

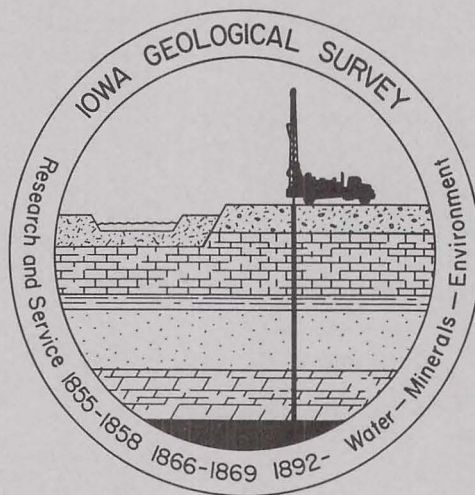
ANNUAL REPORT

of the

STATE GEOLOGIST

to the

GEOLOGICAL BOARD



Volume 45
30 June 1974

GEOLOGICAL BOARD

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STATE OF IOWA

IOWA GEOLOGICAL SURVEY

16 WEST JEFFERSON STREET

IOWA CITY, IOWA 52242

Phone: (319) 338-1173



Iowa
a place to grow

Samuel J. Tuthill
Director and State Geologist

Orville J. Van Eck
Assistant State Geologist

August 14, 1974

TO: Governor Robert D. Ray, Chairman
and Members of the Geological Board

Gentlemen,

Herewith is the Annual Report of the State Geologist made in accordance with the requirements of the Code of Iowa, Sec. 305.7 and Sec. 17.4. It describes the activities and accomplishments of the Iowa Geological Survey for the period of 1 July 1973 to 30 June 1974.

The responsibilities of the Iowa Geological Survey are set forth in the Iowa Code, Sections 305 and 84.

Respectfully submitted,

Samuel J. Tuthill
Director and State Geologist

SJT:wg

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Iowa Geological Survey

ANNUAL REPORT

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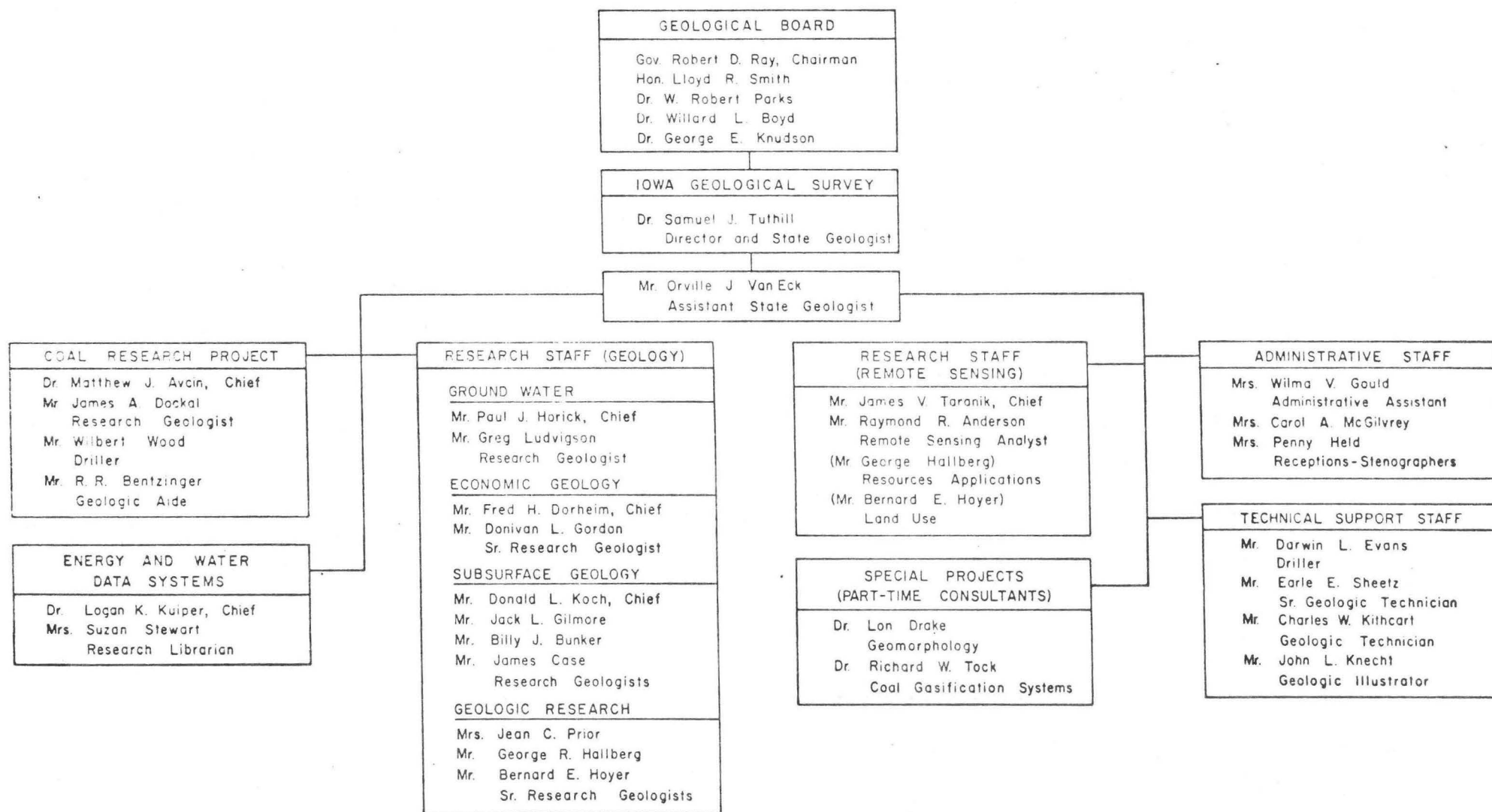
1 July 1974

