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TAX IMPROVEMENT
AND
NATURAL RESOURCES INVENTORY
PROJECT

SURVEY
OF
DATA NEEDS
OF
USER AGENCIES

Prepared For
Oficina de Planificacion de Nicaragua
and
USAID Mission to Nicaragua
April 1966

U.S. ARMY
INTER AMERICAN GEODETIC SURVEY
NATURAL RESOURCES DIVISION
FORT CLAYTON CANAL ZONE

A.I.D.
Reference Center
Room 1656 NS

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A. INTRODUCTION

This report represents a summary of the natural resources data needs of the various user agencies and institutions in Nicaragua as expressed in replies to a questionnaire and in interviews. It is intended to assist in the preparation of the scope of work, specifications, and work plan for the forthcoming "Tax Improvement and Natural Resources Inventory Project." The survey was done under the auspices of the USAID Mission and with the assistance of the Oficina de Planificacion de Nicaragua. The completed questionnaires were thoroughly reviewed with the respondents.

The need for data is an integral part of the development process and, accordingly, the agencies were also asked to furnish general information on their functions and programs. They were also asked to indicate for what specific purposes they wanted the different types of data and what areas they would like inventoried first. Taken collectively the information furnished gives an insight into what type of data is needed, the purpose and thus the detail, depth, and form desirable, and finally the area priorities.

The questionnaire was divided into four parts. The first, which was the principal part, listed in detail the various types and sub-types of natural resources data that could be inventoried, and the respondents were asked to indicate if this data was needed and also to make any appropriate remarks. At the end of each listing for each major topic, (e.g. geology, climatology), they were also asked to indicate the purposes for the data and their survey area priorities. They were also requested to supplement this information by furnishing general maps showing the highway program, the community water supply program, potential hydropower projects, and existing and proposed colonies and settlements. The maps are included in this report along with a general land capability map which provides preliminary guidance on potential agricultural and other land uses.

The second part of the questionnaire solicited information regarding preferences for base maps upon which to publish the various resources data listed in the first part. The choices that were given included (a) planimetric maps in one or two colors, (b) photomaps, with or without traced planimetry, in one or two colors, and (c) existing topographic maps, with or without the contours, in one, two, or multiple colors. Without its contours the topographic map actually becomes a first class planimetric map. The third part of the questionnaire was also related to the first in that it asked the agencies to indicate specific needs and locations for additional meteorological and related stations as well as stream gauging stations.

The fourth and last part of the questionnaire concerned itself with the needs of the user agencies for additional technical and professional

staff, including specialized training for existing personnel. The objective was to obtain a preliminary indication of the staff needs in order to make the best use of resources data when it becomes available and carry out more effective planning and development.

The agencies contacted represented those engaged in engineering programs such as highways and power, and those engaged in continuous operational or service programs such as agricultural extension and banking. Note that the banking institutions represent the needs of the private investment sector. In addition, the general planning organizations were also contacted. The inclosed list shows the agencies and functional units involved in the survey.

A by-product of the survey was that the respondents were given a briefing on the forthcoming inventory project, a better knowledge of the possible types of data that could be produced, and a greater awareness of potential data uses. This process should be continued by instituting training sessions for the user agencies when the data becomes available so that the data can be thoroughly explained and its various uses demonstrated.

LIST OF AGENCIES AND PERSONNEL RESPONDING TO SURVEY

- a. Departamento de Carreteras (M. de Fomento y Obras Publicas)
Division de Estudios y Proyectos
 - (1) Seccion de Puentes; Ing. Guillermo Noffal Z., Jefe
 - (2) Seccion de Localizacion y Diseno; Ing. Armel Gonzalez E., Sub-jefe
 - (3) Seccion de Planificacion; Ing. Raul Leclair L., Jefe

- b. Servicios Municipales (M. de Gobernacion y Anexos)
 - (4) Division de Planeamiento y Diseno; Ing. Franklin Gavarrete, Jefe

- c. Empresa Nacional de Luz y Fuerza (ENALUF)
 - (5) Departamento de Ingenieria; Ing. Silvio Bolanos T., Jefe
 - (6) Division de Desarrollo; Ing. Leonel Gadea, Jefe; Ing. Guillermo de la Rocha

- d. Comision Nacional de Energia; (M. de Fomento y Obras Publicas) Ing. Ricardo Solorzano; Director
 - (7) Seccion de Planeamiento; Ing. Victor H. Chavez

