving land classification resulted in additions of 148,714 acres to outstanding power reserves in 12 States, eliminations of 31,153 acres from such reserves in 8 States, and net increase of the total area of such reserves in 22 States to 6,800,371 acres. Field supervision of power projects for the Federal Power Commission involved investigation and report on 16 projects, construction and operation on 132 projects, and cost accounting on 3 projects.

Returns for the calendar year 1933 disclose the total installed capacity of the systems operated by the holders or users of rights-of-way for power purposes granted by the Secretary of the Interior as 5,855,000 horsepower. The total energy generated in that year was 9,182,000,000 kilowatt-hours, an increase of 28 percent over the output reported in 1932—an increase that is simply statistical, however, and due to the return for 1933 of certain items not previously returned rather than to any material increase in actual output. Revenues accrued from the use and occupancy of public lands under power permits and grants issued by the Secretary of the Interior aggregated

\$190,194 from 1912 to 1933, and \$15,145.31 additional has been assessed for the calendar year 1934. Accrued charges for unauthorized occupancy of public lands by power projects prior to the issuance of license therefor by the Federal Power Commission amount to \$111,826.58 additional, about \$12,000 of which is before the courts for adjudication.

AGRICULTURAL DIVISION

Although the number of applications currently received for agricultural classification, for designations under the stock-raising and enlarged homestead acts and Nevada ground-water act, and for approval of irrigation projects decreased about 9 percent compared with 1933, the number of cases pending on June 30, 1934, was 109 percent greater than on June 30, 1933.

Office activities not indicated in the general summary of cases resulted in the designation of 508,193 acres in 16 States as subject to the stock-raising homestead act, cancelation of prior designations under that act to the extent of 5,470,887 acres in 7 States, and net reduction of the outstanding designated area in 20 States to 119,339,332 acres; the designation of 5,256 acres in 11 States as subject to the enlarged homestead acts, cancelation of prior designations under those acts to the extent of 15,089,655 acres in 4 States, and net reduction of the outstanding designated area in 14 States to 294,413,685 acres; the inclusion of 8,607 acres in 8 States in public water reserves, exclusion of 1,080 acres in 4 States from such reserves, and net increase of the gross area reserved in 13 States to 494,728 acres; and the designation of 8,800 acres under the Nevada ground-water act, with increase of the aggregate area so designated to 1,729,495 acres. Liaison service was maintained for the Interior Department with the committee for acquisition of submarginal land, of the Federal Emergency Relief Administration, and considerable assistance was rendered to members and committees of Congress concerned with the framing and enactment of the Taylor grazing law (Public No. 482, 73d Cong.).

MINING AND OIL AND GAS LEASING DIVISIONS

The work of the mining and oil and gas leasing divisions consists of the exercise of supervisory jurisdiction over mineral prospecting and development on public lands, Indian lands, and naval petroleum reserves.

In spite of an increase during the year of 877, or 14 percent, in the number of Federal properties under supervision, inspectional and regulatory activities, already substantially below the limit of prudent administration, were of necessity further reduced. In their stead remedial activities, required to eradicate the injurious consequences of insufficient Federal supervision in previous years, were undertaken

with funds provided for the purpose by the Public Works Administration.

Field supervision, exercised through 22 offices and suboffices in the public-land States and Alaska, was increased during the year by the issuance of Federal leases, licenses, and prospecting permits for 1,247 additional properties. In the same period leases, licenses, and permits for 368 properties were terminated.

Federal properties under supervision at the end of the fiscal year, indicated in detail in the summary of field operations by States, numbered 7,154 in 19 States and Alaska and involved an aggregate of 9,541,487 acres. They contained 4,236 productive oil and gas wells, 38 of which were completed during the year, 528 coal mines, 2 potassium mines, 1 phosphate mine, 3 sodium plants, 1 oil-shale plant, and a great variety of prospecting operations.

By order of the Secretary dated September 12, 1933, the supervisory function of these divisions was enlarged to include the receipt, for transmission to the General Land Office, of all remittances made in payment of rents and royalties accrued under mineral leases and prospecting permits involving public land and the maintenance of records showing the current status of each account.

