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REMOTE SENSING-APPLICATIONS TO MISSOURI ENVIRONMENTAL RESOURCES INFORMATION SYSTEM

ANNUAL REPORT

Prepared By:
Missouri Department of Natural Resources
Division of Geology and Land Survey

Prepared For:
George C. Marshall Space Flight Center

ANNUAL REPORT

For Period January 15, 1976 to January 15, 1977

REMOTE SENSING APPLICATIONS TO MISSOURI ENVIRONMENTAL RESOURCES INFORMATION SYSTEM

Contract No. NAS8-31766

January 15, 1977

Prepared for:
George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

By:
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Robert E. Myers, Principal Investigator

TABLE OF CONTENTS

INTRODUCTION

"Natural resources information needs have multiplied rapidly in recent years as new perspectives on the environment, energy, development patterns, and resource policy have emerged. New information users and programs have come into existence in response to these evolving perspectives. The new program information needs and the new users' skills and responsibilities present a challenge for the producers of natural resource information.

Often there is a mismatch between the needs of new users and the products available from producers. The mismatch exists for numerous reasons, including a lack of interagency coordination, narrow professional interpretations, an inability to forecast future needs, and a failure to provide timely production. The largest problem however, may be a lack of simple communication among users and producers."[1]

The Inter-Departmental Council for Natural Resources Information has as its primary responsibility the solution of the above problem. The Inter-Departmental Council is administered through the Department of Natural Resources, with specific responsibilities delegated to the Division of Geology and Land Survey. This contract between NASA and the Department of Natural Resources, Division of Geology and Land Survey, recognizes two objectives: First to provide an efficient system for retrieval of remotely sensed data to be used by natural resources oriented agencies, and second to design a natural resources data system that can meet the needs of state agencies. To accomplish these objectives, this contract provides assistance for identifying natural resources data

[1]Natural Resource Data Needs Recommendations, the Council of State Governments

needs and data sources; for the inventorying of remotely sensed data already available to the Division of Geology and Land Survey; and to further the study of systems already in operation which address themselves to the more efficient utilization of natural resources oriented data. It might be stated that the objective of this contract is to further the development of a natural resources information system in the State of Missouri through the development of selected incremental projects which complement the overall system design.

PROGRESS TO DATE

The subject of this contract, although of a technical nature, is deeply involved with the political structure of state government. For this reason, an adequate description of Missouri state government is essential to fully understand the concepts which are being developed by the Inter-Departmental Council for Natural Resources Information. It is not the intention of this report to comment on the organizational structure of Missouri state government; but it is essential to know the organizational constraints which are placed on the development of a natural resources information system by this structure.

As a result of the Omnibus State Reorganization Act of 1974, Missouri state government was divided into 14 separate and distinct departments. Each department is headed by a single director. In order to assure accountability directly to the Governor, nine of these directors are appointed by the Governor with the consent of the Missouri Senate. Their tenure in office generally will be the same as that of the Governor. The other five department directors are selected by various boards and commissions which are in turn themselves appointed by the

Governor. Members of these boards and commissions serve staggered terms so that the boards do not change their full composition at the same time a change in the governor's office occurs. Each department director in turn is responsible for the selection and appointment of employees at the next level of the structure--the division chiefs or district chiefs. Employees below this level are generally in the Missouri State Merit System and not a part of the political system.

Reorganization's main thrust was an attempt to consolidate the functions of state government into proper and meaningful agencies which would decrease duplication of efforts. Included in the Appendix of this report are copies of the organizational diagrams of each of the eight departments represented in the Inter-Departmental Council for Natural Resources Information. These eight departments represent a very broad spectrum of natural resources management. This management ranges from basic research in natural resources to encouraging the location of industrial facilities within the state. Responsibilities also include regulation mandated by both state and federal agencies in regard to wildlife, acquatic life, air, water and land.

In November 1973, a study group was established by Governor Christopher S. Bond with the charge to seek improved methods for coordination and utilization of certain technical data having application in the natural resources field. Such technical data was to include information traditionally categorized as "rare or extensive," as well as information currently becoming available through remotely sensed modes. This committee was formerly identified as a Natural Resources Data Coordination Committee and its members represented 19 state agencies. These agencies composed the bulk of those dealing with natural resources information. Many of these agencies were scheduled for inclusion in the newly formed Depart-

ment of Natural Resources. The committee finalized a report to the Governor on May 1, 1974, exactly two months before final reorganization was to take place. Briefly, the recommendations of that committee were as follow:

Recommendation No. 1. - A continuing permanent structure be established to provide for coordination of natural resources information with the suggestion that it be identified as the Interagency Council for Natural Resources Information, and that the Council be supported by an executive secretary provided by the Director of the Department of Natural Resources. It was also recommended that statutory definition be provided for the Council or that the Council be created by Executive Order.

Recommendation No. 2A - A natural resources data bank for state needs be developed as a primary responsibility of the Council.

Recommendation No. 2B - The development of an electronic processing system for natural resources data be coordinated with the Division of Management Systems, Office of Administration.

Recommendation No. 3 - A primary objective be the establishment of a cartographic data and remote sensing center.

Recommendation No. 4 - The Interagency Council encourage the University sector to further develop research and instructional programs focusing on remote sensing and aerial photography in addition to the programs in natural resources.

Recommendation No. 5 - Consideration be given to the establishment of a state technical information service to serve as a source of technical reports and an interface with similar Federal programs.

Recommendation No. 6 - A pilot project be undertaken to provide the development of the initial phase of the required EDP system for natural resources data.

As previously mentioned, this report was delivered to the Governor approximately two months before the reorganization process began in state government. As a result of this transition, further activity did not take place until September, 1974. At that time it was the decision of the Governor to continue with the concept of an ad hoc committee without issuing any executive order or applying for legislative authority. The director of the Department of Natural Resources was directed to work with the various state departments concerned with natural resources information to establish an Inter-Departmental Council for Natural Resources Information. During the period of September 1974 to October 1975, the Council functioned under this directive. During this period the Council cooperated with Washington University in St. Louis to determine data sources and data needs for the various departments of state government. This project undertaken by Washington University, titled Earth Observation Data Management Systems, was funded by NASA Contract No. NAS5-20680. The Council was able to effectively assist the investigators from Washington University in preparing a Natural Resources Data Requirements Inventory for the State of Missouri. In addition to the Washington University study work, the Council made an exhaustive study of the Land Use and Data Analysis (LUDA) program, developed by the Department of Interior, and various land use classification systems.

The Inter-Departmental Council for Natural Resources Information functioned on a fairly informal basis with representation from eight departments somewhat in proportion to their assessment of the need for involvement. In October 1975, the director of the Department of Natural Resources asked for a thorough review of the activities and structure of the Inter-Departmental Council for Natural Resources and Information. The activities of the Council were held in abeyance

until all comments were received in January 1976. As a result of these comments the future direction of the Council was determined. It was the consensus of all departments involved that the continuation of the Council activities was highly desirable, but that the basic structure of the Council and its procedures needed to be modified in order to become more responsive to the Department Directors. The following provisions were established at that time:

1. Require at least two meetings between the Council Chairman and the Department Directors each year for review of Council activities and approval of proposed new or continued activities.
2. Each department should have one principal representative in service on the Council and that representative would have the sole vote for his department in the determination of action(s) taken by the Council. Other participation from departments was to depend upon the priority of individual department needs to participate in specific work undertaken by the Council.
3. Council's role with respect to policy matters is to continue to be limited to recommendations, which will be presented to the Department Directors by the Council Chairman in the form of memoranda when appropriate and/or at the periodic meetings of the Department Directors described above. The director of the Department of Natural Resources, having the administrative responsiblity for the Council, would have the responsibility of communicating recommendations to the Office of the Governor, when and if there was agreement among participating departments that such action was in order.
4. Finally, the Council should develop some achievable goals, both short-

and long-term, utilizing committee structures to identify and analyze needs; meet these if feasible within their time and support constraints, or develop appropriate recommendations outlining the problems, its priority or urgency, and the support and/or procedures required to meet these needs.

As a result of the agreement between the Department Directors, Department Representatives were appointed to the Inter-Departmental Council for Natural Resources Information, and the next meeting was held on April 1, 1976. At that meeting specific Council objectives, Council procedures, and Council committees were established. The following are a listing of the Council objectives, procedures, committees and committee objectives.

Council Objective Statement

The primary function of the Council is to coordinate the exchange and development of natural resources data. Special emphasis will be placed on data obtained by remote sensing.

Council Procedure

1. Monthly meetings of the Council representatives are to be held.
   a) One voting member from each department on the Council.
   b) Council meetings will be held the first Friday of each month when practical.
2. Committees are to be established to develop recommendations and programs for Council action.
   a) These committees are to be composed of Council representatives and others with special expertise or interest in the committee's area of activity.

3. The Council approves recommendations and programs for presentation by the Council Chairman to the Department Directors, or presentation by the Director of the Department of Natural Resources to the Governor for final implementation.

Committees and Committee Objectives

1. Mapping Advisory Committee
   a) Review the status of topographic mapping in Missouri and develop Council recommendations for future mapping programs (these recommendations will be the major basis for determination of priorities for the cooperative mapping program with the U. S. Geological Survey by the State Geologist (DNR), and the Chief Engineer, Missouri State Highway Department)
   b) Review the status of all mapping programs in the State of Missouri and develop recommendations for the development of a standard base map series for use by all state departments (the proposed bases would probably be in a metric series).
2. Remote Sensing Applications Committee
   a) Study in detail the need for, and the scope of a state remote sensing information center;
   b) Develop procedure for the coordination of the acquisition of remote sensing imagery and aerial photography;
   c) Provide coordination of research efforts in the use of remotely sensed data with state departments and universities.
3. Natural Resources Information System Committee
   a) Develop the conceptual design of a Natural Resources Information

System for use by all agencies concerned with natural resources type information.

In order to insure that the various department directors were in full agreement with the objectives and procedures of this organization, the first meeting was held between the council chairman, Robert E. Myers, and the directors on June 21, 1976. At this meeting, proposed objectives, procedures and committee structure were discussed with each of the department directors and their suggestions received. It was felt that this direct coordination with the directors served an extremely valuable function. It gives the department directors first hand information about the projects being undertaken by the Council. It also gives the chairman of the Council the ability to receive any specific instructions directly from the department directors. Although there is good coordination between the Council representatives and the department directors, it is felt that this direct procedure is necessary at least twice a year.

It must be pointed out once again that the work of the Inter-Departmental Council and its committees is strictly on an ad hoc basis. This council has not been established by either an Executive Order or statutory requirements. It exists primarily as a result of the willingness of the department directors and those persons so designated to serve. The projects undertaken by the Council and its committees are generally quite large and could demand a considerable amount of effort. The work undertaken by these individuals essentially is one of a voluntary nature and must be subordinate to the individual's primary or statutory responsibilities in state government. In view of this, it has been and will continue to be difficult to speedily accomplish Council objectives unless outside assistance is obtained. This assistance should come in the form of personnel

and funds specifically appropriated to this project by the Legislature. Because of the nature of the Inter-Departmental Council, the council itself is not in a position to recieve funds or employ personnel. Therefore it is the responsibility of the individual departments to employ the appropriate personnel, supply operating funds, and make the proper requests to the Legislature for funding. The activities thus funded actually take place on the department level, but are coordinated by the Council.

Many individual tasks which complement the Council's objectives have been completed. Although not funded directly by the Council, nor participated in fully by the Council, many of these projects have utilized the coordinated effort of the Council for review and final use. A listing of these projects and a short description are as follows:

1. Index to Aerial and Space Photography Coverage in Missouri. Published by Terry W. Barney and Chris Johannsen, photography by Jerry McBride, 1976. This very fine publication was produced by the Extension Division, University of Missouri-Columbia, in cooperation with the Inter-Departmental Council. Funds for developing the index were provided by the Rural Development Center of the University of Missouri. This index includes photography flown before May 1, 1975. Only photography that is available for purchase or loan is included in this index. A map of each Regional Planning Commission and the counties therein is given in this index, along with overlays designating the various types of imagery available in those regional planning areas. Complete information is given concerning the agency descriptions, how to order the imagery, and how to use the index itself.

2. Geographic Location Referencing and Display Considerations for Proposed Electronic Data Processing of Missouri Natural Resources Information, by David Hoffman, Department of Natural Resources, under a grant from the U. S. Department of Housing and Urban Development. This report summarizes an investigation on how natural resources data collected on map or graphic form can be handled by computer to make the information usable to more people quicker and at a lower cost. This report contains four tasks pertaining to the geocoding of information for use in a computerized natural resources information system. The four tasks are:

   a) reviewing geocoding systems in Missouri and other states;
   b) developing a catalog of all geocodes likely to be used in a natural resources information system;
   c) recommending a coordinate system and map series for digitizing all geocodes; and
   d) development of a catalog of software for geocoding data and presenting geocoded data and statistical and/or graphical output format.

3. LUDA Mapping

On June 4, 1976, the Council endorsed the Land Use and Data Analysis (LUDA) program of the Department of Interior and encouraged the state to enter into a cooperative agreement to obtain data from this program for the State of Missouri. The Missouri Office of Administration entered into an agreement with the Department of Interior to provide standard information and some special products for the State of Missouri. Standard

information products to be provided are as follow::

a) Land use and land cover maps

b) Hydrologic unit maps

c) Political unit maps

d) Census districts

e) Federal land ownership maps

f) State land ownership maps

These standard products will be delivered at the scale of 1:250,000. The special products will be as follow:

a) Maps formulated on the 20 regional planning districts for the State of Missouri;

b) Maps showing township and range for the State of Missouri with a scale of 1:125,000;

c) A map of the State of Missouri for each of the six standard products at a scale of 1:500,000.