- e. Ministerio de Agricultura y Ganaderia
 - (8) Centro Experimental Agropecuario; Agro. E. Cerda, Director; Agro. J. Diaz; Agro. R. Horvilleur
 - (9) Direccion de Recursos Naturales Renovables; Agro. Ruben Camacho Saenz, Director; Nils-Erik Jotland (FAO); Juan Salas
 - (10) Servicio de Extension; Agro. Luis Osorio, Director
 - (11) Direccion General de Agricultura; Agro. Carlos Marin, Jefe (Climatology section of questionnaire only)

- f. Instituto Agrario de Nicaragua
 - (12) Departamento de Desarrollo Agropecuario; Lic. Alfonso Blandon Z., Jefe

- g. Accion Civica, Guardia Nacional (M. de Defensa)
 - (13) 1^a Compania de Ingenieria; Ing. Cptn. Ulises Carrillo R., Comandante

- h. Oficina Nacional de Urbanismo (M. de Fomento y Obras Publicas)
Ing. Jorge Sevilla, Director
 - (14) Seccion de Planeamiento; Ing. Salomon Fuentes, Jefe; Ing. Salvador Lopez; Arq. Jose Cuadra
- i. Oficina de Planificacion de Nicaragua
 - (15) Division de Proyectos; Ing. Edgar Jose Pereira, Jefe
 - (16) Division de Planificacion Economica y Social, Departamento de Programacion Agropecuaria; Lic. Jose Lainez T., Jefe (Questionnaire filled in by group)
- j. Banco Central
 - (17) Departamento de Estudios Economicos; Lic. Juan Jose Martinez, Jefe (Questionnaire filled in by group)
- k. Instituto de Fomento Nacional (INFONAC)
 - (18) Departamento Tecnico; Lic. Anibal Ramirez F., Jefe (Questionnaire filled in by group)
- l. Banco Nacional de Nicaragua
 - (19) Departamento Tecnico, Lic. Alfredo Papi Gil, Jefe; Agro. Manuel Romero

B. AGENCY FUNCTIONS AND PROGRAMS

B.1 Existing Functions

A general knowledge of the mission, or function, and program of the various agencies using natural resources data is useful in understanding their data needs. These are briefly discussed here in order to provide a basis for such understanding, as well as for analysis of the various agency responses. It should be understood also that the depth and detail of data required by any given agency is closely related to its specific function. Each agency responding to the survey is discussed in the following paragraphs. For detailed information on their programs and budgetary requirements, see the "Plan Nacional de Desarrollo Economico y Social de Nicaragua" which covers the current five-year plan and was published by the Oficina de Planificacion.

(1) Carreteras: The Division de Estudios y Proyectos within the Departamento de Carreteras in Obras Publicas has three sections whose activities require natural resources data. These are the sections of Planificacion, Localizacion y Diseno, and Puentes which are responsible respectively for general planning and economic studies, for site selection and final design, and for bridges and drainage structures. Plate 1 shows the roads under construction, programmed, and under consideration. Their program for the near future involves primarily the Central region and, to a lesser extent, the Pacific coast. However, over the longer term there is an interest in penetrating the east, particularly with two roads connecting to the Atlantic coast. One such road would run between Jui-galpa and San Juan del Norte and the other between Jinotega and Puerto Cabezas.

Based on proposed budgeting, the highway program in the five-year plan is the largest of all the public programs. Over one thousand kilometers of roads are involved for which over one-fourth of the country's budget is proposed. An important aspect of the present and future highway programs is the determination of area development potential for use in planning road locations. The natural resources inventory, particularly the land capability classification, will thus be of considerable value in road planning. It will also furnish valuable data for final site selection and design.

(2) Servicios Municipales: This agency's Division de Planeamiento y Diseno is responsible for providing community public works type services such as water supply, storm drainage, and sewage systems and treatment. Their interest is naturally concentrated in urban areas and population centers, and their current program is almost entirely community water supply. This water supply part of the program, consisting of over 70 projects to be installed through 1969, is shown on Plate 2. Since water supply projects of the size required by small communities are normally met more economically by groundwater, the projects planned will

be of the groundwater type to the extent that these are feasible.

The program of this agency will benefit considerably from adequate natural resources data, especially geology, geomorphology, and hydrology. Because of the experience that this agency already has in exploiting groundwater, it should be contacted by the groundwater survey group for information which would be valuable in planning and executing the groundwater survey.

(3) ENALUF: Empresa Nacional de Luz y Fuerza (ENALUF) is charged with the development, production, and distribution of electric power. The Departamento de Ingenieria and the new Division de Desarrollo together are responsible for power market studies, preliminary and feasibility studies for power projects, and the design and construction of power projects, transmission lines, and distribution lines. Their markets are largely in the heavily populated Pacific coast, and currently proposed transmission lines include Tipitapa to Granada, Managua to Puerto Somoza, Puerto Somoza to Leon, Chinandega to Corinto or Leon to Corinto, Leon to Sebaco, and Tipitapa to a proposed hydro project near Santa Barbara.