Especial activity resulted from a departmental order dated July 12, 1933, requiring that on and after May 1, 1933, the Government royalty on petroleum be computed on the volume of production as determined by tank measurement based on 100 percent tank tables and calculated as barrels of clean oil of 42 standard United States gallons each; from departmental grants of drilling and production relief to numerous operators on Federal lands with corresponding increase of supervisory obligation to determine and assess the monthly charges due to the Government as compensation for any loss of royalty entailed; from departmental instructions of May 16, 1934, obligating supervisors to determine production proration between Federal lands and other lands in areas served by pipe lines occupying rights of way pursuant to the act of February 25, 1920 (41 Stat. 437), and to pass on the rates and terms of transportation and purchase of production in such areas; from increased submissions of proposed plans for the unit operation and development of oil and gas fields involving public land, for consideration and technical approval; and from cooperation with the Petroleum Administrative Board of the National Recovery Administration in facilitating throughout the public-land States the submission of the development plans for new pools required by article III, section 7, of the Code of Fair Competition for the Petroleum Industry.

In the field of mine supervision especial activity resulted from a marked increase of irresponsible trespass on Federal-owned coal lands, with the consequent starting of a large number of outcrop

fires and the filing of many complaints by royalty-paying lessees and permittees of total or partial loss of their coal market by reason of unauthorized unsupervised competition; and from the necessity for local surveys of coal supply and demand as basis for appropriate recommendations under departmental order of January 24, 1934, restricting the issuance of coal prospecting permits and leases to localities whose coal needs cannot feasibly be supplied by existing mines.

Mineral production during the year from lands under Federal leases, licenses, and prospecting permits and revenue accrued therefrom in the form of royalty, rental, or bonus are shown below:

Mineral production from public lands and revenues accrued therefrom, fiscal year 1934

State	Petroleum (barrels)	Natural gas (M cubic feet)	Gas gasoline (gallons)	Coal (short tons)	Potassium (short tons)	Sodium (short tons)	Phosphate (short tons)	Accrued revenue
Alaska				100,347.10				\$8,408.37
Ala.				106,796.00				10,679.60
Calif.	13,276,129.07	36,573,146	58,907,584.00	5.00		45,048.00		2,048,161.49
Colo.	417,341.07	1,030,944	16,609.00	313,675.93				75,697.63
Idaho				2,749.13			43,066.91	3,616.97
La.	1,756.61	1,383,908	31,757.08					16,886.37
Mont.	305,003.11	1,445,773		253,607.43				71,113.05
Nev.								480.00
N.Mex.	2,456,898.10	6,421,645	1,033,534.76	34,612.68	289,836.99	781.56		256,655.11
N.Dak.				386,149.76				23,711.40
Okla.	295,810.65		34,891.99					34,244.71
Oreg.				86.50				221.63
S.Dak.				2,574.26				427.53
Utah	2,850.73	35,860		710,768.70				92,420.01
Wash.				37,551.33				3,755.13
Wyo.	8,299,385.46	10,975,581	27,704,218.00	739,762.72				1,345,091.95
1934	25,055,174.80	57,866,857	87,728,594.83	2,688,686.54	289,836.99	45,829.56	43,066.91	3,991,570.95
1933	24,662,589.46	56,637,196	91,549,635.62	2,953,780.00	173,563.16	37,314.00	1,643.14	3,648,816.65

INDIAN LANDS

On behalf of the Office of Indian Affairs technical supervision of mineral development was continued in 1934 on tribal and restricted allotted lands within the limits of numerous Indian reservations. Oil and gas supervision involved 4,668 leaseholds, 4,588 wells, and aggregate royalty and rental accruals of \$1,817,886.10 for Indian beneficiaries in 7 States and in 27 different tribes, and the drafting of a new form of lease for restricted lands designed to afford the lessor a greater measure of protection and of participation in leasehold revenues than heretofore. Mining supervision involved 40 lead and zinc leaseholds in the Quapaw Reservation, Okla., with aggregate royalty accruals of \$247,367.48 during the year; 42 coal leaseholds involving Choctaw, Chickasaw, and Five Tribes acreage in Oklahoma, with aggregate production of 388,094 tons of coal and royalty accruals of \$25,805.61; 13 agency coal mines in Arizona, Colorado, Montana, New Mexico, North Dakota, and Utah; and special investigations of gold occurrence on land under lease application in the Hoopa Valley Reservation, Calif.