This material, along with all the material in digitized form, will be available to the State of Missouri by July 1, 1977.

4. Natural Resources Data Requirements Inventory: Missouri, September 1975, produced by the Center for Development Technology, Washington University, detailing a program on Earth Observation Data Management Systems, under a contract with NASA, Goddard Space Flight Center Contract No. NAS5-20680, dated February 1975. The EODMS team and the Council agreed to work together to inventory the data needs for Missouri agencies. The two groups jointly determined from which agencies to gather information; Council members arranged initial meetings with agency representatives

and the EODMS team; the EODMS team interviewed the agency representatives to determine the information needs of the agency; and they provided the Council with information obtained from their interviews and received comments. The final report is an extensive listing of task and data needs in Missouri agencies.

5. Prioritization of 15-minute topographic quadrangles in Missouri. This prioritization reflects a plan developed by the Mapping Advisory Committee of the Council. The remaining 15-minute quadrangles of the topographic series for the State of Missouri that have not been scheduled for revision have been prioritized in accordance with this suggested procedure for selecting topographic maps for revision. There are presently fifty 15-minute quadrangle maps which have not been completed in a 7½-minute format. These fifty quadrangles are ranked according to specific priority schedule, using age, location and whether it is a critical area, potentially critical area, or sensitive area. A copy of the suggested procedure for selecting topographic maps for revision is included in the Appendix.

Specific budget requests have been made for FY 1978. These requests, approved by the Council and submitted to the Department Directors for their inclusion, represent a request for the first level of a full time staff for the objectives of this council. The requests for 1978 are for one full time professional and one secretarial position, with sufficient funding for normal supplies and computer operations. This request is for $30,400, and would be provided by the Legislature from General Revenue, thus substantially formalizing the existence of this council and its objectives.

The Council has also reviewed a proposal made by the Department of Natural Resources, Division of Planning and Policy Development, and the Department of Consumer Affairs, Regulation and Licensing, Division of Commerce and Industrial Development. This project is to identify ten major industrial opportunities based on a comparative analysis of the needs of all industrial categories in Missouri's resource base. A secondary objective of this project is to design a framework for the development of a data system for evaluating and attracting new industries that are consistent with Missouri's natural resource base. The Inter-Departmental Council for Natural Resources Information recommended and endorsed this project for implementation during the latter part of FY 1977.

As a result of this contract with NASA, the following projects have been undertaken:

1) Inventory of remote sensing imagery in the Division of Geology and Land Survey. The Division of Geology and Land Survey is the largest source in state government of remote sensing imagery for natural resource agencies. Aerial and space photographic coverage of the State of Missouri purchased by this division in past years in somewhat extensive. This information is available for use by other agencies as well as this division, and the catalog represents a first full indexing and accounting of all the imagery available to the state agencies through this division. The inventory serves as the focal point for determining the need for a remote sensing center in Missouri and for indicating the need to provide complete historical photogrammetric coverage of the state. The inventory includes photography flown by the U. S. Geological Survey, ASCS, Forest Service, NASA, and private photography.

2) The first draft of the conceptual design of a natural resources data sharing system has also been completed and submitted to the Council for further review. This design is based upon a system being utilized in the State of Texas, which is in turn based upon the NAWDEX system being utilized nationally. This is included in the Appendix.

For further design of the natural resources information system, a more detailed inventory of data and data sources is necessary. A conceptual design of such an inventory system has also been prepared and is included in the Appendix. The implementation of this inventory system is scheduled for completion in the next few months.

PROBLEMS TO THE DEVELOPMENT OF A NATURAL RESOURCES INFORMATION SYSTEM

The State of Missouri seemingly has had a very difficult time entering into the field of computerized natural resources information system. At the beginning of Council activities, the state was very decentralized and a great number of agencies were involved in the gathering and use of natural resources information. With the advent of reorganization in the State of Missouri, the basic control of these agencies was reduced to eight departments. Although this represents a considerable step forward, the task of establishing natural resources information at state level is quite ponderous. Some considerations which affect such a project are political, some financial, some from staffing, and some from policy decisions.

One of the major problems encountered, as previously stated, is the fact that the Council is an ad hoc agency, having no statutory or executive definition. For this reason, funding and personnel are not directly delegated to these operations except on a part time basis. A task as large as this, before it will be fully

implemented, will require a concerted, full time effort by a number of professionals.

The department directors of the eight designated departments have agreed to cooperate in the development of a natural resources sharing system. Nevertheless, each department has its own interests and its own priorities. Each department sees the value of the output and the amount of work it can delegate to such a system in a different light. The powers, duties and responsibilities of each department are specifically enumerated in the statutes. It is these functions that serve as their primary objective and the objectives of the Inter-Departmental Council become secondary.

One of the major problems encountered thus far with the development of a computerized information system lies with the utilization of computers in the State of Missouri. Reorganization of state government established the Division of EDP Coordination, under the Office of Administration. This division coordinates and controls the acquisition and use of all electronic data processing equipment. The division is charged with the development and implementation of long range computer facility plans for use of EDP; maintains inventories; and approves all additions in EDP hardware, software, support services and service centers.

The long range computer facility plans developed by this agency have somewhat vacillated during the past four years. The initial direction of this department was toward computer facilities and operations in each of the various departments. This meant budget requests for both hardware, software, and personnel to be submitted by each department, giving full autonomy to each one of the departments in the use of their computer facilities. The most recent long range com-

puter facility plan changed that concept. This newer plan was to create six very large host computer centers in state government. These host centers were to provide only hardware, and each individual department would be responsible for developing its own computer staff and IO devices. In the last year a great deal of progress has been made towards this latter plan. Over the past few months agencies in which the host centers have been housed have become reluctant to participate in the sharing program. The final direction of this program lies with the director of the Division of EDP Coordination, an appointee of the Governor, and finally with the Governor himself. Presently these decisions are in limbo as a result of the change in administration.

WORK PLAN FOR THE NEXT YEAR

A major objective of the Inter-Departmental Council will be the development of a conceptual design for a natural resources information system and a conceptual design of a remote sensing center for the State of Missouri. In furtherance of these objectives the following work will be undertaken during the next year:

Develop a complete and detailed inventory of natural resources data and data sources in state government.

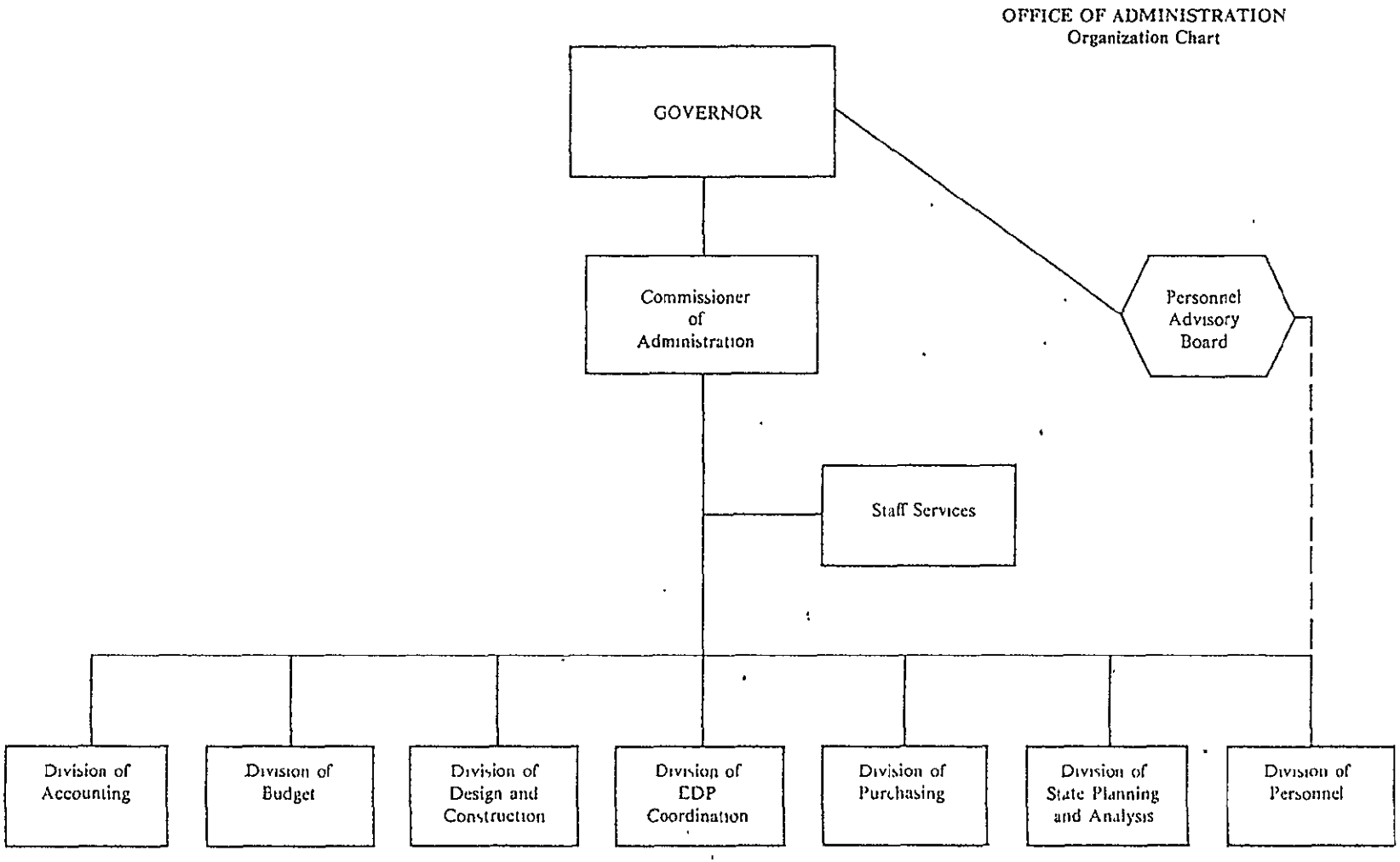
This will be a computerized system having the ability to list all data users and data sources by agency according to a specific format. In turn, this inventory will allow the development of an inventory of machine processable data, and will provide the priority of data items. It is the intent of this study to be able to isolate ten tasks which have high priority and repeatability. From these tasks the Council will select three for more detailed study and possible inclusion into a natural resources data base on a pilot project basis.

During the next year, work on the development of a remote sensing summary record system for state level operation, similar to the NCIC system, will be undertaken. It is felt that not only will this system become an integral part of any remote sensing center of the future, but will allow indexing of current imagery, photography, and other items being presently developed in state government.

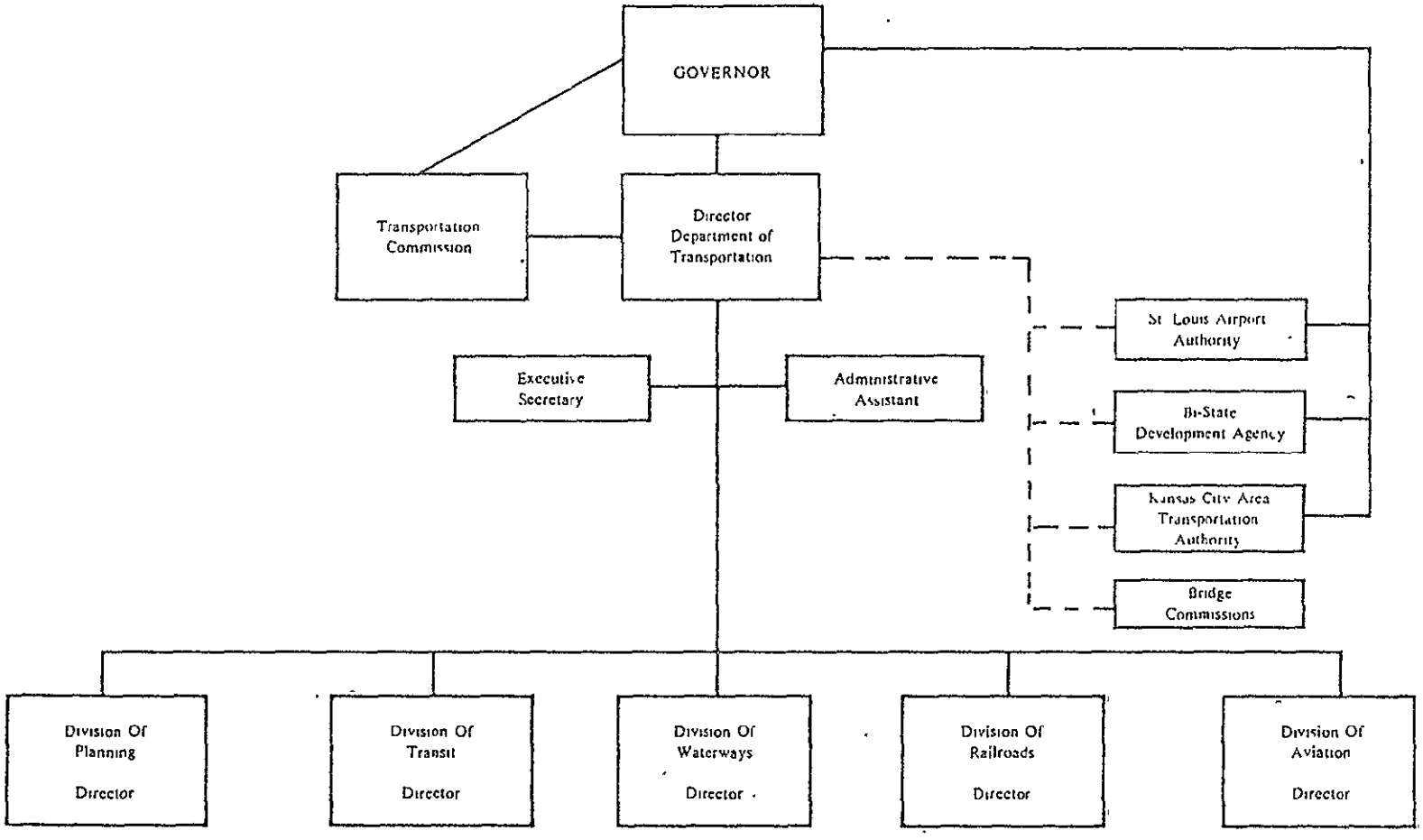
Various council members are also expected to visit existing state and federal systems to determine their application to a Missouri Natural Resources Information System and a Remote Sensing Center.