Figure 1 shows the table of organization for the Iowa Geological Survey for this date. Figure 2 shows the functional relationships of the Survey. During the past year the Survey staff has accomplished the following major tasks:

I. GEOLOGICAL SURVEY PUBLICATIONS

1. Horick, P. J., Steinhilber, W.L., 1973, Mississippian Aquifer of Iowa: Misc. Map Series 3, 3 sheets with text.
2. Hoyer, B.E., Anderson, R.R., Taranik, J.V., Cooper, R.I. and Hallberg, G.R., 1974, Resource Development Land- and Water-Use Management, Eleven County Region, South Central Iowa: Misc. Map Series 4, 35 p.
3. Hoyer, B.E., Hallberg, G.R., and Taranik, J.V., 1974, Summary of Multispectral Flood Inundation Mapping in Iowa: Pub. Info. Circ.
4. Hoyer, B.E., and Taranik, J.V., 1974, An Index of Iowa Spacecraft and Aircraft Imagery: Prelim.Rept. 4.
5. Hansen, R.E., 1973, Bedrock Topography of Southeast Iowa: 2 sheets.

Figure 1. Staff Organization and Responsibility Assignment



IOWA GEOLOGICAL SURVEY

Research Cooperative Programs

U.S. Geological Survey
Groundwater (50/50)
U.S. Geological Survey
Surface Water (50/50)
National Aeronautics and
Space Administration
(40 IGS/60 US)
Dept. of the Interior, Office
of Saline Water
Environmental Protection
Agency

Consultation, Advisory, and Data Source Services

Iowa Department of Revenue
Iowa Water Well Drillers
Local and Regional Planning Commissions
Iowa Counties and Municipalities
Iowa Commerce Commission
Iowa Development Commission
Office for Planning and Programming
Iowa State Department of Health
Dept. of Environmental Quality
Air Quality Commission
Solid Waste Management Division
Water Quality Commission
Chemical Technology Commission
Iowa State Hygienic Laboratory
Iowa Department of Justice
Iowa Natural Resources Council
Iowa Department of Soil Conservation
Iowa Agricultural Experiment Station
State Archaeologist
Iowa Highway Commission
Iowa Department of Agriculture
Iowa Preserves Board
Iowa Conservation Commission
The University of Iowa
Iowa State University
University of Northern Iowa
Iowa Department of Public Instruction
U. S. Department of Agriculture SCS
Iowa Citizens
Private Industry
Engineering Consultants

Participation in Other Agencies

Iowa Natural Resources Council
Iowa State Land Rehabilitation
Advisory Board
Iowa State Map Advisory Council
Iowa Conservation Education Council
Iowa City Chamber of Commerce
Environmental Concerns Committee
Dept. of Environmental Quality
Inter-Agency Resource Council
Dept. of Soil Conservation
Watershed Advisory Board
Conservancy District Task Force
U.S. Department of Agriculture
Iowa-Cedar Rivers Basin
Coordinating Committee

Fig. 2. Functional Relationships of the Iowa Geological Survey

6. Horick, P.J., (in press), Minerals of Iowa: Educ. Series 2.
7. Zietz, I., (in press), Aeromagnetic Map of Iowa: 1 sheet.

II. SURVEY PUBLICATION IN FINAL PREPARATION

1. Stewart, S., and Tuthill, S.J., 1974, Patterns of Fuel Consumption in Iowa: Pub. Info. Circ. No. 6.
2. Hoyer, B.E., Wiitala, S.W., Hallberg, G.R., Steinhilber, W.L., Taranik, J.V., and Tuthill, S.J., 1974, Flood Inundation Mapping and Remote Sensing in Iowa: Pub. Info. Circ.

III. EXTRINSIC PUBLICATIONS

1. Gordon, D.L., and Dorheim, F.H., (in press), Criteria for Use of Abandoned Limestone and Gypsum Quarries as Sanitary Landfill Sites in Iowa: Amer. Inst. of Mech. Eng.
2. Oros, M.O., et al, 1974, Oil and Gas Developments in North Mid-Continent in 1973: Amer. Assoc. Petrol. Geol.
3. Cooper, R.I., Taranik, J.V., and Tuthill, S.J., 1974, Remote Sensing for Landuse Inventory and Land Suitability Analysis in South Central Iowa: Am. Soc. Photogrammetry, Proc. Ann. Mtng., St. Louis, 1974.
4. Hallberg, G.R., and Morrison, R.B., 1973, Evaluation of ERTS-1 Imagery for Mapping Quaternary Deposits and Landforms in the Great Plains and Midwest: Final Report, NASA, NTIS (in press).