NAVAL PETROLEUM RESERVES

On behalf of the Navy Department, supervision was continued during the year over operations for the production of oil and gas within Naval Petroleum Reserves Nos. 1 and 2, in California, and for the conservation of shut-in production within Reserve No. 3, in Wyoming. Production from the California reserves aggregated 3,720,735.36 barrels of petroleum, 4,328,047,000 cubic feet of natural gas, and 14,440,117 gallons of natural-gas gasoline, having an aggregate royalty value of \$682,528.15.

PUBLIC WORKS PROJECTS

Throughout the greater part of the year much of the regular work of the conservation branch was subordinated to related activities undertaken with funds allotted by the Public Works Administration. Under 23 project allotments amounting to \$11,764 expenditures of \$9,819.13 were made during the year for repairs and physical betterments at the camps maintained for branch employees at Taft, Calif., and Midwest, Wyo. Under 9 project allotments amounting to \$200,000 expenditures of \$59,256.09 were made for the proper plugging and abandonment or conditioning for use as a source of water of numerous wells drilled for oil and gas on public lands in the West and thereafter improperly abandoned or merely deserted. Under 6 project allotments amounting to \$428,200 expenditures of \$168,288.53 were made in extinguishing and controlling coal-outcrop fires and in filling, bulkheading, or otherwise safeguarding abandoned mine or prospect openings on publicly owned coal lands in the West and on Indian-owned coal lands and lead and zinc lands in Oklahoma, and in subsurface studies of oil and gas occurrence in Indian-owned lands in Oklahoma. Under 11 project allotments amounting to \$250,000 expenditures of \$99,155.28 were made for utilization surveys of the power and storage resources of important rivers and creeks in nearly all the public-land States. Except for those involving camp rehabilitation the projects undertaken were planned for continuance during a period of 18 months and completion prior to June 30, 1935. Many of the oil and gas projects involved the letting of contracts under which operations were not begun until after the end of the fiscal year 1934.

SUMMARY OF FIELD OPERATIONS BY STATES

Alabama.—Inspected oil and gas prospecting operations throughout the State in aid of mineral classification. Supervised one coal lease.

Alaska.—Supervised 4 leases, 2 licenses, and 18 prospecting permits for coal and 101 prospecting permits for oil and gas.

Arizona.—Supervised 9 power projects and completed 206 miles of stream-utilization surveys on Williams, Little Colorado, and Verde Rivers. In cooperation with the University of Arizona and the United States Forest Service con-

tinued surveys of the grazing and agricultural resources of the State. Supervised on public land 6 prospecting permits for potassium, 6 prospecting permits for sodium, and 63 prospecting permits for oil and gas; on Indian land, 1 lease for oil and gas.

Arkansas.—Supervised 1 power project. Inspected oil and gas prospecting operations throughout the State in aid of mineral classification. Supervised 9 prospecting permits for oil and gas.

California.—Examined the Big Bar coal field, Trinity County, and one tract in Sonoma County for mineral classification. Supervised 44 power projects and completed 310 miles of stream-utilization surveys on Sacramento, McCloud, and Kern Rivers and Putah Creek, including Kennett, Isabella, and Monticello reservoir sites and Kennett, Bakersfield, Democrat Springs, and Isabella dam sites. Continued detailed studies of grazing conditions in Mono Lake and Owens Valleys in cooperation with the city of Los Angeles. Supervised on public land 4 leases and 2 prospecting permits for potassium, 16 prospecting permits for sodium, 3 prospecting permits for coal, 215 leases and 697 prospecting permits for oil and gas; and on naval petroleum reserves 24 leases for oil and gas.

Colorado.—Made structural examination of Mancos Divide gas field, Montezuma County, for mineral classification and leasing-law administration, and geologic surveys of an area of burning coal near Coalmont, Jackson County, precedent to the adoption of measures to extinguish or control the fire. Supervised six power projects and completed 50 miles of stream-utilization surveys on Gunnison, Roaring Fork, and San Juan Rivers, including the Trujillo reservoir site on the San Juan. Supervised on public lands 79 leases, 12 licenses, and 40 prospecting permits for coal, 1 prospecting permit for potassium, and 28 leases and 459 prospecting permits for oil and gas; and on Indian lands 6 leases for oil and gas.

Florida.—Inspected oil and gas prospecting operations throughout the State and examined one tract each in Liberty, Hamilton, and Lee Counties for mineral classification.