Appendix "A"

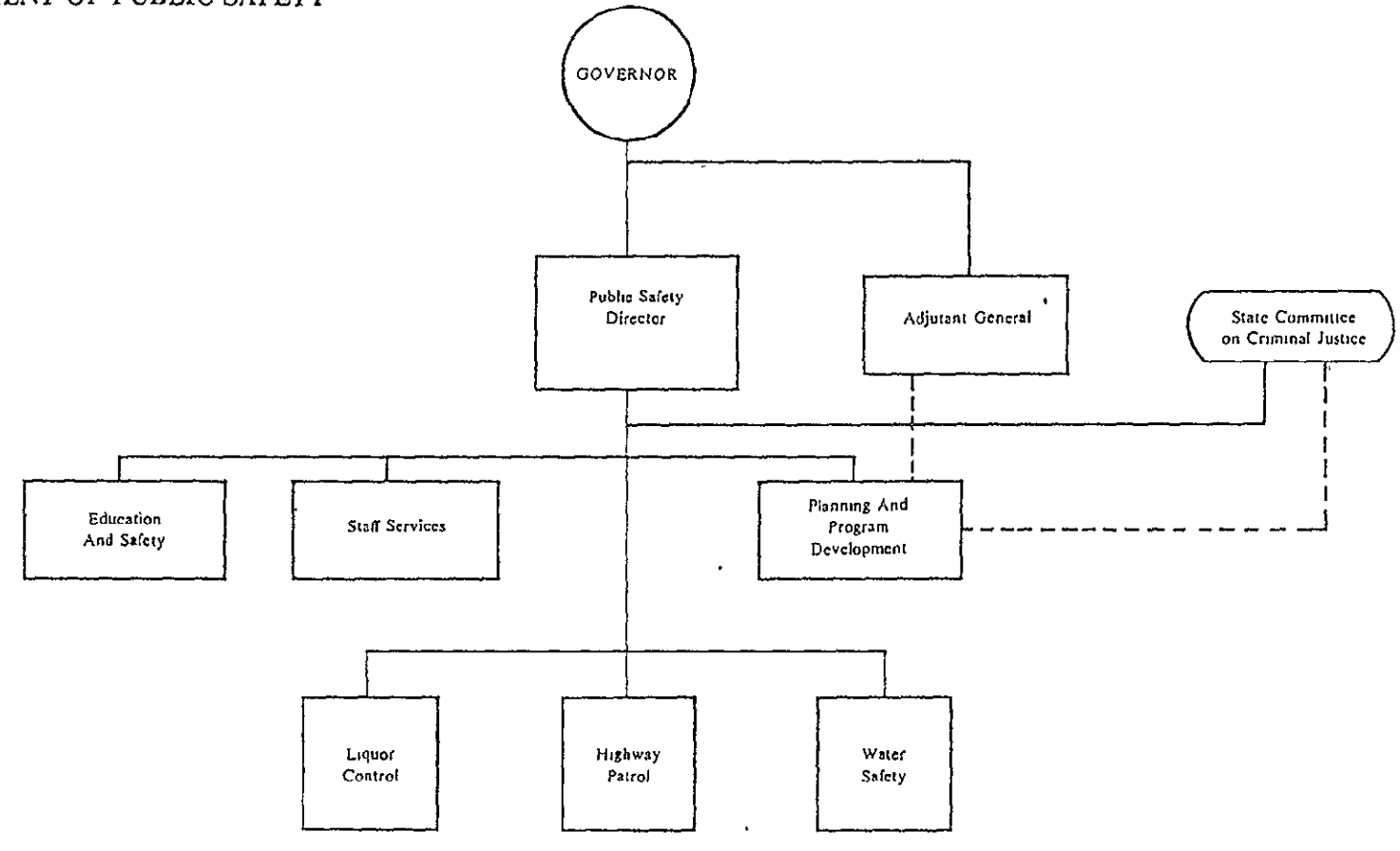
State Government Diagrams


OFFICE OF ADMINISTRATION
Organization Chart
GOVERNOR
Commissioner of Administration
Personnel Advisory Board
Staff Services
Division of Accounting
Division of Budget
Division of Design and Construction
Division of EDP Coordination
Division of Purchasing
Division of State Planning and Analysis
Division of Personnel