5. Taranik, J.V., and Tuthill, S.J., 1974, Remote Sensing Data, a Basis for Monitoring Systems Design: Proc. 2nd Conf. on Environ. Quality Sensors, p. v-17-32, U.S. Env. Prot. Agency, Office of Research and Development, Washington, D.C.
6. Hallberg, G.R., Hoyer, B.E., and Miller, G.A., (in press) The Geology and Paleopedology of the Cherokee Sewer Site: Jour. Iowa Arch. Soc.
7. Hoyer, B.E., and Hallberg, G.R., (in press), Application of Remote Sensing to Flood Mapping, in Manual Remote Sensing: Am. Soc. Photogrammetry, v. 2.
8. Hoyer, B.E., Hallberg, G.R., and Taranik, J.V., 1973, Second Multispectral Inundation Mapping in Iowa, in Proc., Symposium on Management and Utilization of Remote Sensor Data: Am. Soc. Photogrammetry, p. 130-141.
9. Gilmore, J.L., Bedrock Map of Southwestern Iowa.
10. Cavallaro, A.J. and Van Eck, O.J, 1973, Preparation Characteristics and Desulfurization Potential of Iowa Coals: U.S. Bur. Mines, Rept. of Inv. 7830, 32 p.
11. Koch, D.L., 1973, Cold Water Cave - Beauty, Origin, Research: The Iowan, Winter Issue, p. 23-35.

IV. CONSULTATIVE, ADVISORY, AND DATA-SOURCE SERVICES

Well Predictions

Predictions for groundwater resources are made on request for groups or individuals. Most of them are presented in the form of letter reports, but some are telephoned reports. The requests come from a wide range of users and are summarized as follows:

<u>Category</u>	<u>No.</u>
Municipal	49
Industrial	36
Domestic	74
Housing and mobile home projects	11
Feedlots	9
Irrigation	7
Recreational	7
General, areal reviews	7
Rural Water Districts	2
University	1
Airport	1
Other	<u>23</u>
Total	227

Well Logging

Drill cuttings from approximately 55 wells were logged for a total footage of approximately 29,600 feet. Of this footage, approximately

6,000 feet were examined to determine depths to formation tops only. The remaining samples were logged in detail for each sample interval. Emphasis is being placed on logging deep municipal and industrial wells and those wells located in special project areas.

Casing Points

Drill cuttings from 7 municipal wells were examined to define casing points for various well contractors and/or engineers. The average depth of those wells is 1,800 feet. Verification of formation tops by the Geological Survey is relied upon to insure that drilling has reached proper depth for placement of casing in wells.

Oil and Gas Administrator

Under Chapter 84 Code of Iowa the State Geologist is designated Administrator of Oil and Gas. In this capacity the Geological Survey reviewed and processed 318 applications for drilling permits. Of the 318 permits issued, one was for an extended oil test, and the remainder were for gas injection/withdrawal wells associated with gas-storage projects, and stratigraphic tests.

At this time there are two gas storage feasibility studies in progress in the state. The sundry information generated by those studies has been reviewed and status files are being maintained. In this regard, a field study was conducted in the area of the proposed Northern Natural Gas Company Dallas Center underground storage facility to obtain

background hydrologic data for future reference in relation to postulated potential water quality and quantity deterioration attendant to stratigraphic test drilling in the area.

During the year quarterly status reports relative to Chapter 84 of the Code have been prepared for the Iowa Natural Resources Council. In addition monthly oil and gas (drilling) statistics were forwarded to the American Petroleum Institute. Information in relation to Chapter 84 and geologic information was furnished to five major oil companies, 12 independent consultants and nine private interest groups.

The Geological Survey continues to serve as consultant to the Iowa Commerce Commission in the review of procedures being followed by Northern Natural Gas Company in the abandonment of the Vincent gas-storage facility. The original acreage under lease for this facility when abandonment began in 1971 was 12,373 acres. Recovery of gas from the facility has made it possible to reduce the leased acreage to 2,240 acres as of May, 1974.

Requests for Information

Each year the Survey receives a large number of requests for geologic and hydrologic information. The requests range from those from individuals questioning the possibility of an economically valuable geologic resource on their property to those from consulting engineering firms gathering regional geologic and hydrologic data relevant to nuclear power plant siting. The

manner in which the requested data is presented generally is dependent upon the nature and scope of the request.

Many of the requests are very localized in nature and seek information of a very specific type. To provide the detail required to answer requests of this sort often will require a special letter report. Other requests are often much broader in nature and can be fulfilled by Survey publications.

As the geologic and hydrologic data bank becomes more fully automated, our ability to respond rapidly to requests for data has increased tremendously. For example, one of the major petroleum companies requested all the data from our well-log file. Formerly this would have entailed a visit of several weeks' duration for one of the company employees to copy the data, in addition to the time of a Survey staff member to assist in making the data available. We are now able to supply such data in the form of computer print-outs within a week at a nominal cost to the user. Similarly, we are able to provide these data on a county basis to well drillers, engineers, planning agencies, and so forth, at a cost ranging from 5 to 10 dollars per county, dependent on the amount of data available for the particular county.

During the past year the Survey received a great number of requests for information about energy and environmental problems. We have responded to the demand with approximately 100 public addresses by staff members and numerous letter reports.