Idaho.—Supervised 19 power projects and completed 145 miles of stream-utilization surveys on Snake River, Henrys Fork, and Priest River. Completed reconnaissance studies of grazing capacities and conditions in the proposed Garden Creek and Lemhi Valley grazing districts. Supervised 11 prospecting permits for coal, 2 leases for phosphate, and 77 prospecting permits for oil and gas.

Kansas.—Examined one tract in Riley County for land classification. Supervised 13 prospecting permits for oil and gas.

Louisiana.—Inspected oil and gas prospecting operations throughout the State and examined one tract in Catahoula Parish for mineral classification. Supervised 11 leases and 1 prospecting permit for oil and gas.

Mississippi.—Inspected oil and gas prospecting operations throughout the State and examined two tracts in George County for mineral classification.

Montana.—Supervised three power projects and completed 140 miles of stream-utilization surveys on Kootenai, Flathead, and Blackfoot Rivers. Completed investigation of the grazing resources of the Mizpah-Pumpkin Creek Grazing Reserve. Supervised on public land 90 leases, 22 awarded leases, 66 licenses, and 44 prospecting permits for coal, 5 leases for phosphate rock, and 82 leases and 643 prospecting permits for oil and gas; and on Indian land 1 lead-silver-gold lease and 50 leases for oil and gas.

Nebraska.—Supervised one prospecting permit each for potassium and for oil and gas.

Nevada.—Supervised five power projects and completed 117 miles of stream-utilization surveys on Little Humboldt and Muddy Rivers. Supervised 4 prospecting permits for coal, 1 lease for phosphate, 10 prospecting permits for potas-

sium, 1 lease and 5 prospecting permits for sodium, and 59 prospecting permits for oil and gas.

New Mexico.—In cooperation with the geologic branch completed geologic survey of parts of Sandoval and Rio Arriba Counties for coal classification. Completed 125 miles of stream-utilization surveys on Chama, Gila, and San Francisco Rivers and Rio Grande. Supervised on public land 22 leases and 23 prospecting permits for coal, 9 leases and 158 prospecting permits for potassium, 10 prospecting permits for sodium, 22 prospecting permits for sulphur, and 94 leases and 1,195 prospecting permits for oil and gas; and on Indian land all agency coal mines and 7 leases for oil and gas.

North Dakota.—Supervised 72 leases, 14 authorized leases, 18 licenses, and 1 prospecting permit for coal, and 20 prospecting permits for oil and gas.

Oklahoma.—Supervised on public land 17 leases and 14 prospecting permits for oil and gas; and on Indian land 42 leases, 3 pending leases, 12 prospecting permits, and 6 pending permits for coal, 40 leases for lead and zinc, and 4,563 leases for oil and gas. Bored 103 auger holes and made 207 water analyses in a study of sub-surface pollution involving appraised damages of \$100,000 to 24 Indian allotments.

Oregon.—Examined one tract in Multnomah County for coal classification. Supervised 37 power projects and completed 51 miles of stream-utilization surveys on the Hood, Willamina, and Umatilla Rivers and Gales and Catherine Creeks, including numerous small reservoir sites. Supervised 1 lease and 7 prospecting permits for coal, 1 lease for oil shale, and 46 prospecting permits for oil and gas.

South Dakota.—Supervised 4 leases, 1 license, and 2 prospecting permits for coal and 26 prospecting permits for oil and gas.

Utah.—Completed detailed geologic survey of Petroleum Reserve No. 7, in Washington County, for mineral classification and leasing-law administration and examined one tract in Iron County, for coal classification. Began a systematic survey of the grazing resources of grazing district no. 4, in the west-central part of the State. Supervised seven power projects and completed 72 miles of stream-utilization surveys on Huntington, Cottonwood, Pleasant, Ephraim, and Manti Creeks. Supervised 37 leases, 2 licenses, and 86 prospecting permits for coal, 3 prospecting permits for sodium, 42 prospecting permits for potassium, and 11 leases and 535 prospecting permits for oil and gas. Supervised on Indian land one lease for oil and gas.

Washington.—Supervised 12 power projects and completed 93 miles of stream-utilization surveys on Nooksack and Toutle Rivers, Clark Fork, and Sheep Creek. Supervised 17 prospecting permits for coal, 1 authorized lease and 1 prospecting permit for sodium, and 8 prospecting permits for oil and gas.

Wisconsin.—Supervised one power project.