The recently completed Centro America hydropower project has substantially increased the country's generating capacity to 96,000 Kw. However, power demand projections indicate that additional capacity will be required in the near future if the country's economic growth is to continue unhampered by power needs. While it is obvious that the power markets are in populated and industrial areas, primarily the Pacific coast in the case of Nicaragua, it may not be so obvious that additional hydropower plants in Nicaragua will have to be based on hydro resources which are more to the east, where the terrain and rainfall are more conducive to hydropower development. Considering the locations of the hydro resources and the desirability of holding transmission line and access road requirements to a minimum leads ENALUF to concentrate its hydropower studies in the Central region closest to the markets, particularly the Tuma-Matagalpa-Viejo river complex. See Plate 3 for hydropower sites of current interest.

The continued growth of the overall power system must be supported by adequate resources data, particularly geology, geomorphology, climatology, and hydrology. Presently, the lack of adequate resources data, coupled with the time required for feasibility studies and the initial cost of hydropower, make thermal and diesel plants initially attractive. There is no doubt, however, that well-selected hydropower projects have a long-term economic advantage, inherent advantages in operational flexibility, and incidental benefits such as stream regulation. Hydropower can also be incorporated into multiple-purpose projects, thus improving the economics of the overall development. The timely execution of the resources inventory will do much to stimulate

development in this area of activity and thereby contribute to the country's economic growth.

(4) Energia: The Comision Nacional de Energia is a regulatory agency but it is also involved in water resources development studies similar to ENALUF above, except that it is beginning to give more thought to multiple-purpose possibilities, including navigation. The area of interest for development studies is also similar to ENALUF. See the above discussions on water resources development studies and on study areas since they are equally appropriate here. The information on hydro sites of current interest shown on Plate 3 mentioned above, as well as the information included on meteorological and stream gauging stations, was furnished by Energia.

(5) Agricultura: The Ministerio de Agricultura y Ganaderia has three divisions involved in the development and use of natural resources. These are the Centro Experimental Agropecuario, the Direccion de Recursos Naturales Renovables, and the Servicio de Extension. They are, of course, keenly interested in data on land and climate, but they also have an interest in water resources to the extent that they relate to agriculture, livestock, fisheries, and forestry. In addition, the Direccion General de Agricultura is interested in climatology to support studies on the ecology and control of plant diseases.

The Centro Experimental maintains an experimental station on the outskirts of Managua and is starting another in Chinandega. It is also seeking to establish others throughout the country. In addition, it monitors a large number of small test plots on widely scattered private farms. The Servicio de Extension also has a geographically diverse function in that it develops programs and, through its agencies, maintains operations in the 17 Departments throughout the country. As the name implies, the Direccion de Recursos Naturales Renovables is charged with the exploitation and management of forests and fisheries. It can readily be seen that the divisions of this Ministry will benefit greatly from the variety of data to be produced by the inventory project. Their interest and programs are, of course, diverse but are concentrated mainly in the Pacific, Northern, and Central regions, except that the forestry group has little interest in the Pacific coast. These are the regions of greatest population, which is no accident since they also represent a large part of the better lands. A general land capability map is shown on Plate 4; note the concentration of the best lands in the Chinandega-Leon-La Paz Centro and the Managua-Masaya-Granada areas.

(6) IAN: The Instituto Agrario de Nicaragua is an autonomous agency which has the responsibility for agrarian reform and modified land tenure including all the related activities which this implies. It is actively engaged in the study and development of colonies and settlements including the administration of the colonies, which is what distinguishes them from settlements. A large part of their activities are

carried out in cooperation with other government agencies. Their interest in natural resources data is largely from the agricultural point of view, as in the case of the Ministerio de Agricultura y Ganaderia above. The Instituto currently has 11 existing colonies, 6 existing settlements, and 3 projects under study, as shown on Plate 5. Note how these existing colonies and settlements are concentrated in the Pacific coast region. The largest of the study projects, Rigoberto Cabezas, consisting of some 300,000 hectares in the Rama area is currently being studied with a loan from the Interamerican Development Bank.

(7) Accion Civica: This title actually refers to the program being carried out by the Primera Compania de Ingenieria of the Guardia Nacional. Their program, which is largely in the Pacific coast region, consists of local public works projects, particularly local roads and, to a lesser extent, the installation of wells. They are also currently carrying out, in coordination with the Servicio Geologica Nacional a groundwater exploration program in an area of 10,000 hectares to the south of Leon. Their need for natural resources data is similar to that of Carreteras and Servicios Municipales, since they are engaged in similar activities.