Iowa Water Resources Data System

Through the cooperation of the Interagency Resources Council and the Iowa Natural Resources Council the Geological Survey is investigating the establishment of an Iowa Water Resources Data System as the technical data backup system for the State Comprehensive Water Plan. The proposed system has as its primary goal the establishment of a water resources data bank maintained by the Survey through a System Central which will integrate basic water quantity and quality data for all state resource agencies and the private sector. Under this system CPU linkages, for data input, retrieval, and manipulation would be established between Systems Central- the resource agencies within the Capitol Complex through the state's multicomputer network- and the Water Resources Division files of the U.S. Geological Survey in Washington.

The ultimate goal of the system is the expeditious and economical interagency exchange of water resource data to the end that the elimination of duplication of data will generate a favorable economic framework for operation of the system. It is recognized that the data system is essential to Iowa's future management, protection and allocation of water resources under a Comprehensive State Water Plan.

Consultative Contacts

The Survey is often called upon to provide consultative services to various state agencies, industries, and individuals. These services frequently involve on-site investigations in various parts of the state and interpretation of data. The following tabulation indicates the approximate number of

contacts that fall within this category:

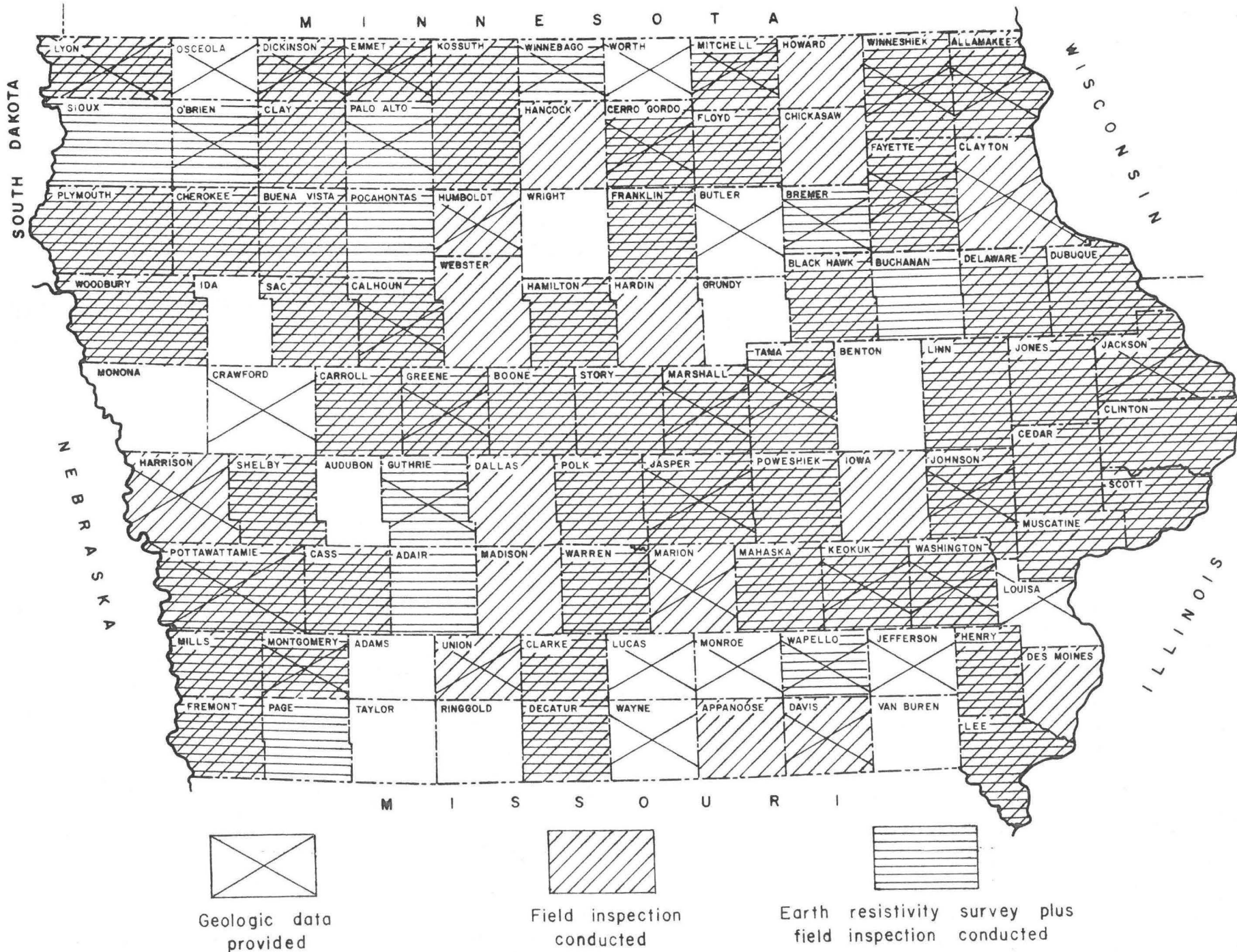
<u>Agency or Group</u>	<u>No. Contacts</u>
Iowa Natural Resources Council	70
Iowa Commerce Commission	12
Department of Environmental Quality	80
Iowa Conservation Commission	28
Iowa State Highway Commission	3
Office for Planning and Programming	10
Iowa Development Commission	20
Iowa Department of Justice	10
State Hygienic Laboratory	5
State Archaeologist	6
Iowa Department of Soil Conservation	30
State Universities and Public Schools	45
Counties and Cities	70
Federal Agencies (F.H.A., U.S.D.A., etc.)	25
Engineering Consultants	75
Water Well Drillers	100
Industry	51
Individual Citizens	<u>80</u>
Total	720