Wyoming.—Examined 9 square miles in Natrona County for coal classification and 4 square miles in Goshen County for phosphate classification. Supervised 4 power projects and completed 98 miles of stream-utilization surveys on Bear, Laramie, and Green Rivers. Supervised on public land 44 leases, 21 licenses, and 49 prospecting permits for coal, 2 prospecting permits for sodium, 422 leases and 1,270 prospecting permits for oil and gas; and on Indian land 40 leases for oil and gas. Made 22,970 determinations of oil gravity, 55 analyses of oil, 35 analyses of natural gas, and 295 analyses of oil-field waters.

WORK ON PUBLICATIONS

Texts.—The book publications of the year in the regular series numbered 47, covering 6,602 pages. Besides these publications, 46 brief papers in mimeographed form were issued as memoranda for the

press. During the year 19,007 pages of manuscript were edited and prepared for printing, and 2,234 galley proofs and 7,434 page proofs were read and corrected. Indexes were prepared for 29 publications, covering 5,039 pages. Copy and proof or stencils for 1,297 pages of multigraph and mimeograph matter were read.

Illustrations.—The section of illustrations prepared 2,002 drawings and photographs, transmitted 456 illustrations to accompany 26 reports, received and examined 515 proofs, and examined 32 editions. The work included considerable drafting for the Public Works Administration.

Geologic editing and drafting of maps and illustrations.—The geologic map of Colorado, scale 1:500,000, was prepared for engraving and reached first plate proof of the boundaries. Letter symbols for this map were prepared for engraving, and the explanation was prepared for typesetting. The geologic map of Texas, scale 1:500,000, was prepared for engraving and the explanation prepared for typesetting. The printing of the geologic map of the Valley of Virginia, scale 1:250,000, and of the map showing mineral resources of the Tennessee Basin, scale 1:500,000, was completed. The maps for the Somerset-Windber (Pa.) and Montevallo-Columbiana (Ala.) folios were approved for printing. The geologic maps of the Hollidaysburg-Huntingdon (Pa.) folio reached first plate proof. Illustrations for 16 papers, ready for publication, were edited, and 113 drawings were made for papers by geologists for publication by State geological surveys or other organizations.

Engraving and printing.—During the fiscal year 80 newly engraved topographic maps were printed, including 6 revised maps (of this number 7 were completed under the Public Works allotment), and 8 new State and other maps and 3 special maps were photolithographed and printed, making a total of 91 new maps printed and delivered. Corrections were engraved on the plates of 115 maps. Reprint editions of 150 engraved topographic maps and 7 photolithographed State and other maps were printed and delivered. In addition, 43 new topographic maps had been engraved and were in press June 30, including 18 under Public Works allotment, and the engraving of 6 other new topographic maps was nearly completed, including 2 under Public Works allotment. Of new and reprinted maps, 248 different editions, amounting to 612,115 copies, were delivered.

A large amount of work was done for 58 other units of the Government and 2 State Governments. This work included many reprints, and the charges for it amounted to about \$141,000, for which the appropriation for engraving and printing geologic and topographic maps was reimbursed.

Of topographic maps, geologic maps, and contract and miscellaneous work of all kinds, a grand total of 2,214,728 copies were printed and delivered.

The output of the photographic laboratory consisted of 8,588 negatives (including 3,763 wet plates for photolithographs, 882 wet plates for photographic prints, 12 paper negatives, 988 dry plates, 328 lantern slides, and 2,615 field negatives developed), 21,044 prints (including 2,699 maps and diagrams, 16,983 photographs for illustrations and records and 1,362 bromide enlargements), 3,154 zinc plates, 282 intaglio etchings, 4 celluloid prints, and 167 prints mounted.

Distribution.—A total of 295 publications, comprising 47 new books and pamphlets, 91 new or revised topographic and other maps, and 157 reprinted topographic and other maps, were received by the division of distribution during the year. A number of special pamphlets and forms for administrative use were also delivered and distributed. The total units of all publications received numbered 102,291 books and pamphlets and 612,115 topographic and other maps, a grand total of 714,406.

The division distributed 142,611 books and pamphlets, 1,575 geologic folios, and 630,741 maps, a grand total of 774,927, of which 1,358 folios and 457,965 maps were sold. The net proceeds (gross collections less copying fees and amounts refunded) from the sales of publications were \$35,101.52, including \$34,705.33 for topographic and geologic maps and \$396.19 for geologic folios. In addition to this \$1,621.78 was repaid by other establishments of the Federal Government at whose request maps or folios were furnished. The total receipts, therefore, were \$36,723.30.