(8) Urbanismo: The Oficina Nacional de Urbanismo, which is a part of the Ministerio de Fomento y Obras Publicas, is not a development agency but one engaged in urban and regional development planning and studies of all types. Their data needs are general but comprehensive. Their areas of primary interest are those of intensive human use or occupation, notably the Pacific coast and adjacent regions.

This office is presently interested in delimiting the country's regions in terms of population, economic activity, and physical features. Any agencies would benefit from a breakdown of this type in planning their programs, such as for agriculture, roads, power, schools, and health facilities. Urbanismo has prepared, as a first step, a 1:1,000,000-scale atlas of natural resources, transportation, population, economic activity, and so forth. Since the natural resources portion is based on limited and very general data, Urbanismo has expressed a very definite need for the more detailed data to be produced by the forthcoming inventory project.

(9) Planificacion: The Oficina de Planificacion de Nicaragua is responsible for general programming and has recently published the country's first "Plan Nacional de Desarrollo Economico y Social de Nicaragua". The Oficina has two groups interested specifically in natural resources. These are the Division de Proyectos and the Departamento de Programacion Agropecuaria. The latter group is part of the Division de Planificacion Economica y Social. The Projects group is engaged in identification and study of engineering type resource development projects. Their current activities relate primarily to geothermal power possibilities in the Telica and Tipitapa areas and water resources in the Central

region. They also have an interest in navigation possibilities on Lake Nicaragua. The interests of the Agropecuaria group are similar to those of the Ministerio de Agricultura y Ganaderia, but from a general study and programming point of view. Similarly, their primary interest is in the Pacific coast, followed variably by the North and Central regions, and lastly the Atlantic.

(10) Banco Central: This agency is not a development agency, but its Departamento de Estudios Economicos is interested in natural resources data to support its agro-economic studies. To this extent, its interests and data needs are similar to the previously discussed Ministerio de Agricultura y Ganaderia and to the Departamento de Programacion Agropecuaria of the Oficina de Planificacion. Various parts of the Pacific and Central regions are the areas in which they are primarily interested.

(11) INFONAC: The Instituto de Fomento Nacional is actually a development bank but it is also engaged in various public and private agricultural, livestock, industrial, and related programs. It works in collaboration with government agencies in planning, advising, and financing. Some of its activities include the development and introduction of better seed, livestock improvement, and pilot experimental stations for agricultural diversification. Its Departamento Tecnico has a general overall need for natural resources data to support these various programs, particularly for agro-economic studies and agricultural activities, including small private irrigation works. As could be expected, their interest lies primarily in the agricultural areas of the Pacific coast followed by those of the Central and North regions. There is also an interest in the valleys of the Rio Grande de Matagalpa and the Rio San Juan.

(12) Banco Nacional: This bank finances a major portion of private investment loans in Nicaragua. Its Departamento Tecnico has a general need for natural resources data, particularly land capability, hydrology, and climatology, in order to advise clients on agricultural and rural projects and to evaluate loan requests therefor. The Departamento's primary interest is in the Pacific coast region, followed by the Central region.

B.2 Needed Functions

An analysis of the questionnaires together with comments made during discussions with officials of the responding agencies indicate three important functional needs in the total resources development activity.

(1) Water Resources: There is no agency charged with the overall responsibility for the study, planning, and development of water and related land resources. The Empresa Nacional de Luz y Fuerza (ENALUF) is engaged in water resources activities but its interest is naturally

limited largely to hydropower. The Comision Nacional de Energia within the Ministerio de Fomento y Obras Publicas is a regulatory agency but it is also involved in hydropower studies. It is, however, beginning to give more thought to multiple purpose possibilities, including navigation. The Projects group within the Oficina de Planificacion de Nicaragua is also showing an interest in the study of water resources, primarily power and navigation. Other agencies have indicated a marginal responsibility for irrigation and flood control but largely to fill a void. There is an apparent need for a single agency vested with the overall responsibility for the study, planning, and development of the country's water resources for all purposes.

(2) Transportation: There is no agency responsible for the overall and continuing planning and development of airfields or of river and harbor navigation facilities. Development of such facilities, which is limited at present, has involved various agencies, including the Ministerio de Fomento y Obras Publicas, the Oficina de Planificacion, and the Direccion General de Aeronautica Civil of the Ministerio de Defensa. In addition, the Comision Nacional de Energia, because of its involvement in water resources, and the Projects group in the Oficina de Planificacion are currently taking an interest in developing waterways. Unlike airfields and navigation facilities, the responsibility for highways is specifically vested in an appropriate agency, the Departamento de Carreteras. The various means of transportation all fill definite needs but are not independent of each other. The total transportation function should be better organized to permit more adequate planning and development.