Sanitary Landfills

The Geological Survey established geologic and hydrologic criteria to be included in the rules that govern sanitary landfill siting, under the jurisdiction of the Solid Waste Management Division, Department of Environmental Quality. These criteria are designed to protect the water resources of the state. To assist municipal and county governmental agencies in the selection of sites that will best meet the geologic and hydrologic criteria, the Survey has either furnished extant data, made on-site inspections, or conducted earth-resistivity surveys for all but 10 counties of the state (fig. 3). To date those 10 counties have not petitioned the survey for assistance in the selection of landfill sites.

To insure compliance with the rules designed to protect water resources the Geological Survey reviews all plans of proposed sanitary landfills that are submitted to the Department of Environmental Quality.

Figure 3: Status of Assistance Provided for Sanitary Landfill Site Selection



V. RESEARCH IN PROGRESS

1. Saline Water Study. In response to a recommendation by the Water and Disposal System Committee of the Governor's Rural Policy Council a study of the economic feasibility of desalination systems for municipal water supplies was begun in December of 1972. The study, which was conducted under a grant provided by the U.S. Department of the Interior Office of Saline Water and administered by the Iowa Geological Survey, has been completed and a report is now in press.

For the study the cities of Adair, Estherville, Grundy Center, Holstein, Le Claire, Leon, Oakland, Oxford, Sibley and Washington were chosen as providing a representative cross section of the more than 160 cities in the state using water that contains 1,000 or more parts per million dissolved solids for a municipal water supply. Later the city of Greenfield was included in the study to provide a comparative observation of an actual desalting application to a public water supply in Iowa. Greenfield was the first community in the United States to have a municipally owned and operated desalting plant.

The study determined the range of costs for the various desalting methods for each of the study communities, and also the estimated range of saving which should result from improving water quality by desalting. Because the cities chosen for inclusion in the study represent a wide range

of conditions it is expected that the results will be applicable to any comparable city in the state.

2. Coal Research Project. The primary purpose of this project is to more precisely define the coal reserves of the state in terms of quantity and quality and to develop a predictive sedimentological model that will enable us to predict where a particular coal seam will or will not be encountered. In addition, information about the nature of the materials overlying the coals will be compiled in order that mining and reclamation of surface-mined areas can be carried on in an economically and environmentally acceptable manner.

Progress on the project has been hampered severely by the delay in the delivery of the drill rig which will be used to obtain the subsurface information that is so vital to the interpretation of the stratigraphy of the coal-bearing rocks of Iowa. Extant subsurface and surficial exposure data relative to the subject have been readied for incorporation into the project.

Samples of coal and associated shales at each of the active coal mines are being chemically analyzed to determine contained trace elements. Analyses of this type possibly will provide a tool for stratigraphic correlations. If in fact the percentage of some of the trace elements are as high as indicated by preliminary analyses, a potential exists for economical recovery of a secondary resource from the produced coal.

3. Coal and Flue Gas Desulfurization Study. The United States Environmental Agency has funded a study in Iowa at a level of \$200,000 that has the following objectives:

1. To assess the feasibility of coal cleaning with respect to the degree and cost of reduction of sulfur emission.
2. To assess the sulfur control obtained and the cost effects resulting from burning cleaned coal and installing flue gas cleaning processes on existing plants.

The study is being conducted by the Houston-based engineering firm of M.W.Kellogg with the Geological Survey acting as coordinator of data from the utilities and other state agencies.

Preliminary results of the study indicate that none of the coal-burning utilities in the state are large enough to justify the expense of installing flue-gas cleaning devices. At this time it appears that the most economic approach will be to clean midwestern high-sulfur coal and blend the cleaned product with low-sulfur western coal, or else burn only the low-sulfur western coal. The final decision is dependent upon the sulfur emission standards that must be satisfied.

It is expected that the report of the study will be completed by August 1974.

4. Cold Water Cave. An outline of research efforts for the cave was presented in the 30 June 1973 Annual Report, and a summary of research progress was presented to Governor Robert D. Ray on 13 February 1974.

Detailed mapping of the cavern system beneath the Kenneth Flatland property was begun on 3 June 1974 with a projected completion date of 30 August 1974. This part of the cave is being mapped with a T-2 Wild Theodolite and subtense bar.

Water samples from the cavern stream and from drip water will be collected at regular intervals for complete chemical analysis, including analysis for heavy metals content. The purpose of this sampling program is to determine if variations in chemical constituents occur and if so, are those variations correlative with precipitation patterns.

5. Hydrology of Carbonate Aquifers of the Eastern Iowa Groundwater District. The research objectives for this project were outlined in the 30 June 1973 Annual Report. This program is being carried out under a cooperative agreement with the Water Resources Division, U.S. Geological Survey.