LIBRARY

A Civil Works Administration project was set up for the library December 18, 1933, and about 50 workers were employed on a rehabilitation program. Much worth-while work in cataloging the Kunz collection on precious stones, inventorying the library, mending more than 3,000 books, etc., was accomplished before the closing up of the Civil Works Administration on April 28, 1934. The inventory showed a count of 186,900 books in the library. Since June 1, 1934, this special work has been continued under the Emergency Relief Administration. The accessions during the year comprised 9,366 books, pamphlets, and periodicals and 755 maps. The library was used by 11,182 readers, nearly half of them not members of the Survey, and the loans for use outside of the library numbered 13,910. Work on the bibliography of North American geology was continued. The library facilities are being used in preparing a bibliography of foreign geology for the Geological Society of America and an annotated bibliography of economic geology for the National Research Council.

Funds available, expenditures, and obligations incurred by Geological Survey, fiscal year ended June 30, 1934

87859-34-17

	Funds available				Obligations			Balance
	Amounts appropriated or transferred	Repayments on account of work performed		Total	Disbursements	Outstanding liabilities	Total	
		Made	To be made					
APPROPRIATIONS								
Salaries.....	\$125,000.00		\$12,121.02	\$137,121.02	\$112,821.56	\$23,433.02	\$136,254.58	\$866.44
Topographic surveys.....	450,000.00	\$161,692.28	65,272.31	676,964.59	568,161.68	28,288.95	596,450.63	1 80,513.96
Geologic surveys.....	300,000.00	15,161.46	25,636.91	340,798.37	310,659.70	23,732.31	334,392.01	6,406.36
Volcanologic surveys.....	12,500.00			12,500.00	5,684.76	1,864.09	7,548.85	4,951.15
Alaskan mineral resources.....	30,000.00	4,815.19	1,482.70	36,297.89	30,540.99	2,339.76	32,880.75	3,417.14
Gaging streams.....	540,000.00	232,371.25	199,830.87	972,202.12	781,278.41	26,344.86	807,623.27	2 164,578.85
Classification of lands.....	100,000.00	2,346.13	7,768.57	110,114.70	99,403.69	6,169.33	105,573.02	4,541.68
Printing and binding.....	110,000.00	912.54		110,912.54	19,727.30	56,185.24	75,912.54	3 35,000.00
Preparation of illustrations.....	15,000.00	1,837.10		16,837.10	16,590.12	59.26	16,649.38	187.72
Geologic and topographic maps.....	85,000.00	116,786.68	28,560.52	230,347.20	207,986.18	11,476.75	219,462.93	10,884.27
Mineral leasing.....	225,000.00	17,605.67	15,629.46	258,235.13	210,174.39	13,121.08	223,295.47	34,939.66
	4 1,992,500.00	553,528.30	356,302.36	2,902,330.66	2,363,028.78	193,014.65	2,556,043.43	346,287.23
TRANSFERS								
Federal Power Commission (act Feb. 17, 1933), 1934.....	700.00			700.00	104.92	11.39	116.31	583.69
Flood control, Mississippi River and tributaries (War Department, act Feb. 14, 1931).....	6 1,310.30	146.43		1,456.73	587.58	869.15	1,456.73	0
Irrigation, Indian reservations (reimbursable; act Feb. 17, 1933), 1934.....	800.00			800.00	479.69	280.01	759.70	40.30
Irrigation, San Carlos and Florence-Casa Grande projects, Arizona (reimbursable; act Feb. 17, 1933), 1934.....	2,750.00			2,750.00	1,894.37	823.46	2,717.83	32.17
Maintenance and improvement of existing river and harbor works (War Department, act Feb. 14, 1931).....	6 478.57	11.15		489.72	471.83	17.89	489.72	0
Maintenance and improvement of existing river and harbor works (War Department, act Apr. 22, 1932).....	6 4,093.50	349.40		4,442.90	4,442.90		4,442.90	0
Maintenance and improvement of existing river and harbor works (War Department, act Feb. 17, 1933).....	21,034.00	10.25	208.24	21,252.49	15,679.96	4,104.56	19,784.52	7 1,467.97
National industrial recovery, Interior Department, Geological Survey, 1933-35.....	4,497,164.00	17,269.82	15,510.45	4,529,944.27	2,015,434.87	217,535.04	2,232,969.91	7 2,296,974.36
Operating and care of canals and other works of navigation (War Department, act Feb. 17, 1933).....	2,800.00			2,800.00	1,344.17	1,069.06	2,413.23	7 386.77
Operation and conservation of naval petroleum reserves (Navy Department, act Feb. 17, 1933), 1934.....	37,582.00	1,790.34	325.58	39,697.92	38,363.78	899.96	39,263.74	434.18
Supervising mining operations on leased Indian lands (act Feb. 17, 1933), 1934.....	56,800.00	2,664.21	1,743.05	61,207.26	59,339.16	1,868.10	61,207.26	0