DEPARTMENT OF TRANSPORTATION

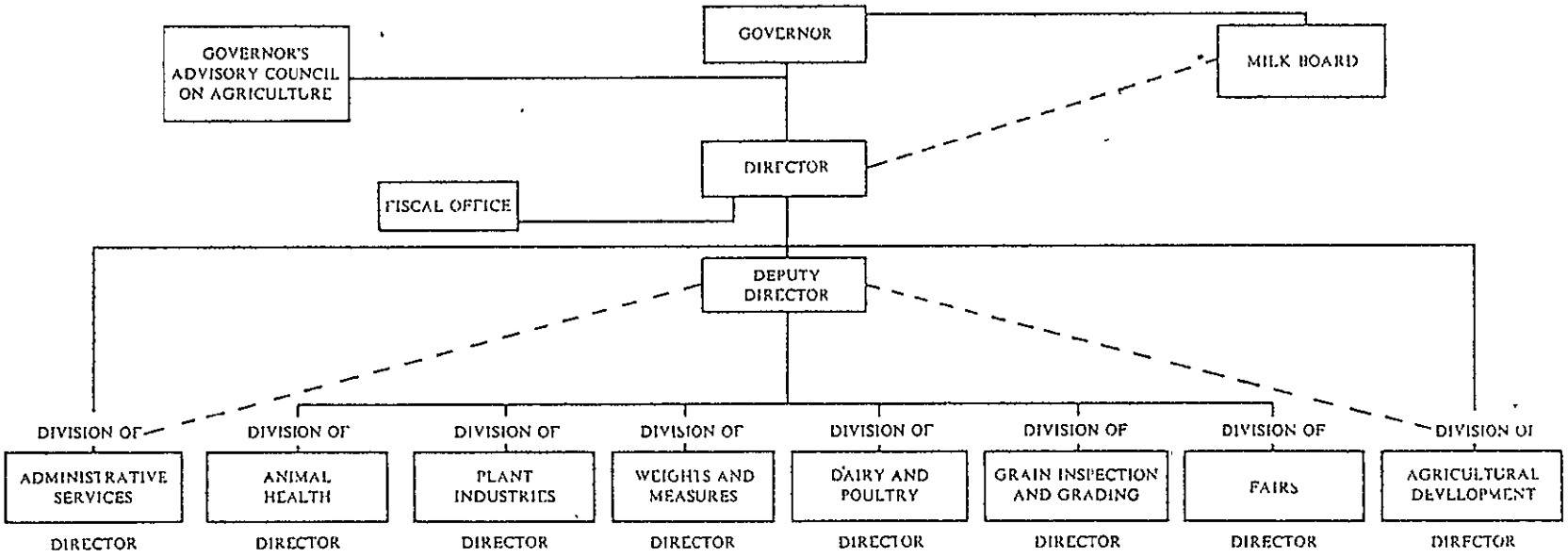


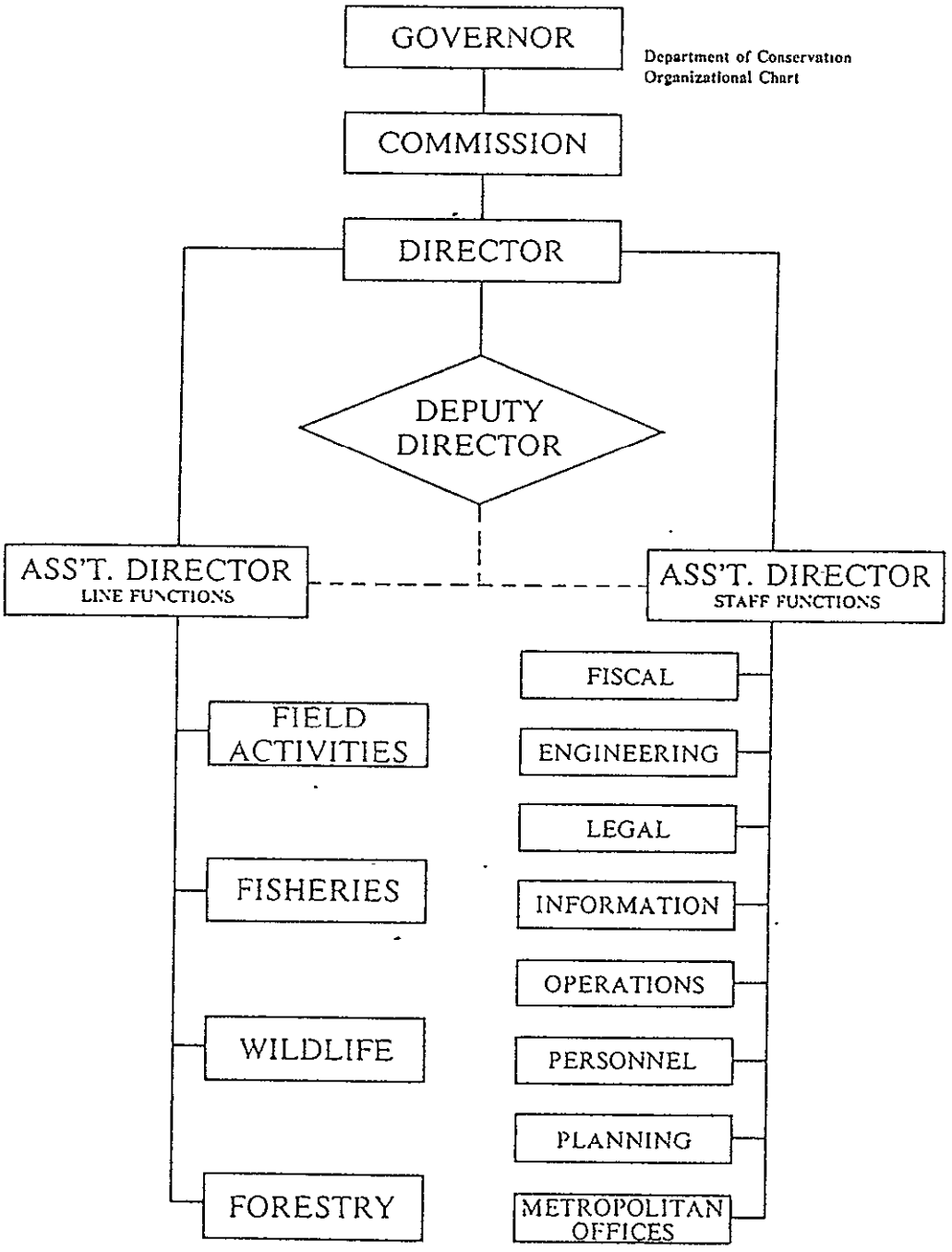
DEPARTMENT OF PUBLIC SAFETY



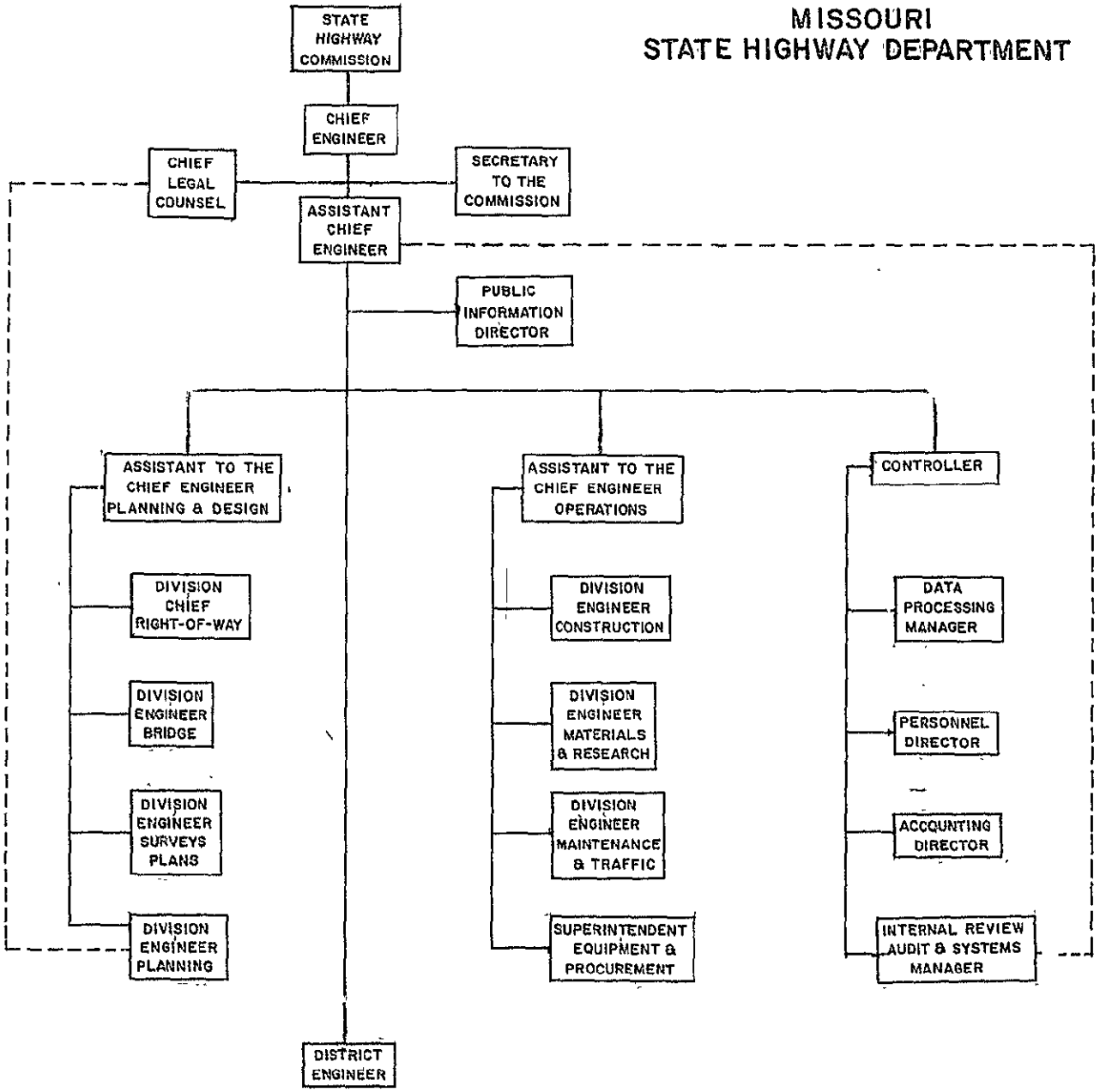
DEPARTMENT OF CONSUMER AFFAIRS, REGULATION AND LICENSING

DEPARTMENT OF AGRICULTURE
ORGANIZATIONAL PLAN

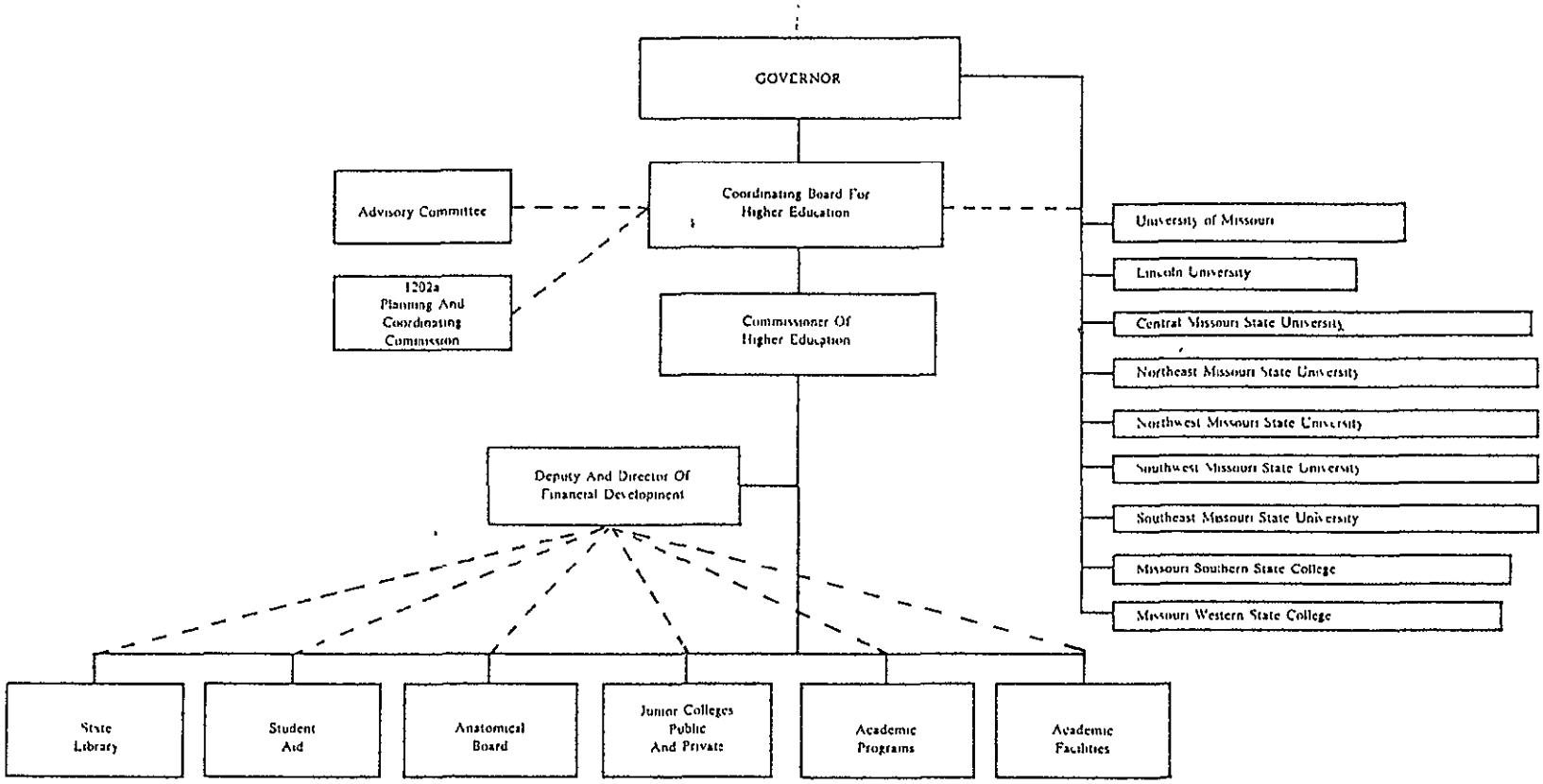



GOVERNOR
Department of Conservation
Organizational Chart
COMMISSION
DIRECTOR
DEPUTY
DIRECTOR
ASS'T. DIRECTOR
LINE FUNCTIONS
ASS'T. DIRECTOR
STAFF FUNCTIONS
FIELD
ACTIVITIES
FISHERIES
WILDLIFE
FORESTRY
FISCAL
ENGINEERING
LEGAL
INFORMATION
OPERATIONS
PERSONNEL
PLANNING
METROPOLITAN
OFFICES

MISSOURI
STATE HIGHWAY DEPARTMENT



DEPARTMENT OF HIGHER EDUCATION



APPENDIX "B"

SAMPLE OF
REMOTE SENSING DATA

REMOTE SENSING CATALOG

SOURCE NASA-Ames Research Center

LOCATION Central United States

DATE 6 June 1972

Missouri and Mississippi Rivers

TYPE - FORMAT 70mm rolls

GENERATION

INDUSTRY

PROJECT

Spring floods of the Missouri River.

AERIAL good; cloudy in parts

GROUND

TITLE - PURPOSE

Cloud free coverage in Missouri begins at Chamois, follows the Missouri River to St. Louis, turns following the Mississippi River to Cairo, Ill. Coverage originates in Colorado.

FLIGHT ALTITUDE U-2

SCALE

CAMERA

FOCAL LENGTH

SCANNER

SENSOR

TIME

FILM	TYPE	FORMAT	FILTER	FRAMES	SLIDES	PHOTOS
2402	B&W		475-.575um	98-134*		
2402	B&W IR	70mm	580-.680um	1-134		
2424	Color IR		690-.760um	1-134		
2443			510-.900um	**		

REMARKS

Flight No. 72-093 Accession No. 00412-5

* includes frames 1-40 and 56-83

** no coverage in Missouri

REMOTE SENSING CATALOG

SOURCE NASA SKYLAB 4 LOCATION Missouri River

DATE 30 November 1973

TYPE - FORMAT 9 inch (23cm) roll

Osage-Missouri Rivers confluence to Illinois-Mississippi Rivers confluence.

GENERATION

INDUSTRY

PROJECT

Skylab

AERIAL clouds, haze fair to poor GROUND

TITLE - PURPOSE

FLIGHT ALTITUDE

SCALE

CAMERA S190B 2X

FOCAL LENGTH

SCANNER SENSOR TIME 4:45

FILM	TYPE	FORMAT	FILTER	FRAMES	SLIDES	PHOTOS
CIR		9 inch		105-116		

REMARKS

Cloud cover over Missouri obscures all but frames 111 to 116. However these frames do not have good color probably due to haze.

Pass/orbit 54; Track 1 Roll 92

REMOTE SENSING CATALOG

SOURCE NASA Corn Blight Watch LOCATION Western Missouri

DATE Spring 1971

TYPE - FORMAT 9-inch positive prints - cut

North-south flightline extending from Excelsior Springs (Clay Co.) to Mount Ayr (Ringgold Co. Iowa)

GENERATION

INDUSTRY

PROJECT

Corn Blight Watch 1971

AERIAL

GROUND

TITLE - PURPOSE

1971 Corn Blight Watch experiment. Flights were made biweekly throughout the 1971 growing season in order to determine the development and spread of the southern corn leaf blight. Overflights by RB-57 and DC-3 (MSS). Study compiled by USDA-SRS, LARS/Purdue U., ERIM/U. of Mich.

FLIGHT ALTITUDE 60,000

SCALE

CAMERA

FOCAL LENGTH

SCANNER SENSOR TIME

FILM	TYPE	FORMAT	FILTER	FRAMES	SLIDES	PHOTOS
Color IR		9 inch		7600-7617		

REMARKS

Flight 710012

Frames: 7600-Excelsior Springs (Clay Co.)
7606-Cameron (Clinton Co.)
7612-Albany (Gentry Co.)
7617-Mount Ayr (Ringgold Co. Iowa)

REMOTE SENSING CATALOG

SOURCE NASA JSC SKYLAB 4 LOCATION Central & Southwest Missouri
Pass/orbit extends from
Lake of the Ozarks to
Lake of the Cherokees.

DATE 12 January 1974

TYPE - FORMAT 9 inch roll B&W neg. and pos. transparencies

GENERATION

INDUSTRY

PROJECT

Skylab

AERIAL Clouds, haze fair GROUND

FILE - PURPOSE

FLIGHT ALTITUDE SCALE

CAMERA S190A 4X FOCAL LENGTH

SCANNER SENSOR TIME

FILM	TYPE	FORMAT	FILTER	FRAMES	SLIDES	PHOTOS
B&W	neg.& pos. trans.	9 inch	red,green near&far infrared	284-290		

REMARKS

Roll 61: b/w near infrared pos and neg transparencies
Roll 62: b/w far infrared pos and neg transparencies
Roll 65: b/w red filter pos and neg transparencies
Roll 66: b/w green filter pos and neg. transparencies
Frame: 285-Lake of the Cherokees 289-Lake of the Ozarks
288-Stockton-Pomme de Terre Res. 290-Jefferson City

Rolls 61, 62, 65, and 66 Pass/orbit 82; Track 1

LANDSAT IMAGE INVENTORY

ORBIT/PASS	CENTER POINT	DATE	FILM TYPE	ID NUMBER
1	132	30 March 1973	B&W	1250-16054 4-7
1	132	17 April 1973	B&W	1268-16054 4-7
1	132	10 June 1973	B&W	1322-16051 4-7
1	132	14 October 1973	B&W	1448-16030 4-7
1	133	10 June 1973	B&W	1322-16054 4-7
1	133	16 July 1973	B&W	1358-16045 4-7
1	133	16 July 1973	B&W	1358-16051 4-7
1	133	14 October 1973	B&W	1448-16032 4-7
1	134	22 February 1973	B&W	1214-16062 4-7
1	134	12 March 1973	B&W	1232-16061 4-7
1	134	12 March 1973	B&W	1232-16063 4-7
1	134	30 March 1973	B&W	1250-16061 4-7
1	134	30 March 1973	B&W	1250-16063 4-7
1	134	17 April 1973	B&W	1268-16063 4-7
1	134	9 June 1973	B&W	1321-16002 4-7
1	134	10 June 1973	B&W	1322-16060 4-7
1	134	28 June 1973	B&W	1340-16055 4-7
1	134	16 July 1973	B&W	1358-16054 4-7
1	134	25 September 1973	B&W	1429-15584 4-7
1	134	14 October 1973	B&W	1448-16035 4-7
1	134	1 November 1973	B&W	1466-16031 5 & 7
1	134	1 November 1973	B&W	1466-16033 5 & 7
1	135	17 January 1973	B&W	1178-16060 4-7
1	135	22 February 1973	B&W	1214-16065 4-7