During the current report period 16 research wells were drilled for a total footage of 2,700 feet. Of this total footage, approximately 1,200 feet were cored and the remainder was drilled conventionally. Some of the drill holes were constructed as multiple observation wells and

instrumented to monitor fluctuations of water levels in the various aquifers penetrated. Other drill holes were completed as pumping wells for production tests. In several of the pumping wells tests were performed in which various zones within an aquifer were isolated to test the production from each isolated zone. Water samples from each zone were collected to determine if differences in chemical quality exist in the water from the various zones within a single aquifer.

Thin sections were prepared from 55 samples of rock core. These thin sections will be studied with a petrographic microscope to determine diagenetic features that may effect variations in water chemistry and that may control the rate and direction of groundwater flow.

6. Linn County Environmental Geology Project. Environmental planning is especially vital in areas that are undergoing rapid urban-industrial and agricultural growth with accompanying modification of rural regions. Linn County typifies such an area. For that reason a suite of maps that summarize the geological environment of Linn County have been prepared to aid in making landuse decisions and to help solve problems arising from man's interaction with his physical environment. The maps provide information on surface topography and materials, thickness and stratigraphy of unconsolidated sediments, bedrock type and topography, surface and groundwater resources, and flood-prone areas. Maps that present the above data will delineate regions having high, moderate and low environmental hazard for various landuse

practices. It is planned that the maps will go to press by August of 1974.

7. Cooperative Research. To implement geologic and hydrologic research in Iowa the Geological Survey uses the authority granted in Chapter 305.8, Code of Iowa, to cooperate with Federal agencies in cost-sharing programs. During the current reporting period the Survey continued a 50/50 cost-sharing cooperative program with the Water Resources Division of the U.S. Geological Survey. The objectives of the program are threefold: (1) to inventory the groundwater resource, which involves an overall appraisal of groundwater occurrence and quality in an aquifer-or basin-wide organization of information; (2) to maintain surveillance of the groundwater resources which involves maintaining a network of observation wells to determine water-level and chemical-quality changes; and (3) to maintain a system for collection and compilation of basic records of daily stage and flow rate of streams, and the concentration and total load of sediments carried by streams. The data gathered in these programs form the foundation for good water-management policies and comprehensive planning.

During the past year the Iowa and U.S. Geological Surveys have discussed the establishment of an integrated research effort with the U.S. Soil Conservation Service, State Soil Survey staff of Iowa State University Experimental Station, and the Soils Engineering Group at Iowa State University. All of these groups are involved in research and/or management of various resources aspects (i.e., soils, groundwater, etc.) of the uncon-

solidated materials in Iowa. The intent of the program is to coordinate, integrate and improve some of the data collection programs of these agencies.

In the process of analyzing the materials to solve their individual problems, the various disciplines within the several agencies and groups utilize many of the same techniques. Data derived from these analyses could and should be jointly collected and used.

The program potentially can provide information on the physical limitations of the land and water resources of the state which has not been available before. Some cooperative work has begun and the program will be expanded during the coming year. Examples of the type of work are as follows:

- (1) Determine the geologic framework of soils in various counties;
- (2) Establish the relationship of the unconsolidated materials to groundwater recharge and availability in the Carbonate Aquifer study area;
- (3) The correlation of large-magnitude floods with modern soils series.

VI. REMOTE SENSING LABORATORY

Environmental Investigations

1. Feedlot and Sewage Lagoon Inventory. The Iowa Department of Environmental Quality, using the staff expertise of the Iowa Geological Survey Remote Sensing Laboratory, (RSL), requested that the U. S. Environmental Protection Agency provide imagery over an area covering 15 counties in south-central Iowa. In October 1973 the U. S. Air Force flew the 15-county area at altitudes over 60,000 feet and acquired imagery that allowed the detection and identification of animals in feedlots and pasture. This imagery acquisition mission was coordinated through the Office of Research and Monitoring, U.S. Environmental Protection Agency, Washington, D.C. The EPA Photographic Interpretation Center at Vint Hill, Virginia developed mosaics and interpreted the imagery using special high resolution equipment. Representatives of the RSL staff visited Vint Hill and assisted with development of the interpretation criteria. Mosaics are being prepared for each Iowa county and overlays show the distribution of the following:

- | | |
|---------------------------|---|
| 1. Strip mines | 5. Junkyards |
| 2. Strip mine reclamation | 6. Outfalls |
| 3. Tailings | 7. Water Impoundments (3 acres or larger) |
| 4. Landfills | 8. Feedlots |
| | 9. Waste Treatment facilities |

2. Thermal Monitoring of Power Plant Discharges. The U.S. Environmental Protection Agency, Region VII Office, Iowa Department of Environmental

Quality, and RSL have been cooperating in a series of overflights to detect and map thermal outfalls associated with power generating plants in Iowa. To date there have been repetitive flights over more than 22 power generating facilities. The imagery is now being analyzed by the Kansas City Office of EPA and will soon be furnished to the Iowa Department of Environmental Quality.