SUMMARIES OF BUREAU REPORTS

Funds available, expenditures, and obligations incurred by Geological Survey, fiscal year ended June 30, 1934—Continued

	Funds available			Obligations			Balance	
	Amounts appropriated or transferred	Repayments on account of work performed		Total	Disbursements	Outstanding liabilities		Total
		Made	To be made					
TRANSFERS—continued								
Wapato Irrigation and Drainage District, Washington (reimbursable; act Feb. 17, 1933), 1934	\$575.00			\$575.00	\$239.70	\$313.35	\$553.05	\$21.95
Waterways treaty, United States and Great Britain (State Department, act Mar. 1, 1933), 1934	48,200.00	\$52.77	\$122.50	48,375.27	35,390.83	11,160.34	46,551.17	1,824.10
Working fund, Department of the Interior, Civil Works	146,150.00			146,150.00	130,865.56	7,740.38	138,605.94	7,544.06
Working fund, Department of the Interior, Public Works (Agriculture, Public Roads)	75,000.00	628.08	833.19	76,461.27	33,282.74	301.29	33,584.03	7 42,877.24
Working fund, Department of the Interior, Public Works (Agriculture, Weather Bureau)	46,900.00		73.50	46,973.50	19,079.64	5,357.39	24,437.03	7 22,536.47
Working fund, Department of the Interior, Public Works (Army Engineers)	11,900.00			11,900.00	4,240.04	5,039.73	9,279.77	7 2,620.23
Working fund, Department of the Interior (General Land Office)	11,900.00			11,900.00		7,675.00	7,675.00	7 4,225.00
Working fund, Department of the Interior, Public Works (Mississippi Valley Committee)	8,000.00			8,000.00	4,754.90	1,331.48	6,086.38	7 1,913.62
Working fund, Department of the Interior, Public Works (Bureau of Reclamation)	10,000.00		222.50	10,222.50	8,171.61	1,157.02	9,328.63	7 893.87
Working fund, Department of the Interior, Public Works (advance for water-resources branch supplies and materials)	5,000.00			5,000.00	612.50	2,797.50	3,410.00	7 1,590.00
Working fund, Department of the Interior (Tennessee Valley Authority)	170,140.00	4.59	6,199.34	176,343.93	125,093.05	47,703.66	172,796.71	7 3,547.22
Total	5,159,277.37	22,927.04	25,238.35	5,207,442.76	2,499,873.80	318,055.76	2,817,929.56	2,389,513.20
Grand total	7,151,777.37	\$ 576,455.34	\$ 381,540.71	\$ 8,109,773.42	\$ 4,862,902.58	\$ 511,070.41	\$ 5,373,972.99	2,735,800.43

¹ \$50,000 of this balance continued available for expenditure during the fiscal year 1935.² \$163,000 of this balance continued available for expenditure during the fiscal year 1935.³ This balance continued available for expenditure during the fiscal year 1935.⁴ In addition to these appropriations, there was an allotment of \$9,345.80 for miscellaneous supplies from the appropriation for contingent expenses of the Interior Department.⁵ Expenditure of these appropriations was restricted by the Bureau of the Budget, which imposed a "cash withdrawal limitation" of \$1,496,212 during the fiscal year.⁶ Balance unobligated June 30, 1933, and continued available for expenditure in the fiscal year 1934.⁷ Balance unobligated June 30, 1934, and continued available for expenditure in the fiscal year 1935.⁸ Included in these amounts is \$454,340.52 covering work performed by Geological Survey units for other Geological Survey units; supplies furnished by one branch to another; credits to appropriations on account of impounded salaries which have been released; adjustment vouchers between transferred funds and Geological Survey appropriations; and other adjustments necessarily reported in combining totals but otherwise a duplication.