(3) Planning: Nicaragua has two national planning organizations: the Oficina Nacional de Urbanismo within the Ministerio de Fomento y Obras Publicas and the Oficina de Planificacion de Nicaragua. Urbanismo is responsible for general urban and regional planning of public or community facilities and services whereas Planificacion has a primary responsibility for general programming for economic and social development. In addition, there are the various specific planning functions within the individual action agencies. There are no particular problems in having these multiple planning organizations, but their roles should be better defined and strengthened to permit more comprehensive planning and to avoid duplication.

C. PART I OF QUESTIONNAIRE (NATURAL RESOURCES DATA)

C.1 General

This section presents a compilation of PART I of the questionnaires dealing with the natural resources data needs of the various agencies. Their indicated need for each item or sub-item of data has been presented in tabular form and shown with an "X". There is a separate table for each resource topic and each table is accompanied by several pages of

text which summarize the pertinent remarks, uses for which the data is needed, and the views of the various agencies regarding the survey area priorities they would like to see assigned in relation to their own needs. Based on the completed questionnaires, as well as on comments made during interviews, there are certain observations or conclusions which can be stated as follows:

(1) The various agencies collectively expressed a need for all of the various data listed in the questionnaire with the exception of tectonics. Requests for data not listed in the questionnaire were minimal and those made under the following topics included:

- (a) Geology: thickness of rock strata.
- (b) Geomorphology: cultivability of swamp and marsh lands, once drained. Also, salinity of flood waters and effect on potential cultivation.
- (c) Climatology: an isohumidity map. Also data on dew in dry regions.
- (d) Surface Water Hydrology: data on maximum floods and on minimum dry season flows.
- (e) Agricultural Soils: a special land capability map based solely on forestry capability. Also a special map of problem areas based on soils problems solely as these relate to forestry.
- (f) Other: an inventory of all roads and navigable rivers for use in forestry studies and exploitation.

(2) The exact details and depth of inventory as well as the form of presentation for the various data should be left to the inventory or survey specialists who would have a better knowledge of the factors involved because of their closeness to the work, assuming that these specialists have a good knowledge of the practical uses of the data.

(3) The data users are not particularly interested in raw data, that is, they want the data to be evaluated and presented in a composite, readily usable form where possible. For example, water-quality data would be evaluated and summarized to indicate usability for industry, irrigation, or drinking, and land resources data would be evaluated and summarized to show land capability. In this latter case, although no interest was shown in any specific capability classification system, it was deemed essential that the classification system adopted show a dual capability classification covering both labor-intensive agriculture and mechanized agriculture.

(4) Maps should generally be produced in two scales. The first would be the reasonably large scale map produced by the inventory project for intensive use by the groups intimately involved in projects and programs. The second would be a smaller scale map, derived from the first

map, which would be used for more general work and general reference where large scale maps would be unwieldy. Additionally, special large scale maps would be desirable where appropriate for urban areas for industrial, public works, construction and similar uses.

(5) The priority areas for survey are, of course, somewhat variable with the different agencies but they are remarkably concentrated in the populated Pacific coast and Central regions. This is understandable considering that the agencies' programs are developed to meet the needs of the people and that they, in turn, generally occupy the better land resources, which in Nicaragua are largely in the Pacific and Central regions. Variations include ENALUF and Comision Nacional de Energia who must look more to the east for their hydropower resources but, since the power markets are in the west, investigations are presently held to the Central regions to keep transmission lines to a minimum. Another variation is Carreteras which, while interested in road programs in the Pacific and Central regions, would like to penetrate the eastern region, particularly with two roads connecting to the Atlantic coast, one between Jui-galpa and San Juan del Norte and another between Jinotega and Puerto Cabezas.

C.2 Compilation of PART I of Questionnaire

The tabular presentation of PART I of the questionnaire together with textual summaries of the remarks, data uses, and survey area priorities follows.

COMPILATION OF PART I OF QUESTIONNAIRE

1. GEOLOGY	NATURAL RESOURCE DATA NEEDS																		
	Carreteras			Serv. Munic.	ENALUF		Ener-gia	Agricultura			IAN	Accion Civica	Urban-ismo	Planifi-cacion	Banco Cent'1	INFONAC	Banco Nac'1		
Item	B	E	P	E	E	P	P	A	F	T	P	E	P	F	S	S	T	T	
1.1 General petrology and structure of surface rock masses:																			
a. Geological origins.		X		X		X			X			X	X	X		X	X		
b. General petrological types, units, families, suites, or groups.	X	X	X	X	X	X			X			X	X	X		X	X		
c. General age differentiation by types, units, families, suites, or groups.		X		X	X	X			X				X					X	
d. General dips and strikes for major rock units.	X	X	X	X	X	X			X				X					X	
e. Major faults and fault zones.	X	X		X	X	X	X		X			X	X	X				X	
f. General foldings of the strata.		X			X	X			X				X					X	
g. General trends of schistosity and gneissosity.		X				X	X		X				X					X	X
Preferred geology map scale for all above (1,000's):	50	50	100	20	50	50	20	- 1000 & 200	-	-	10	100 rural 10 urban	50/100 -	500	200				
1.2 Tectolines and tectonics:																			
a. Map of interpreted traces of tectolines, which may or may not be separate from geological map.																			
b. Map of interpreted tectonic framework, which may or may not be separate from geological map.		X			X								X						
1.3 Delineation of areas within or under which known mineralization occurs.		X	X		X				X			X	X					X	