ORBIT/PASS	CENTER POINT	DATE	FILM TYPE	ID NUMBER
1	135	22 February 1973	FCC	1214-16065
1	135	12 March 1973	B&W	1232-16070 4-7
1	135	17 April 1973	B&W	1268-16070 4-7
1	135	9 June 1973	B&W	1321-16004 4-7
1	135	10 June 1973	B&W	1322-16063 4-7
1	135	28 June 1973	B&W	1340-16061 4-7
1	135	25 September 1973	B&W	1429-15590 4,5, & 7
1	135	14 October 1973	FCC	1449-16100
1	135	14 October 1973	B&W	1448-16041 4-7
1	135	1 November 1973	B&W	1466-16040 5 & 7
2	147	29 June 1973	B&W	1341-16104 4-7
2	147	17 July 1973	B&W	1359-16103 4-7
2	147	26 September 1973	B&W	1430-16033 4-7
2	148	2 October 1972	FCC	1071-16104
2	148	2 October 1973	B&W	1071-16104 4-7
2	148	9 August 1972	B&W	1071-16102 4-7
2	148	23 February 1973	B&W	1215-16114 4-7
2	148	13 March 1973	B&W	1233-16115 4-7
2	148	31 March 1973	FCC	1251-16115
2	148	31 March 1973	B&W	1251-16115 4-7
2	148	11 June 1973	FCC	1323-16112
2	148	11 June 1973	B&W	1323-16105 4-7
2	148	11 June 1973	B&W	1323-16112 4-7

LANDSAT IMAGE INVENTORY NEGATIVES

ORBIT/PASS	CENTER POINT	DATE	FILM TYPE	ID NUMBER
1	134	1 November 1973	B&W	1466-16033 5 & 7
1	135	22 February 1973	B&W	1214-16065 5 & 7
2	148	2 October 1972	B&W	1071-16104 5 & 7
2	149	23 February 1973	B&W	1215-16121 4,5 & 7
2	149	2 October 1972	B&W	1071-16111 5 & 7
2	150	15 October 1973	B&W	1449-16100 5 & 7
3	161	16 October 1973	B&W	1450-16142 5 & 7
3	162	16 October 1973	B&W	1450-16145 5 & 7
3	163	24 February 1973	B&W	1216-16175 4 & 5
3	163	28 August 1972	B&W	1036-16165 7
3	163	14 March 1973	B&W	1234-16180 7
3	164	24 February 1973	B&W	1216-16182 5 & 7
4	176	2 January 1973	B&W	1163-16225 4,5 & 7
4	176	29 August 1972	B&W	1037-16215 5 & 7
4	177	17 October 1973	B&W	1451-16210 5 & 7
4	177	4 October 1972	B&W	1073-16221 7
4	178	17 October 1973	B&W	1451-16212 5 & 7
5	189	5 November 1973	B&W	1470-16254 5 & 7
5	190	28 November 1972	B&W	1128-16284 5 & 7
5	191	20 July 1973	B&W	1362-16283 5 & 7
5	192	18 October 1973	B&W	1452-16270 5 & 6
6	206	17 March 1973	B&W	1237-16342 5 & 7

LANDSAT 2 INVENTORY

ORBIT/PASS	CENTER POINT	DATE	FILM TYPE	ID NUMBER
1	133	13 October 1975	B&W	2264-15522 4-7
1	134	13 October 1975	B&W	2264-15525 4-7
1	135	13 October 1975	B&W	2264-15531 4-7
2	147	17 April 1975	B&W	2085-15591 4-7
2	148	17 April 1975	B&W	2085-15593 4-7
2	148	16 July 1975	B&W	2175-15592 4-7
2	148	14 October 1975	B&W	2265-15581 4-7
2	149	16 July 1975	B&W	2175-15595 4-7
2	149	17 April 1975	B&W	1085-16000 4-7
2	149	14 October 1975	B&W	2265-15583 4-7
3	160	17 July 1975	B&W	2176-16044 4-7
3	161	17 July 1975	B&W	2176-16051 4-7
3	162	17 July 1975	B&W	2176-16053 4-7
3	163	17 July 1975	B&W	2176-16060 4-7
4	174	16 October 1975	B&W	2267-16084 4-7
4	175	18 July 1975	B&W	2177-16103 4-7
4	175	16 October 1975	B&W	2267-16091 4-7
5	188	17 October 1975	B&W	2268-16143 4-7
5	189	1 July 1975	B&W	2160-16160 4-7
5	189	1 July 1975	B&W	2160-16163 4-7
5	190	1 July 1975	B&W	2160-16165 4-7
5	190	19 July 1975	B&W	2178-16163 4-7
5	190	10 December 1975	B&W	2322-16144 4-7
5	191	19 July 1975	B&W	2178-16170 4-7

PHELPS

Indicies

November 9,	1938	Sheet 1 of 2	BLY-1, -2, -3, -4, -5, -6, -7
November 9,	1938	Sheet 2 of 2	BLY-1, -2, -3, -4, -5, -6, -7
	1964	Sheet 1 of 4	BLY-1EE, -2EE
	1964	Sheet 2 of 4	BLY-1EE, -2EE
	1964	Sheet 3 of 4	BLY-1EE, -2EE
	1964	Sheet 4 of 4	BLY-1EE, -2EE
	1971	Sheet 1 of 4	BLY-1MM, -2MM
	1971	Sheet 2 of 4	BLY-1MM
	1971	Sheet 3 of 4	BLY-1MM, -2MM
	1971	Sheet 4 of 4	BLY-1MM

Photographs - 1938 & 1963

BLY - 1 - 54 to 85
2 - 4 to 29
30 to 38
40 to 74
82 to 94
3 - 1 to 23
29 to 42
44 to 50
53 to 64
70 to 97
4 - 1 to 8
55 to 76
84 to 87
91 to 93
5 - 5 to 15
22 to 43
46 to 65
69 to 74
83 to 95
6 - 1 to 16
20 to 40
56 to 84
7 - 21 to 46

BLD - 6 - 71 to 89
BLY

BLY - 1EE - 2 to 32
35 to 67
69 to 97
100 to 128
2EE - 3 to 35
38 to 72
75 to 108
112 to 146
148 to 169
174 to 195
197 to 218
221 to 269
272 to 299

OZARK

Indicies

June 15, 1939	Sheet 1 of 3	BLX-6, -8, -9, -12
June 15, 1939	Sheet 2 of 3	BLX-3, -4, -12
June 15, 1939	Sheet 3 of 3	BLX-1, -10, -11
1964	Sheet 1 of 6	BLX-3EE, -4EE
1964	Sheet 2 of 6	BLX-1EE, -3EE, -4EE
1964	Sheet 3 of 6	BLX-1EE, -2EE, -4EE
1964	Sheet 4 of 6	BLX-1EE, -3EE, -4EE
1964	Sheet 5 of 6	BLX-3EE, -4EE
1964	Sheet 6 of 6	BLX-1EE, -2EE, -4EE

Photographs - 1939

BLX - 1 - 5 to 34
42 to 68
3 - 2 to 28
62
67 to 84
91 to 93
96 to 113
4 - 4 to 20
22 to 25
38 to 61
6 - 24 to 46
56 to 79
85
87 to 112
8 - 7 to 30
41 to 66
81 to 98
9 - 7 to 13
25 to 49
10 - 43 to 59
65 to 73
82 to 96
11 - 1 to 9
15 to 41
67 to 77
12 - 8 to 31
71 to 93

MONROE

Indicies

August 21,	1939	Sheet 1 of 2	BYX-2, -3, -4
August 21,	1939	Sheet 2 of 2	BYX-1, -2, -3, -4
	1962	Sheet 1 of 4	BYX-1CC, -2CC
	1962	Sheet 2 of 4	BYX-1CC, -2CC
	1962	Sheet 3 of 4	BYX-1CC, -2CC
	1962	Sheet 4 of 4	BYX-1CC, -2CC

Photographs - 1950

BYX - 1G - 3 to 25
71 to 83
2G - 6 to 28
3G - 2 & 3
50 to 73
87 to 101
151
196 to 213
4G - 3 to 10
12 to 34
41 to 62
67 to 71
79 to 101
5G - 31 to 49
54 to 72
137 to 156
6G - 7 to 26
32 to 41
46 to 56
7G - 23 to 45
52 to 74
119 to 131

DENT

Indicies

July 22, 1939 Sheet 1 of 3 BLG-3, -4
July 22, 1939 Sheet 2 of 3 BLG-1, -2, -3, -5, -6, -7
July 22, 1939 Sheet 3 of 3 BLG-7, -8, -9, -10
October 26, 1955 Sheet 1 of 4 BLG-1P, -4P, -5P
October 26, 1955 Sheet 2 of 4 BLG-2P, -3P, -4P
October 26, 1955 Sheet 3 of 4 BLG-1P, -4P, -5P
October 26, 1955 Sheet 4 of 4 BLG-2P, -3P, -4P
1964 Sheet 1 of 4 BLG-1EE, -2EE, -5EE
1964 Sheet 2 of 4 BLG-1EE
1964 Sheet 3 of 4 BLG-1EE
1964 Sheet 4 of 4 BLG-1EE, -2EE, -5EE, -6EE

Photographs - 1939

BLG - 1 - 3 to 24
29 to 39
47 to 63
2 - 4 to 19
25 to 48
52 to 56
86 to 93
3 - 6 to 12
18 to 47
54 to 85
4 - 3 to 32
40 to 56
62 to 71
5 - 2 to 34
39 to 54
59 to 82
6 - 4 to 22
7 - 14 to 47
51 to 87
8 - 25 to 35
39 to 73
80 to 95
9 - 11 to 19
26
10 - 2 to 12
18 to 27
56 to 64
69 to 77
84 to 94
11 - 2 to 11

CASS

Indicies

October 17, 1940 Sheet 1 of 2 FW - 1A, -2A, -3A, -4A
October 17, 1940 Sheet 2 of 2 FW - 1A, -2A, -3A, -4A
August 26, 1958 Sheet 1 of 1 FW - 1V, -2V

Photographs - 1940

FW - 1A - 27 to 54
2A - 5 to 13
59 to 87
94 to 122
130 to 158
165 to 189
3A - 4 to 7
17 to 43
51 to 78
85 to 112
118 to 144
159 to 185
4A - 5 to 14
20 to 47
56 to 82
90 to 117
125 to 151

Indicies

September 14, 1937	Sheet 1 of 14	TU-1
September 14, 1937	Sheet 2 of 14	TU-1
September 14, 1937	Sheet 3 of 14	TU-1
September 14, 1937	Sheet 4 of 14	TU-1
September 14, 1937	Sheet 5 of 14	TU-1
September 14, 1937	Sheet 6 of 14	TU-2, TU-3
September 14, 1937	Sheet 7 of 14	TU-2, TU-3
September 14, 1937	Sheet 8 of 14	TU-2, TU-3
September 14, 1937	Sheet 9 of 14	TU-2, TU-3
September 14, 1937	Sheet 10 of 14	TU-2, TU-3
September 14, 1937	Sheet 11 of 14	TU-3, TU-4
September 14, 1937	Sheet 12 of 14	TU-3, TU-4
September 14, 1937	Sheet 13 of 14	TU-3, TU-4
September 14, 1937	Sheet 14 of 14	TU-3, TU-4
August 23, 1959	Sheet 1 of 3	TU-1W, -2W
August 23, 1959	Sheet 2 of 3	TU-1W, -2W
August 23, 1959	Sheet 3 of 3	TU-1W, -2W

Photographs - 1937

TU - 1 - 2 to 20
20 A,B,E,F
21 to 39
44 to 85
91 to 136
2 - 141 to 184
196 to 239
3 - 248 to 290
295 to 337
348 to 383
4 - 386 to 424

APPENDIX "C"

SUGGESTED PROCEDURE FOR SELECTING TOPOGRAPHIC MAPS FOR REVISION

M I S S O U R I
CHRISTOPHER S. BOND
GOVERNOR

DEPARTMENT OF
Natural Resources
JAMES L. WILSON
DIRECTOR

Wallace B. Howe, Director & State Geologist, Division of Geology & Land Survey

P.O Box 250 Rolla, Missouri 65401 314-364-1752

MEMORANDUM

DATE: January 21, 1977

FROM: Mapping Advisory Committee

TO: ICNRI

SUBJECT: Report on the prioritization of 15-minute quadrangles

The Mapping Advisory Committee has completed prioritization of the 15-minute quadrangles for recommendation to the USGS for series revision, in accordance with Council direction.

The procedure used for prioritization (copy appended) was adapted from the draft plan developed earlier by Steve Boody. It incorporates Demand and Special Emphasis factors that in the collective opinion of the Committee contribute to the essence of priority.

Please note that the eight maps selected earlier by the Committee and tabled by the Council pending prioritization were each given 30 points special emphasis because they were selected by unanimous vote of three Committee members.

Also please note that 7½-minute quadrangles were not included. The Committee proposes to accept Dr. Johannsen's offer of student projects leading to prioritization of all 7½-minute quadrangles and computer programs for doing this on a yearly basis.