Classification of obligations incurred by the United States Geological Survey during the fiscal year ended June 30, 1934

	Salaries	Topographic surveys	Geologic surveys	Volcanologic surveys	Alaskan mineral resources	Gaging streams	Classification of lands
Personal services.....	\$106,968	\$1,161,136	\$356,866	\$5,725	\$23,048	\$809,272	\$85,682
Supplies and materials.....		20,190	5,169	115	153	99,780	203
Storage of motor cars.....		901	397			415	43
Communication service.....		1,497	239	2	19	4,280	84
Travel expenses.....		301,794	38,713	8	5,919	117,778	4,911
Transportation of things.....		67,025	6,380	34	205	27,973	429
Printing, binding, photographing, etc.....		67,209	3,467		348	4,579	146
Heat, light, power, water, and electricity.....		272	143		81	409	
Rents.....		373		1		5,922	
Repairs and alterations.....		9,452	860	102	146	41,324	57
Special and miscellaneous current expenses.....		387	194				21
Equipment.....		163,794	7,692		69	111,324	111
Structures.....				627		76,705	
Impoundments of compensation deductions and vacancy savings.....	29,287	75,614	34,787	2,135	2,652	28,543	10,176
Miscellaneous transfers and adjustments.....		139,593	10,889		241	234,000	3,728
Total.....	136,255	2,009,237	465,796	8,749	32,881	1,564,015	105,591

	Printing and binding	Preparation of illustrations	Geologic and topographic maps	Mineral leasing	Civil Works projects	Total
Personal services.....		\$15,109	\$175,465	\$432,942	\$51,274	\$3,223,487
Supplies and materials.....		512	26,918	11,770	4,387	169,197
Storage of motor cars.....				111		1,867
Communication service.....			2	2,578	272	8,973
Travel expenses.....			102	29,762	30,256	529,243
Transportation of things.....			41	2,534	1,523	106,144
Printing, binding, photographing, etc.....	\$75,043	266	7,798	378	26,093	185,327
Heat, light, power, water, and electricity.....				4,092		4,997
Rents.....				1,076	247	7,619
Repairs and alterations.....			396	38,384	281	91,002
Special and miscellaneous current expenses.....				557	128	2,998
Equipment.....		28	3,425	8,710	24,145	319,298
Structures.....				11,673		89,005
Impoundments of compensation deductions and vacancy savings.....		692	12,691	16,495		213,072
Miscellaneous transfers and adjustments.....	870	42	300	32,081		421,744
Total.....	75,913	16,649	227,138	593,143	138,606	5,373,973

NOTE.—In addition to the above amounts, there was expended directly by cooperating agencies \$72,242 for topographic surveys and \$244,547 for stream gaging.

OFFICE OF EDUCATION

(BESS GOODYKOONTZ, Acting Commissioner)

I. GENERAL STATEMENT

1. CHANGES IN THE ADMINISTRATIVE ORGANIZATION THE COMMISSIONERSHIP

In May of this year Commissioner of Education George F. Zook resigned to become Director of the American Council on Education, his resignation to become effective on June 30. At the same time announcement was made of the appointment to the commissionership of John Ward Studebaker, superintendent of schools of Des Moines, Iowa, who will take office September 1.

The year of Dr. Zook's incumbency of the commissionership was a particularly important one for education and educational agencies. The effects of the depression were still weighing heavily on the schools, and the problems of adjustment were critical. The relation of education to the whole program of economic recovery was stated by Dr. Zook in this way:

Today, from the President to the humblest citizen there is a common agreement that education, widespread and up to date, holds the key to our national problems. On education depends all of our progress in the development of the production and distribution of material goods. To education we must look for vision and balance in our social life. In other words, our provision for education, in its broadest sense, is the greatest assurance to the American people of an opportunity for an abundant life.

Because of the close connection of education to the activities of many of the Government agencies engaged in phases of the recovery program, Commissioner Zook attempted to cooperate in every possible way with such Government programs. Illustrations of this include the Public Works Administration in its school-building activities, the N.R.A. in whatever codes affect the schools, and the C.C.C. in the educational programs in the camps. Descriptions of these cooperative activities as well as accounts of the continued research and service program of the office are given on the following pages.

UNION OF TWO FEDERAL EDUCATION AGENCIES

In October 1933 the duties and functions of the Federal Board for Vocational Education, which was created as a separate organization in 1917, were transferred to the Office of Education under the Commis-