User groups responding to survey:

A - Agriculture:

(MAG) Centro Experimental Agropecuario

B - Bridges:

(Carreteras) Seccion de Puentes

E - Engineering:

(Carreteras) Seccion de Localizacion y Diseno
(S. Municipales) Div. de Planeamiento y Diseno
(ENALUF) Dept. de Ingenieria
(Accion Civica) Primera Cia. de Ingenieria, G. Nac.

F - Forestry & Fisheries:

(MAG) Direccion de Recursos Naturales Renovables

P - Planning:

(Carreteras) Seccion de Planificacion
(ENALUF) Division de Desarrollo
(Energia) Seccion de Planeamiento
(IAN) Dept. de Desarrollo Agropecuario
(Urbanismo) Seccion de Planeamiento
(Planificacion) Division de Proyectos

S - Economic Studies:

(Planificacion) Dept. de Programacion Agropecuaria
(Banco Central) Dept. de Estudios Economicos

T - Technical Assistance:

(MAG) Servicio de Extension
(INFONAC) Departamento Tecnico
(Banco Nacional) Departamento Tecnico

GEOLOGY DATA NEEDS

Remarks, Purpose of Data, and Indicated Survey Area Priorities

General: Geology data will find diverse uses in road and bridge planning and design; groundwater exploitation; possible mineral exploitation; identifying sources of construction materials; evaluating sites for major structures and reservoirs and canals; studies of geothermal power sources; and in furnishing information relative to soils and thus to agriculture, forestry, and colonization. There is a need for special large scale maps of the urban areas for use by those involved in industry, public works, and construction. Interest in tectonics was expressed only by those involved in the design of major structures and not a single agency indicated an interest in tectonics. First choice for selection of initial survey areas vary with the agencies and are indicated in the following paragraphs.

Carreteras: Geology is needed for the location and design of bridges and roads and for sources of construction materials. Information on mineral deposits is desirable to permit consideration of exploitation in road planning and to otherwise avoid destruction of deposits in laying out roads. The first preference survey area is in the eastern region, particularly two strips between Juigalpa and San Juan del Norte and between Jinotega and Puerto Cabezas which would support consideration of roads to open up the east and connect the two coasts.

Servicios Municipales: Geology is needed to exploit groundwater for community water supply and to help select the types of drilling rigs. The thickness of strata is also desirable. The first preference survey areas are Boaco followed by San Juan del Sur.

NALUF: Geology is needed for studies, site selection, and design of hydropower projects, design of transmission lines, and sources of construction materials. Information on mineral deposits is desirable to avoid inundation by new reservoirs or otherwise evaluate their loss. The first preference survey area is the Central region, particularly the Usuma-Matagalpa-Viejo river complex.

Energia: Geology is needed in the investigation of hydropower sites. The first preference survey area is the North Central region followed by the watersheds of Lakes Managua and Nicaragua.

Agricultura: Geology interest was expressed only by Recursos Naturales renovables for forestry uses. This group would also like information on transportation of geologic materials and their origin and direction. First preference survey areas include Matagalpa, Jinotega, Esteli, Huehuetenango, Segovia, Boaco, and Chontales.

IAN: This agency has no geology interest.

Accion Civica: Geology interest by the Primera Compania de Ingenieria is for siting and designing roadways and locating sources of construction materials. Their first preference survey area is the Pacific region.

Urbanismo: Geology interest is for urban planning of engineering structures and estimation of mineral resources. First preference survey areas are the urban and potentially urban areas; also the traditional mining areas of the northeast.

Planificacion: The Projects group is interested in geology for geothermal power studies, with primary interest in the Telica and Tipitapa areas. The Agropecuaria group has no geology interest.

Banco Central: This organization has a limited geology interest to the extent that this subject relates to soils and thus to agro-economic studies for diversification and possibly irrigation. First preference survey areas include Carazo and Esteli for diversification and Leon and the east and west coasts of Lake Nicaragua for irrigation.