Natural Resource Investigations

1. Floodplain analysis. Evaluation of multispectral imagery from Iowa floods has allowed development of a comprehensive aerial floodplain analysis program. Floods can now be flown to assess damage, maximum limit of inundation, and floodplain characteristics. This information is leading to the development of information necessary for landuse planning in floodplains. The RSL staff has established that certain soil series correlate with floods of major record. Soil series mapping appears to quantify the magnitude, frequency, and distribution of flooding along major rivers in Iowa and prediction of flood inundated areas now appears possible. The RSL staff is cooperating with the members of the soils faculty, Department of Agronomy, Iowa State University, in this study.
2. Soils Mapping analysis. Recently the RSL acquired imagery of Johnson County, Iowa to test the applicability of color and color infrared imagery for soils mapping and landuse inventory. This project was coordinated with the Johnson County Board of Supervisors, the U. S. Soil Conservation Service

in Johnson County, the City of Iowa City, and the Iowa Department of Soil Conservation. The imagery is being evaluated by soil mapping teams in the field and a final report will be prepared by the cooperating staff of the Iowa agencies.

3. Ponded Water Inventory. The Iowa Natural Resources Council and RSL staff have developed a comprehensive program to inventory ponds and lakes from high-altitude imagery of the Iowa landscape. Imagery being analyzed includes optical bar camera imagery flown by the U.S. Air Force for the U. S. Environmental Protection Agency, and color infrared imagery flown by NASA in support of the Corn Blight Program. Currently all water bodies over 3 acres in size are being inventoried for 15 counties in south-central Iowa.

4. Cedar River Hydrologic Study. The U. S. Geological Survey (U.S.G.S.) has been studying the hydrology of the Cedar River basin for the past several years. The U.S.G.S. and the RSL are currently using remote sensing data, including multispectral imagery, and color infrared imagery to examine the hydrologic characteristics of the basin. Karst features, collapse structures, and large fracture systems are being analyzed by remote sensing techniques on a repetitive basis. Thermal mapper investigations are planned for periods of low flow to identify discharge of groundwater into surface water streams.

Land and Water Planning Investigations

1. Eleven-County Landuse Analysis for South-Central Iowa. The RSL staff has analyzed an eleven county area in South-Central Iowa under a \$31,000 grant from the EROS Program, U. S. Geological Survey, Department of the Interior, Washington, D. C. The project was completed 10 November 1973, the final technical report was submitted, and the atlas of maps was made available for distribution June 1974. This project applied ERTS-1 satellite data to the information needs of state and local planners involved in land- and water-use management in this central region of Iowa. The project utilized direct input from local planners in the area and they are evaluating the map atlas. The published results of the study include an atlas of the following maps at 1:250,000 scale:

- | | |
|---|------------------------------|
| 1. Eleven-County Region | 8. Mineral Resources |
| 2. Critical Planning Areas | 9. Flood Hazards |
| 3. Political Subdivisions | 10. Surface Topography |
| 4. Transportation Systems | 11. Unconsolidated Materials |
| 5. Recreational Resources | 12. Subsurface Geology |
| 6. Land-Use | 13. Water Resources |
| 7. Suitability for Landfill Site Location | |

2. Landform and Surficial Materials Mapping. The RSL received a grant from the U. S. Geological Survey, Denver, Colorado to evaluate the capabilities of the Earth Resources Technology Satellite (ERTS-1) for mapping surficial deposits and landforms in the Midwest and Great Plains. This project is now complete, and the final report was submitted to the U.S.G.S. in Denver, on 1 January 1974. Under the grant the co-principal investigator

was a member of the Iowa Geological Survey Remote Sensing Laboratory staff and the RSL in Iowa acted as coordinator for five other co-investigating midwestern geological surveys. The initial evaluation of the capabilities of using satellite imagery for landuse inventory of the eleven county area was made under this program. The flood inundation mapping studies were also undertaken using imagery provided through this grant. The State of Iowa now has a complete set of spacecraft imagery covering Iowa and surrounding states. The program has provided a synoptic view of landuse and landforms in Iowa, particularly as they relate to management-planning in other states.

3. Archaeological Site Detection. The RSL and the Office of the State Archaeologist have had a continuing program of research in archaeological site detection since 1971. Several multispectral overflights have been arranged in support of this program but analysis of imagery has not detected any sites. Recently a mission was flown along the Mississippi River and Upper Iowa River with color infrared and multispectral photography. This imagery is awaiting analysis. In general, spring appears to be the best time to fly for detection of these sites.

4. Conservation Inventory Program. The RSL and Iowa Conservation Commission have been cooperating on a series of projects since 1972. Techniques for delineating grazed versus ungrazed timber are being evaluated. Another study is aimed at developing automated techniques for conducting

waterfowl inventory. The Iowa Conservation Commission is also investigating the use of color infrared photography for inventory of wetlands and is developing a comprehensive program to monitor state parks and preserves on a repetitive basis. Another cooperative program involves the development of techniques for recreational use surveys of the Mississippi and Missouri River systems. This project is designed to determine periods and areas of maximum use so conservation officers can staff to meet peak demand periods and areas. The Iowa Conservation Commission recently purchased a Piper Aztec twin engined aircraft, and through cooperation with the RSL configured the aircraft to accept aerial cameras and thermal mapping systems. Under this cooperative effort Iowa Geological Survey obtained the aerial cameras, camera mounts, camera controls, etc. and has agreed to supervise the installation and operation of this equipment in the Commission aircraft. Iowa Conservation Commission has agreed to furnish the aircraft at low cost to Iowa agencies requiring remote sensing imagery.