Respectfully submitted,

Jerry D. Vineyard, for Mark Weston,
Committee Chairma

PRIORITY LIST FOR 15-MINUTE QUADRANGLES

*	122	Thayer		51	Brookfield
*	110	Hermitage		51	Galt
	108	Birch Tree		51	Princeton
*	104	Fristoe		50	Trenton
✓ *	97	Noel		49	Kennett
	87	Plattsburg		49	Valley Ridge
✓ *	86	Rocky Comfort		48	Darlington
	82	Polo		48	Piggott
	80	Clarksdale		47	Utica
	79	Maysville		46	Marmaduke
*	78	Eugene		45	Willow Springs
	78	Winston		44	Couch
	77	Chillicothe		44	Stanberry
*	73	Bado	2	42	Blockton
*	73	Meta		42	Grant City
*	70	West Plains		42	Maryville
	68	Braymer		42	Parnell
	65	Gallatin		41	Gilman
	64	Bolckow		41	Pattonsburg
	63	Montier		38	Manes
	57	Iberia		37	Lamoni
	55	Clear Springs		37	Mt. Ayr
	54	Bethany		36	Tavern
	54	Pittsburg		35	Blythedale
	53	Chula		32	Hale

* Initial Committee recommendation

SUGGESTED PROCEDURE FOR SELECTING TOPOG. MAPS FOR REVISION

12-8-76

Assumptions:

1. All 15' maps revised or in process of revision
2. Date of map is that of last revision (interim or otherwise)

	Criteria	Points
1.	Age of sheet (one point per year)	0-34
2.	Location in an environmentally critical area	
	Critical Area	25
	Potentially Critical Area	15
	Sensitive Area	5
3.	Population	
	In an SMSA	10
4.	Percent change in population	0-34
5.	Demand Factor	
	High	25
	Medium	15
	Low	5
6.	Special emphasis	
	Unanimous Committee recommendation	50
	Three or more members recommend	30
	Two members recommend	20
	One member recommends	10
	Maximum point total	178

APPENDIX "D"

CATALOG OF DATA ITEMS

Data Code

1000 CARTOGRAPHIC DATA

1100 Aerial and Space Imagery

1101 Aerial Imagery (electronic origin)
1102 Aerial Photographs
1103 Space Imagery (electronic origin)
1104 Space Photographs
1105 Computer Compatible Tapes of Imagery

1200 National Topographic Map Series

1201 1:24,000 scale
1202 1:62,500 scale
1203 1:100,000 scale
1204 1:250,000 scale
1205 1:1,000,000 scale

1300 Special Base Maps

1301 Local Project Maps
1302 Orthophoto Maps
1303 Urban Area Maps
1304 County Maps
1305 Regional Maps
1306 State Maps
1307 Satellite Image Maps

1400 Earth Resources Maps

1401 Geophysical Maps and Charts
1402 Geologic Maps
1403 Soil Maps
1404 Surficial Materials Map
1405 Climate Map
1406 Hydrologic and Related Maps
1407 Land Form Maps
1408 Mineral and Energy Resources Maps
1409 Engineering Geology Maps

1500 Administrative

1501 Transportation Maps
1502 Land-use Maps
1503 Utility Maps
1504 Census Maps
1505 Federal - State Land Maps
1506 Congressional District Maps
1507 Tax Maps

1600 Navigation Charts

1601 Aeronautical
1602 Nautical (Inland river and lake charts)

1700 Survey Records

1701 Cadastral Surveys
1702 Geodetic Surveys
1703 Engineering and Mapping Surveys
1704 State Boundaries
1705 County Boundaries
1706 City Boundaries

1800 Related Cartographic Data

1801 Atlases and Gazetteers
1802 Geographic Names
1803 Raised-relief Maps

1900 Digitized Cartographic Data

2000 METEOROLOGICAL

2100 Climatological

2101 Precipitation
2102 Temperature
2103 Wind
2104 Humidity

2200 Air Quality

2201 Gaseous & Particulate Concentrations
2202 Radioactivity
2203 Turbidity

2300 Man's Activities

2301 Emission Sources
2302 Air Pollution Regulations and Standards
2303 Air Pollution Compliance Data
2304 Severe Weather Damage Data

3000 BIOLOGICAL RESOURCES

3100 Wildlife

- 3101 Fish Inventory
- 3102 Fish Distribution (stocking)
- 3103 Wildlife Inventory
- 3104 Deer - Turkey Harvest

3200 Natural Vegetation

- 3201 Aquatic Habitat Assessment
- 3202 Wildlife Habitat Assessment
- 3203 Natural Areas Inventory

3400 Microorganisms

- 3401 Bacterial Water Quality of Streams, Rivers and Lakes

3500 Man's Activities

- 3501 Inventory of Grass Lands
- 3502 Livestock Counts
- 3503 Inventory of Crops
- 3504 Forest Inventory
- 3505 Forest Protection Data
- 3506 Forest Products Inventory
- 3507 Agricultural Products Inventory
- 3508 Inventory of Irrigated Land and Products

4000 WATER RESOURCES

4100 Surface Water

- 4101 Stream Flow Data
- 4102 Sediment Load
- 4103 Surface Water Temperature
- 4104 Chemical Analysis of Surface Water
- 4105 Springs and Characteristics

4200 Subsurface Water

- 4201 Groundwater Quality
- 4202 Chemical Analysis of Groundwater
- 4203 Observation Well Network Data

4300 Man's Activities

4301 Well Data (private and municipal)
4302 Public Water Supply Sources
4303 Water Pollution Compliance Data
4304 Municipal Point Source Discharge
4305 Dam Inventory
4306 Chemical Spills Data
4307 Industrial Point Source Discharge

5000 EARTH RESOURCES

5100 Soil and Surficial Materials

5101 Physical Analysis of Soil
5102 Chemical Analysis of Soil
5103 Stratigraphic Studies
5104 Descriptive Sections and Information of Soils

5200 Mineral and Energy Resources

5201 Mineral Production and Value
5202 List of Mineral Producers and Processors
5203 Inventory of Mined Lands
5204 Oil and Gas Production and Data
5205 List of Producers
5206 Inventory of Oil and Gas Resources
5207 Inventory of Coal Resources and Depletion
5208 Chemical Analysis of Minerals
5209 Physical Analysis of Minerals

5300 Geology

5301 Geomorphic Studies
5302 Structural Geology Studies
5303 Stratigraphic Studies
5304 Seismic Risk Zones
5305 Physical Analysis of Rock
5306 Chemical Analysis of Rock
5307 Descriptive Sections and Information of Rock Formations
5308 Inventory of Caves
5309 Physical Analysis or Rock
5310 Well Logs and Special Logs
5311 Subsurface Geologic Data

5400 Man's Activities

5401 Engineering Geology Reports
5402 Permits for Landfill and Toxic Waste Disposal Sites
5403 Inventory of Solid Waste Disposal Sites
5404 Chemical Analysis of Sewage and Leachate

6000 SOCIO-ECONOMIC RESOURCES

6100 Social

6101 1970 Census Data
6102 Current Land Use
6103 Highway Traffic Volume Counts
6104 Employment Data
6105 Manpower Resources

6200 Economic

6201 Transportation Resources
6202 Utilities Resources
6203 Land Ownership
6204 Earnings and Income Data
6205 Roadway Characteristics - State - County System
6206 Community Profile
6207 Land Values
6208 State Airport Directory
6209 Real Estate Activity (Land Survey User Fee)

6300 Recreation

6301 Park Use Data
6302 Recreation Facilities Inventories
6303 Public Use or Access Area
6304 Trail Inventory
6305 Bikeway Inventory
6306 Land and Water Conservation Fund Data
6307 Tourist Expenditure

6400 Governmental

6401 Police Station Locations
6402 Fire Station Locations
6403 Public Use or Access Area
6404 School Districts
6405 Political Boundaries
6406 State Government Officials
6407 County Government Officials
6408 Zoning Data

6500 Archeologic and Historic

6501 Register of Historic, Archeological and Architectural Sites
6502 Known Archeological Resources

APPENDIX "E"

CONCEPTUAL DESIGN OF A MISSOURI NATURAL RESOURCES INFORMATION SYSTEM

Adapted From:
Texas Natural Resources Information
System Conceptual Design
December 1974

PRESENT MANAGEMENT OF DATA/INFORMATION BETWEEN STATE AGENCIES

Natural resource data is consistently collected by the various State agencies in accordance with their individual statutory responsibilities. However, agency specialization alone does not identify completely the type of data that is being collected by any one agency. For this reason there has been some lack of knowledge of the existence, residence, or status of natural resources data/information. Acquiring natural resources data/information from outside one's own agency can many times be cumbersome and time-consuming, and this often causes potential users within the State agencies to forego the advantage of using all available data/information. Also, when a user has need for certain data/information but has no indication that such is already being accumulated, there is the possibility that another, similar data collection program could be launched, thus constituting a duplication of effort and unnecessary expenditure of funds.

The lack of knowledge concerning existing and emerging data extends to generating sources other than State agencies, i.e., cities, regional governments, other states, and federal agencies. In cases involving the acquisition of federal agency data/information, there are multitudinous avenues of approach through the various federal agencies. Attempts by individual State agencies to obtain valuable data/information from federal sources have at times resulted in unnecessary repetition of efforts and multiple financial outlays by the State of Missouri for the same data.

Missouri citizens, as potential users, are afforded access to available data/information generally on a "search and find" basis. Considerable time and expense can many times be expended by users in obtaining natural resources data/information.

At the present time, although specialized systems are being developed within the State, the mechanism does not exist in Missouri to link, in common network, the sources and users of natural resources data/information. The greatest present need is for a comprehensive system to weld together the capability that already exists.

GENERAL CONCEPTS

The Natural Resources Information System is not a "system" in conventional systems engineering language. As defined herein, it "refers to a service mechanism for the (1) assembling of sensed, monitored, measured, and collected data which may be maintained in both machine processable and nonmachine processable forms; (2) Processing these raw data into physically meaningful data; (3) adjusting and organizing processed data into forms and formats suited to modern storage, retrieval, and manipulative procedures; (4) storing this data in a systemized manner as an information base; (5) disseminating data from this base of information; and (6) the manipulating and processing required to transform these data into graphs, models, study plans, specifications, and simulative systems needed to manage natural resources, as may be determined necessary by user requirements."

Basic to the successful implementation and operation of any large-scale information system are three critical elements: (1) the users of the system, (2) the information base, and (3) the information services. In order to better define the NRIS scope, these three important areas are covered individually below.

NRIS USERS

The NRIS must be designed to serve the intended users, i.e., the decision maker, the planner, the technician, the researcher as well as the public in general. The starting point in detailed design then is to identify the needs of

the users. As envisioned, the Missouri NRIS would ultimately serve the natural resource information needs of various governmental levels as well as the general public. The involvement of these users will no doubt evolve as the NRIS expands and develops.

NRIS INFORMATION BASE

The heart of the Natural Resources Information System is the NRIS Information Base, which will be designed to meet the needs of the user agencies for information. The Information Base contains the organized "information" collected and dispersed within the system. Though comprehensive in nature, and systematically organized along defined structurally similar lines, the Information Base need not be centralized. Each agency can, and generally should, maintain its own information files needed to fulfill its particular function or functions. The NRIS Information Base will exist in both machine-processable form (computer cards, tapes, disks, etc.) and non-machine processable form (published material, maps, imagery, microfilm, etc.). how accessed?

The Information Base should be organized by categories and subcategories, and include information on all relevant and related resources.

The categories as shown in the data system catalog have evolved from the NRIS identification activity and represent a present "definition" of the NRIS Information Base.

The NRIS Information Base will be implemented using certain standard codes and procedures designed for ease of use and system compatibility. The Information Base would remain "open ended" in structure in order to accommodate new data and information. Some data in the Information Base may have certain restrictions on its release to NRIS users. In these cases, the requestor would be notified by NRIS to contact the NRIS data-source agency to specifically re-

quest release of this data. In this manner security and any other release restrictions established by the data-source agency would be safeguarded. To the fullest extent possible, the NRIS Information Base should be made compatible with existing and planned state and federal systems.

NRIS SERVICES

From the NRIS Information Base, various services would be available to NRIS users. NRIS services would include providing information on data availability, providing basic data and information retrieval, and providing various data analysis capabilities. These services should be available to users requesting them through letter and telephone contacts, and also through remote computer terminal access.

Catalogs and indexes, in both machine processable form and non-processable form, would be readily accessible for determining availability and location of data and information. This service would include providing printed and computer aids to determine NRIS Information Base contents and location, form and format of data available, periods of record, station location networks, etc. These services would provide initial information to users and would provide the basis for users to easily use other NRIS services.

Other NRIS services would include access to and retrieval of data and information from the NRIS Information Base. The data/information requested could in many instances be provided to the user in a variety of forms and formats as desired. These include computer generated reports, microfilm product, published reports, computer cards, and tapes. As mentioned earlier these services would be available in response to telephone, letter, and personal contacts as well as through the usage of various computer terminal capabilities.

Various analysis capabilities would also be an integral part of NRIS services.