INFONAC: Geology interest is due to its relationship to geomorphology and soils and to data uses in irrigation, wells, and drainage for agricultural development. Areas of first preference for survey are the Central region, Valle de Sebaco, Valle de Esteli, Nueva Segovia, and Jalapa, in that order.

Banco Nacional: This agency has no geology interest.

2. Item
GEOMORPHOLOGY

2.1 General geomorphology of land forms:

a. Geological origins.

Carreteras	Serv. Munic.		QUALITY		Eros.	Agricultura			CAN	Accion Civica	Urban-ismo	Planifi-cacion		Banco Cent'l	INFORAC	Banco Neg'l
	E	P	E	P		A	E	T				P	E			
X			X				X	X		X	X	X	X	X	X	X

b. Unit landform types, origin, and gross physical characteristics.

X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
---	---	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---

c. Topographic contours.
Preferred contour interval (meters):

X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
10	20	20	10	5	50	10	-	5	-	20	5	5	20	20	50	10/15 semi det. 5 det.	20

d. Slope-range categories for each landform if control does not permit contouring.

X	X	X	X	X	X	X		X		X	X	X	X			X	X
---	---	---	---	---	---	---	--	---	--	---	---	---	---	--	--	---	---

e. Estimated dominant textural categories which characterize the parent materials of the landforms.

X	X	X			X		X	X	X	X	X	X	X			X	X
---	---	---	--	--	---	--	---	---	---	---	---	---	---	--	--	---	---

f. Estimated categories of vertical drainage which characterize the landforms.

X	X	X	X		X	X	X	X	X	X		X	X	X	X	X	X
---	---	---	---	--	---	---	---	---	---	---	--	---	---	---	---	---	---

g. Estimates of petrological origins of materials of the landforms.

X					X			X	X				X	X		X	X
---	--	--	--	--	---	--	--	---	---	--	--	--	---	---	--	---	---

2.2 Drainage and Erosion:

a. Delineation of all major and intermediate streams.

X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

b. Delineation of all intermittent lower order streams as compatible with photo and map scales.

X	X	X	X	X	X		X	X	X	X		X	X			X	X
---	---	---	---	---	---	--	---	---	---	---	--	---	---	--	--	---	---

c. Delineation of areas of tidal and freshwater swamp and marsh.

X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
---	---	---	---	---	---	--	---	---	---	---	---	---	---	---	---	---	---

d. Delineation of areas subject to periodic or perennial high water tables.

X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
---	---	---	---	---	---	---	---	---	---	---	---	--	---	---	---	---	---

e. Delineation of areas of isoped vertical drainage.

X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X
---	---	---	---	---	---	---	--	---	---	---	--	---	---	---	---	---	---

f. Delineation of areas subjected to periodic flooding.

X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

g. Delineation and classification of areas of gully and rill-sheet erosion.

X	X		X	X	X	X	X	X	X	X	X		X	X		X	X
---	---	--	---	---	---	---	---	---	---	---	---	--	---	---	--	---	---

Preferred geomorphology map scale (1,000's):

50	50	100	20/50	50	50	20	50	10/	-	50	10	100	50/	10/50	500	50 semi det	20
								200					100			10 det.	

1000
roads/
forestry

GEOMORPHOLOGY DATA NEEDS

Remarks, Purpose of Data, and Indicated Survey Area Priorities

General: Geomorphology data will find diverse uses, somewhat similar to geology, in road and bridge planning and design; groundwater exploitation; identifying sources of construction materials; planning and design of major structures, reservoirs, canals, irrigation systems, and transmission lines; studies of geothermal power sources; and in furnishing information relative to soils and thus to agriculture, forestry, and colonization. It would also furnish data on fishery environment, rainfall runoff coefficients, and the possibilities of swamp and marsh reclamation or of exploitation for crustaceans and shellfish. Preferred areas for initiating surveys vary with the different agencies and are indicated in the following paragraphs.

Carreteras: Geomorphology is needed for the location and design of bridges and roads and for sources of construction materials. It will also permit better identification of existing and potential agricultural production for road planning purposes. Comments also indicate some specific uses for texture and vertical drainage data in determining runoff coefficients for drainage works, and high water table data in foundation design. It was also commented that one-meter contour strip maps are normally prepared for final design. The first preference survey area, as in geology, is the eastern region, particularly two strips between Juigalpa and San Juan del Norte and between Jinotega and Puerto Cabezas which would support consideration of roads to open up the east and connect the two coasts. Additionally, the Central region is of interest.