Educational Programs

1. Remote Sensing Newsletter. The RSL published a newsletter which informs agency personnel of ongoing remote sensing investigations, reports the results of significant investigations, and announces the availability of imagery and publications. The current circulation of the newsletter is 600 persons.
2. Public Information Program. During the past year the RSL staff has presented over 29 lectures to the public describing the Iowa remote sensing

program. Three papers were presented at national scientific meetings concerning the results of remote sensing investigations in Iowa, and staff members were asked to serve as chairmen of two sessions on remote sensing at national scientific meetings.

3. Development of Remote Sensing Education in Institutions of Higher Education. In response to the need for individuals trained from an interdisciplinary background in photointerpretation, remote sensing, and photogrammetry, the Remote Sensing staff at Iowa Geological Survey developed a coordinated program of university research and teaching between Iowa's three major universities. A total of six courses are now offered in remote sensing science at the university level where none were offered prior to 1972. Students who are progressing through the educational programs have been employed in applied remote sensing programs within the laboratory and other agencies using the remote sensing approach. Joint equipment purchase and utilization is encouraged between the RSL and the state universities under this program.

Service Programs

1. Index of Iowa Spacecraft and Aircraft Imagery. During the past year the RSL published an Index of Iowa Spacecraft and Aircraft Imagery in support of the information needs of the Iowa Map Advisory Council, and for state agencies interested in this type of information. The index is currently being revised and updated for publication in the summer of 1974, and it will be updated regularly.

2. Design and Coordination of Remote Sensing Investigations in Iowa.

The RSL routinely provides a consultative service to other state agencies in remote sensing mission design. Remote sensing missions are designed to meet the data collection requirements of the largest number of agencies possible. At present only informal coordination of remote sensing investigations between agencies exists.

PARTICIPATION OF REMOTE SENSING STAFF WITH OTHER AGENCIES

1. Dr. Samuel J. Tuthill

- a. Advisor to the National Aeronautics and Space Administration: Earth Resources Satellite (ERTS-1) program evaluation. Technology Applications Center, New Mexico, Summer 1973.
- b. Advisor to the U. S. Environmental Protection Agency, Office of Research and Monitoring: Program development of National Environmental Surveillance.

2. Mr. James V. Taranik

- a. Scientific Advisor to NASA: Earth Resources Technology Satellite Program, geology review panel, Goddard Space Flight Center, February 11-22, 1974.
- b. Scientific Advisor to NASA: Synchronous Earth Resources Satellite, earth resources evaluation panel, Goddard Space Flight Center. March 22, 1974 to present.

- c. Scientific Advisor to NASA: Active Microwave Systems Working Group, Johnson Space Center, April 25, 1974 to present.
- d. Scientific Expert for U. S. Environmental Protection Agency: National program for satellite and high-altitude surveillance and monitoring of environmental quality. April 1974 to present.
- e. Member of Air Photo Subcommittee, Iowa Map Advisory Council.
- f. Member of the Technical Subcommittee, Johnson County Landuse Committee.

VII. ENERGY

Lack of detailed information on fuel use and supplies in Iowa prompted the establishment of the Iowa Energy Data System at the Geological Survey. The purpose of this data system is to gather information on Iowa's fuel delivery system and the energy consumption of various consuming sectors in the state. This information is used by state government agencies. Some of the information gathered by the Iowa Energy Data System has been presented in the Energy Budget for Iowa, 1971, 1972, 1973; Energy facts for Iowa; and Patterns of Fuel Consumption in Iowa.

Geological Survey staff were closely involved in the state's public information program on energy. About 75 speeches were presented to groups around the state on energy. The publications cited above were widely distributed in Iowa.

Dr. Tuthill served as chairman of the Governor's Advisory Committee on Fuel Supply and the Midwestern Governors' Task Force on Midwest Energy Requirements and Environmental Protection. He also is a member of Energy Priorities Committee, a group formed to deal with problems involved in the allocation of state-owned fuel under the Mandatory Allocation Program.

IOWA GEOLOGICAL SURVEY BUDGET

1973-1974

<u>Item</u>	<u>Allocation</u>
Salaries and Wages	\$276,282
Travel	18,480
Aircraft Expense (Remote Sensing)	6,500
Office Supplies and Expense	11,700
Printing and Binding (includes allocation for publications by State Archaeologist)	26,000
Telephone and Telegraph	5,950
Data Processing (Coop. with U.S.G.S.)	8,800
Rentals (Warehouse)	7,500
Equipment	25,000
Insurance	2,200
Groundwater Investigations (Coop. with U.S.G.S.)	112,000
Carbonate Hydrology Study (Coop. with U.S.G.S.)	55,000
Planning and Study (Coop. with U.S.G.S.)	8,000
Operating Materials	9,580
Cold Water Cave Study	14,370
Geophysics Survey	<u>8,000</u>
Total:	\$595,362

Coal Research Study

<u>Item</u>	<u>Allocation</u>
Salaries and Wages	\$ 39,818
Travel	3,000
Office Supplies and Expense	1,750
Printing and Binding	1,000
Telephone and Telegraph	500
Autos and Trucks	7,000
Equipment	60,000
Operating Materials	<u>35,000</u>
Total:	<u>\$148,068</u>
Total Allocation:	<u><u>\$743,430</u></u>