A computer library of statistical packages and analysis models would be available. Providing data and information to users in the form of computer generated plots, charts, and maps would also be important. These services would be supported by digital plotters, digitizing equipment, and interactive graphics equipment. Services would be available for the analysis and reproduction of certain microfilmed and published information. Light tables, transfer equipment, etc. would be available to provide analysis capabilities with respect to remotely sensed information. Various important management level reports would also ultimately be available from the system. These analysis services would be an important part of the NRIS operation in order to provide requested data and information in the most useful and meaningful forms possible.

NRIS ORGANIZATION

General

Having defined the scope of the NRIS, the next step is to delineate a set of feasible alternative approaches for organization. Considerable difficulty is encountered in attempting to define alternative approaches. Organizational functions interface so completely with those of acquisition, user service, and management that it is impossible to design an organization independently. The alternative is to postulate a set of total system configurations and to describe the functions within each. Three approaches will be described in some detail.

Linked Network Approach

The linked network approach consists of many NRIS centers linked together by a communication network and management structure. Although individual centers would differ from each other because of their emphasis, the functions of acquisition, indexing, cataloging, reproduction, archiving, retrieving, re-

ferral, and dissemination would be performed within the network. However, the functions of analysis and interpretation would not be performed by network centers. The linked network users would need to be sophisticated enough to analyze their own needs and synthesize the desired information from the data they receive. In one sense, each center is a referral agency. That is, to the extent that the center can service a request, it will do so. However, uninformed users would be referred to proper facilities to process requests. Since all centers are housed in some existing agency, the only management structure to be suggested concerns the network operations. The directors of the participating departments or the NRIS committee could establish policy and guidelines for the network. Although the linked approach in its minimal form is only a small modification in the structure of department level systems, its value to a new community of users has proven to be very high. Since the existing entry for a user from the public domain is into an archive, only those requests by proper index terms can be serviced efficiently. However, by adding user oriented centers which are linked into the network, less precise requests could be serviced.

A Hierarchical Organization

The Natural Resources Information System can be portrayed as a hierarchical network in which each center can be seen from both a function and organization viewpoint. The operation of such a system will be discussed below.

A user enters the system at a nearby entry point. These points can be called Access Centers. The request is analyzed, formalized, and processed. The system may respond, subject to any prescribed security provisions, by disseminating to the user a list of information sources for the user to contact, a list of

documents for the user, a set of documents for the user to read, physical samples or raw data for the user to analyze, a set of displays showing the results of the system analyzing the data on behalf of the user, a list of algorithms (or even the computer programs themselves) to do some analysis of raw data, or combinations of these. The products, usually given out at the entry point, can be documents, physical samples, imagery data, or raw data. Moreover, provisions for mail or communication of output to the user by mail, etc., can be made.

The control of the system would be based at a central focal point, called an Analysis Center. Here the data acquisition and processing functions will be located and/or monitored. The central focal point is the Analysis Center surrounded by Access Centers. This is a hierarchical network structure. More levels can be added if deemed necessary.

Each center would be specialized in scope, with the degree of specialization increasing as one goes down the hierarchy. Thus the size of the data base stored in the center and the number of various services on the premises decreases with the hierarchical level.

Management is an important segment of the hierarchy. The specific plan of organization and authority would have to be worked out properly. A primary issue would be the degree of autonomy each level in the hierarchy has over its own affairs. Another issue would be the funding arrangements for the system.

The system would be set up initially using a decentralized format. The Analysis Center would generate data indexes. Existing systems would do some analysis and one could serve as the Access Center. The system would evolve eventually into a full-scale hierarchical information network.

Single Agency Approach

An operational Single Agency Natural Resources Information System would consist of three major subsystems: (1) a data acquisition subsystem, (2) a data handling subsystem, and (3) an administration subsystem. These three subsystems would be housed in a single agency center.

The data handling subsystem would perform three main functions: (1) data collection, (2) data processing and storage, and (3) data distribution.

The Single Agency NRIS would perform the following functions:

-- Initially processing all data received, including recording, annotating cataloging, and indexing

-- Reproducing data for storage, analysis, and further processing

-- Further processing, including image enhancement, rectification, digitizing, and gridding

--Maintaining and administering a Working Data Bank, that is, a point at which those data with high utilization potential are deposited

-- Maintaining and administering a Permanent Data Bank, that is, a depository for all data received into the system

-- Providing any special processing requested by users

-- Coordinating the components of the system

The Single Agency NRIS would handle user requests and distribute data to users.

The Single Agency NRIS management subsystem would consist of an administration which would be the hub of the entire system and house the collection, processing and user service centers. The organization could be a completely new agency or a designated existing agency.

Although this description differs markedly from that which would perhaps

evolve from the present effort, it is worthwhile to establish the salient features of the Single Agency NRIS in the event this type of system were elected.

-- It would be a new agency or a designated existing agency.

-- It would be a highly centralized system, with the major operations housed in a single center.

-- There would exist an assortment of well organized, highly capable data sources.

-- There would exist a highly capable processing technology.

-- There would be a small, elite community of users, so that the system would be rather passive in interfacing with a wide variety of users.

RECOMMENDED NRIS ORGANIZATION

Careful study has been made of the advantages and disadvantages of the three organizational approaches mentioned above by various state and federal agencies. Extensive design work has been done at the federal level by the U.S. Geological Survey in development of the National Water Data Exchange System (NAWDEX). The NAWDEX organizational concept is actually a combination of the linked network approach and the hierarchical approach where all participating agencies make up the linked network and a "Systems Central" provides a coordinating point of contact and gives this approach its hierarchy. It is recommended that this approach be taken for the development of a Missouri Natural Resources Information System.

COMBINED LINKED NETWORK AND HIERARCHICAL APPROACH

As the name implies, the combined linked network and hierarchical approach is organized as a network, within a defined hierarchy.

The process of acquiring natural resources data from original sources would not be significantly different in this approach than it is at present, allowing for normal growth in technological capability. The data collection functions would be coordinated through the ICNRI, but would remain the responsibility of those agencies with expertise in the appropriate areas. Regardless of who collects the data, the important factors are:

-- Make the data available to users, consistent with cost and efficiency, rather than just to the source agency.

-- Minimize redundant data collection programs through intensified coordination.

Storage of all natural resources data and information in a centralized location is not the objective of this approach. However, a centralized facility is made available to those cooperating agencies not wishing to internally develop the necessary storage, processing, and retrieval capabilities. This centralized facility is also available to store certain duplicate files for cooperating agencies.

The basic concept behind a system of the NAWDEX type is that the large users (agencies) maintain internal data storage and retrieval systems for data which they collect and use. A "Systems Central" also provides the computer services for the smaller agencies and is the processing site for external requests to the information system. Obviously, a high degree of interagency coordination and standardization of data formats is necessary to make a system of this type function properly.

In addition to the data storage and retrieval function, "Systems Central" would maintain an accurate and complete index of natural resources data in the

files of the participating agencies. This index would have sufficient detail so that the location, character, form, and availability of the data in the files of each participating agency can be determined therefrom. Additional details on this organizational approach are included in the following section.

ORGANIZATIONAL RESPONSIBILITIES

As envisioned in this approach, specific organizational responsibilities fall into three main categories:

(1) Overall administrative level direction;

(2) NRIS committee level direction; and

(3) Implementation and operation.

OVERALL ADMINISTRATIVE LEVEL DIRECTION

The ICNRI would continue to provide overall direction of the NRIS effort. Activities would possibly include certain policy formulation, communication of system objectives, action of committee level recommendations, and coordinate funding requests. Hopefully, the ICNRI would help insure that the NRIS was the focal point for resource information needs of other Council working groups and activities, i.e., remote sensing, land resource management, and other resource related efforts. An important ongoing responsibility of the ICNRI will be for each department director to help insure responsive participation of other staff members in his department in NRIS implementation and operation. Such would also include careful attention to department representation on and participation in the work of the NRIS committee. Only with this committment of ICNRI support can the NRIS succeed.

COMMITTEE LEVEL DIRECTION

The NRIS committee under the direction of ICNRI would provide the "working level" direction to NRIS implementation and operation. This would include implementation scheduling, development of operational guidelines, prioritizing implementation activities, and recommendations on staffing, funding, etc., all within ICNRI guidance. Needed subcommittees and working groups would be established to accommodate certain areas of specialization and mutual interest, i.e., a working group of four to five agencies might consider implementation questions regarding the geologic and land resources area of the NRIS, etc. The NRIS committee would provide general guidance to the NRIS implementation and operation staff and through each agency committee representative help insure full participation by each respective agency.

IMPLEMENTATION AND OPERATION

The implementation and operational responsibilities would be coordinated by NRIS "Systems Central" staff with assistance from technical support staff eventually in each of the NRIS agencies. The functions and responsibilities of these two groups are described below.

NRIS "Systems Central" provides the coordinated implementation direction and serves as the primary point of contact for system operation. "Systems Central" staff would accommodate the coordinated analysis, design, and implementation of evolving NRIS capabilities which would include provisions for new data and information as well as extending and enhancing existing capabilities. "Systems Central" would also carry out the repetitive functions associated with day-to-day operations of the NRIS. These activities would include receiving and interpreting requests; routing requests to the proper entity as necessary; pro-

cessing requests for data and information; communicating with agency technical support staff to insure coordination of responses to users; processing NRIS utilization and accounting information; monitoring file updates and indexes; and maintaining communication with NRIS users. Related responsibilities would include the development of standards, user manuals, documentation, request forms, and other procedures.

The technical support staff, eventually in each NRIS agency, would provide the necessary interface with NRIS "Systems Central" for system implementation and operation. This would include analysis, design, and other technical support related to each agency's inventories and other development work toward system implementation. The technical support staff would work with "Systems Central" in receiving, forwarding, processing, and tracking user requests in an operational mode.

Successful NRIS implementation using this approach requires a close, well coordinated working relationship between "Systems Central" and the technical support staff in order to insure cohesive system implementation and responsive system operation.

NRIS-NAWDEX CONCEPT

Listed below is a general description of this approach:

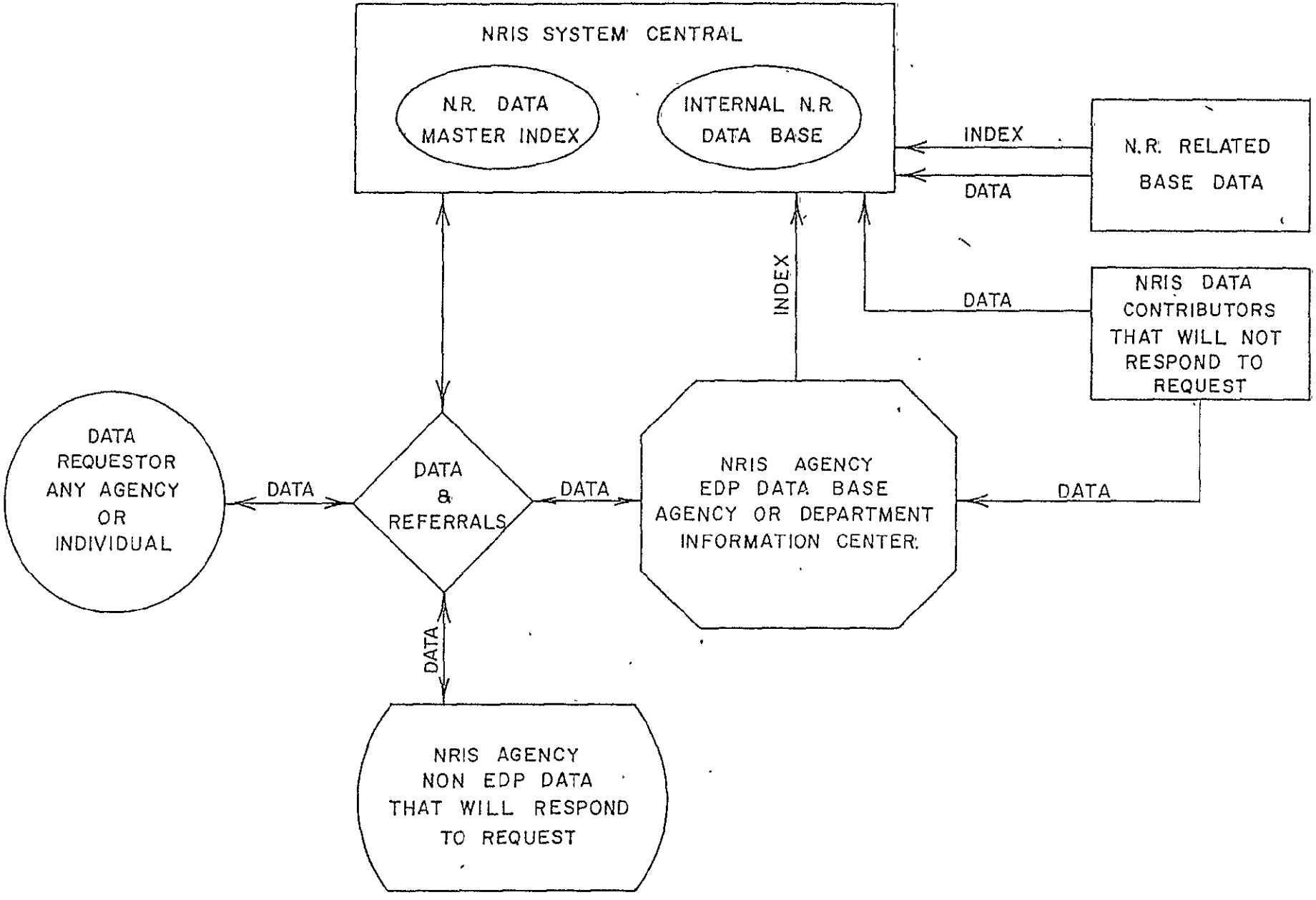
1. NRIS agencies continue to maintain data entry, verification, storage, and retrieval systems for data which they collect and use.
2. Requests for information may come from two sources, these being NRIS agencies and other requesters.
3. Requests for information may come to two sources, these being NRIS agencies and NRIS "Systems Central".

4. Requests which cannot be satisfied through the file holdings of a particular NRIS agency will be coordinated through "Systems Central" (via computer terminal, mail telephone, etc.).

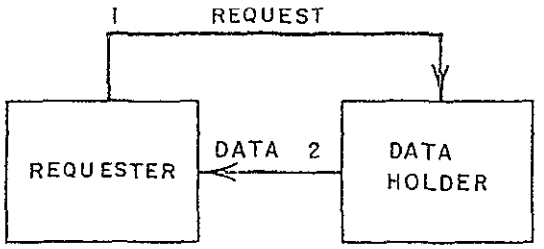
5. "Systems Central" will process requests through its file holdings (see 6 below) or will interact with other appropriate NRIS agencies to satisfy the request.

6. "Systems Central" file holdings will include appropriate copies of selected NRIS files; accompanying computer retrieval and analysis software for these files will also be available. The basis for selecting these NRIS files will be a mutually recognized need for extensive interagency utility of certain files and the need to provide integrated data bases.

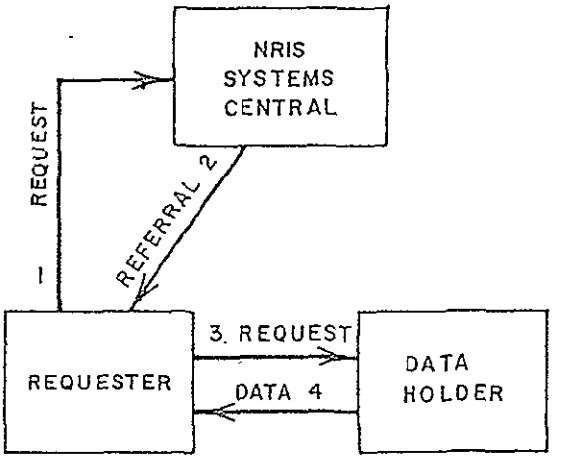
MISSOURI NATURAL RESOURCES INFORMATION SYSTEM



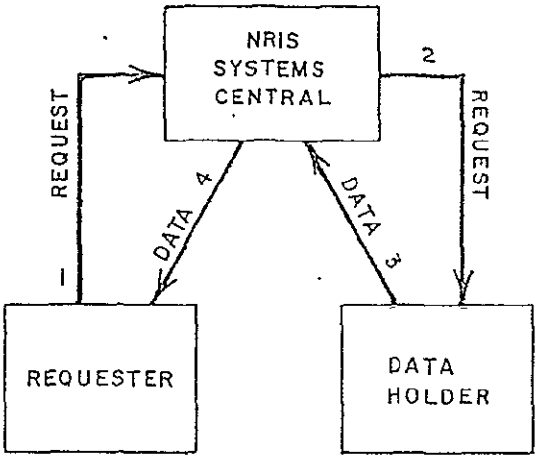
NRIS REQUEST RESPONSE SITUATIONS



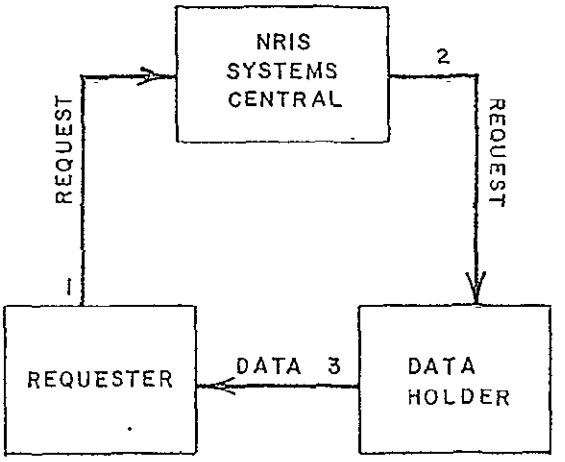
DIRECT RETRIEVAL



DIRECT RETRIEVAL BASED ON REFERRAL



RETRIEVAL THROUGH SYSTEMS CENTRAL



DIRECT RETRIEVAL AT SYSTEMS CENTRAL'S REQUEST

Appendix "F"

Plan For The Inventory Of Missouri Natural Resources Data and Data Sources

INTRODUCTION

Natural resources data is being continuously collected by the various state agencies in accordance with their individual statutory responsibilities. However, agency specialization alone does not identify completely the type of data that is being collected by any one agency. For this reason, there has been some lack of knowledge of the existence, residence, or status of natural resources data. Acquiring data from outside one's own agency can be cumbersome and time consuming, and this often causes potential users within the state agencies to forego the advantage of using all available data.

The first and most obvious solution to this problem is to develop an inventory of all natural resources data that is available within the various state agencies. The second and long range solution is to develop methods of sharing the data itself.

INVENTORY OF NATURAL RESOURCES DATA AND DATA SOURCES

The completed inventory of natural resources data and data sources will provide the following information.

1. A listing of natural resources data items that are collected by state agencies. Some data items will be given by a fairly broad subcategory and some will be very specific. This collected data should include only those items which are available or could be made available for use by other agencies.
2. Certain basic facts about the data. What format is the data in? How often is the data collected or revised? How is the data referenced geographically? To what extent is the state covered by this data? For how many years has this data been collected, what agency and what person should be contacted about this data, and what constraints will be placed on the sharing of this data?
3. A list of agencies which use the data items. This list will also show how often this data is used. A use generated priority rating of each data item will be given.

The inventory will be conducted by sending a questionnaire to all departments and agencies. The questionnaire will contain a preliminary listing of data items as previously determined by the Inter-Departmental Council for Natural Resources Information. Additional items may be added by the agency if necessary.

FORMS TO BE COMPLETED BY THE AGENCY

Agency Key Person

Each department and each division within the department should complete the agency key person form. Department name and division name will be given. The department number will be as shown on the enclosed department code number (a number between 1 and 14). The division number will be a number between 1 and 9, as determined by the department itself. In other words, each department can have up to nine divisions. Each department and each division should assign a number to each of their key employees, giving the name, address, and phone number of that key person. The key person will be the person that should be contacted about the use or collection of the data items. It is not necessary for each division to designate a key person. It is entirely appropriate for the department to designate one person as a key person for the entire department if it so chooses.

Inventory Form

Each division should complete an inventory form. The person completing the form should complete the department, and the division name, the name of the person preparing the form, and his phone number. The agency number is the department number followed by the division number. The data code and data name will be typed on each one of the forms. The individual department and division should complete the form as to agency involvement, frequency of use, frequency of data collection, form of information, collection format, data coverage, data sharing potential, period of record, and key person for each of the items that they either use or collect. Items in which they have no contact should be left

blank. In completing the inventory form, each agency should note that the first two items are to be completed only for items which the agency uses. The last eight items on the inventory form are to be completed only if the data is collected by the agency. A sample of a completed form is enclosed.

Output Format

The output format is as shown on the enclosed form. Information will be sorted by data code and the data name will be given by area, category, and subcategory. The information for each data code will be tabulated as follows: By agency number and department name, by agency involvement, frequency of use, form of information, coverage, collection format, data sharing potential, period of record, and key person number. The first agencies to be shown will be those agencies which are collectors of the data. Second will be those agencies which are both collectors and users of the data, and third will be those agencies which are just users of that data. At the end of the tabulation for each data code, the frequency of use codes will be numerically added and shown at the end of the frequency of use column.

Specific Computer Requirements

A special file will be necessary for the names of each one of the departments. This will be given by its department code. A data file will be needed for the area, one for category, and one for subcategory. In the process of tabulating the results of these inventories, the frequency of use number of code must be tabulated. Frequency of use for agencies that do not use a particular piece of data should be given a value of 7, and this value should also be accumulated. In other words, everytime a record is searched and is not used in any way, a frequency of use of 7 should be added to the total for that category or that subcategory of data.

NATURAL RESOURCES DATA INVENTORY CODES

Code

Agency Involvement With the Data

C - Collector — Agency participates in collecting data and can supply this data to other users at the present time. The agency does its own collecting; contracts for or cooperatively works with one or more other agencies in securing the data.

U - User — Agency uses the particular kind of data regularly or periodically.

B - Both User and Collector

Blank - not involved with this data

Frequency of Collection and Update of Data

1 Daily
2 Monthly
3 Quarterly
4 Longer intervals
5 Continuing collection at irregular intervals based on need

Frequency of Data Use

1 Use one or more times per week
2 Use one or more times per month
3 Use several times annually
4 Use annually
5 Use less than once annually
6 Unpredictable but will use if available

Primary Form of Information

1 Machine processable (numerical statistics in tabular form)
2 Manuscript
3 Mapped
4 Machine processable and manuscript
5 Machine processable and mapped
6 Mapped and manuscript
7 All three forms

Code

Primary Data Collection Format

(Nominal area for which the data is reported)

1 By township
2 By county
3 By river basin or watershed
4 By municipal boundary
5 By census tracts
6 Map quadrangles
7 Point source network
8 Random point source
9 Other

Data Sharing Potential

1 Data can be used readily by agencies in the present format.
2 Data could be used by other agencies after a data format modification.
3 Data could be used by other agencies with assistance from the collector.
4 Data could only be used by persons proficient in the technology of the data.
5 Data is not available for use by other agencies because of confidential, complex, or special nature of the data, or because it is completely outdated.

Data Coverage

1 Statewide coverage
2 Coverage less than statewide
3 Very limited coverage

DEPARTMENT CODES

Code	
1	Department of Agriculture
2	Department of Conservation
3	Department of Consumer Affairs, Regulation & Licensing
4	Department of Elementary & Secondary Education
5	Department of Higher Education
6	Department of Highways
7	Department of Labor and Industrial Relations
8	Department of Mental Health
9	Department of Natural Resources
10	Department of Public Safety
11	Department of Revenue
12	Department of Social Services
13	Department of Transportation
14	Office of Administration

AGENCY KEY PERSON

Input Form

Department _____ Number _____ (see dept. code)

Division _____ Number _____ (1 to 9)

Key Person Number	Name	Address	Phone

The Key Person is the person that should be contacted about the use or collection of the data.

INVENTORY FORM

NATURAL RESOURCES DATA SOURCES INVENTORY

Agency Number FOLDOUT FRAME

Department FOLDOUT FRAME 2

Division

Prepared By

Phone

				To be completed only for data which is collected by your agency							
Data Code	Data Name	Agency Involvement Code	Frequency of Data Use	Frequency of Data Collection	Form of Information	Collection Format	Data Coverage	Data Sharing Potential	Period of Record		Key Person
									From	To	

INVENTORY FORM

NATURAL RESOURCES DATA SOURCES INVENTORY

FOLDOUT FRAME 2

Agency Number 902

Department NATURAL RESOURCES

Division GEOLOGY AND LAND SURVEY

Prepared By JAMES A. MARTIN.

FOLDOUT FRAME 1

Phone 364-1752

Data Code	Data Name	Agency Involvement Code	Frequency of Data Use	To be completed only for data which is collected by your agency: Frequency of Data Collection	Form of Information	Collection Format	Data Coverage	Data Sharing Potential	Period of Record From	Period of Record To	Key Person
	GEOLOGICAL AND LAND RESOURCES										
	Surface										
5101	Soil or Surficial Materials										
5102	Geomorphic Features Studies										
5103	Chemical Analysis of Soils	B	1	1	1	2	1	3			4
5104	Seismic Risk Zones										
	Subsurface										
5201	Stratigraphic Studies	U	1								
5202	Geologic (bedrock) Map	U	1								
5203	Inv. of Rare & Unusual Geol. Features										
5204	Inventory of Caves										
5205	Chemical Analysis of Rock	B	2	5	1	1	1	3			5
5206	Chemical Analysis of Minerals	B	2	5	1	1	1	3			5
5207	Inv. of Metallic & Nonmetallic Min. Dep.	B	2	2	7	1	1	5			5
5208	Inv. of Coal Resources & Depletion	B	1	1	7	1	1	5			5
5209	Inv. of Gas & Oil Resources										
	Man's Activities										
5301	Mineral Production Resources Data	B	2	2	4	2	1	5			5
5302	Inv. of Mined Land	B	1	1	7	1	1	5			5
5303	Engineering Geol. Mapping										
5304	Inv. of Reclaimed Mined Land										
5305	Gas & Oil Production Data										
5306	Permits for Landfills & Ind. Disp. Sites										

Output Format

DATA CATALOG

Data Code _____ (Number) FOLDOUT FRAME 1

Data Name _____ (Area)

_____ (Category)

_____ (Sub-Category)

FOLDOUT FRAME 2

Agency Number	Department	Agency Involvement	Frequency of Use	Form of Information	Coverage	Collection Format	Data Sharing Potential	Period of Records		Key Person
								From	To	
(Number)	(Name)	(Code)	(Code)	(Code)	(Code)	(Code)	(Code)	(Yr)	(Yr)	(Number)