Servicios Municipales: Geomorphology data would support groundwater exploitation for community water supply. Comments indicate that slope-range classes should be 0-1%, 1-2%, 3-5%, 5-10%, and over 10%. Comments also indicate some specific uses as follows: tidal swamp and marsh as an indication of salt water intrusion; areas of high water table and flooding as an indication of contamination; and areas of impeded vertical drainage and of erosion as an indication of poor recharge. Areas of primary interest are Boaco, San Rafael del Sur, and Ocotal, in that order, although projects are planned throughout the western regions.

ENALUF: Geomorphology data is to be used in the study, site selection, and design of hydropower projects and transmission lines, and for sources of construction materials. As in the case of geology, the first preference survey area is the Central region, particularly the Tuma-Matagalpa-Viejo river complex. The Pacific coast region is also of interest for transmission line projects.

Energia: Geomorphology would support investigations of hydropower projects, including multiple-purpose use in irrigation and flood control. Navigation is also of interest. Erosion data would furnish information on sedimentation problems. The first preference survey area is the North Central region followed by the watersheds of Lake Managua and Nicaragua, as in the case of geology.

Agricultura: Geomorphology data would support agricultural experimentation and extension service activities as well as fisheries and forestry, including soil conservation, drainage, and irrigation. On fisheries, the data would provide information on environment; there is also a particular interest in tidal swamp and marsh areas because of crustaceans and shellfish. The first preference survey area is the Pacific coast followed by the Central region.

IAN: Geomorphology would support colonization and settlement studies. Areas of first preference for survey include Rama, which is, however, being studied under a BID loan, Pena Blanca east of Jinotega, and the Villanueva-Puente Real area of Chinandega, in that order.

Accion Civica: Interest in geomorphology is for siting and designing roads and bridges, including data on sources of construction materials. The Pacific region is the survey area of first priority as in the case of geology.

Urbanismo: Geomorphology interest is to support regional and urban planning, particularly to identify areas of resources uses and limiting factors. The survey area of priority interest is the Pacific coast.

Planificacion: The Projects group is interested in geomorphology to support geothermal power, hydropower, and irrigation studies. The Agropecuaria group would use data for regionalization and agricultural programming. The Projects group would like data developed first for the Telica and Tipitapa areas for geothermal studies, for the Lake Nicaragua watershed for irrigation, and for the Paigua area along the Rio Grande for hydropower. The Agropecuaria group is interested in the Pacific coast, the North Central (Matagalpa-Jinotega) area, the Central (Chontales-Boaco) area, and the Atlantic region, in that order.

Banco Central: This agency has indicated no specific uses or priority areas, but presumably they would be similar to those stated under geology. This would indicate an interest because of the relation to soils and thus to agro-economic studies for diversification and possibly irrigation. Based on their geology replies, their first choice for survey areas would be Carazo and Esteli for agricultural diversification, and Leon and the east and west coasts of Lake Nicaragua for irrigation.

INFONAC: Geomorphology would provide information on the pedology and edafology of soils and allow better utilization of water and land resources.

The areas of first preference for survey are the Pacific coast, the Central region, the Rio Grande de Matagalpa area in Zelaya, and the area around San Carlos, Rio San Juan, and San Miguelito, in that order.

Banco Nacional: Geomorphology data would be useful in evaluating loan requests for agricultural projects. Specific data which could also be provided includes an indication of whether or not swamp or marsh areas could be cultivated once drained, and also, in flood areas, the salinity of flood waters and its effect on potential cultivation. The areas of first preference for survey are the Pacific coast and the Central region.

3.	Item	Caracteras			Serv. Munic.	ENALUF		Ener-	Agricultura*			IAN	Accion Civica	Urban-	Planifi-	Banco	INFONAC	Banco	
		B	E	P	E	E	P	P	A	F	T	P	E	P	P	S	S	T	T
3.1	Atmospheric pressure belts: description of influence of atmospheric pressure belts.		X			X	X			X				X		X	X	X	
3.2	Wind: description and charts of winds and wind patterns for each recording station.	X	X	X	X	X			X	X	X			X		X	X	X	
3.3	Temperature: charts and tables of maximum, minimum, and average per month for each recording station.	X	X	X	X	X			X	X	X	X		X		X	X	X	
3.4	Sunshine: charts and tables of average hours per day and hours per month for each recording station.		X	X	X	X			X	X	X			X		X	X	X	
3.5	Cloud cover: description on a daily basis for each recording station.		X	X					X	X				X		X	X	X	
3.6	Solar radiation: charts and tables of solar radiation for each recording station.				X				X	X	X			X		X	X	X	
3.7	Soil temperature: charts and tables of soil temperature at various depths for each recording station.					X	X		X	X	X			X		X	X	X	
3.8	Relative humidity: charts and tables of maximum, minimum, and average per month for each recording station.	X			X	X		X	X	X	X		X	X		X	X	X	
3.9	Evaporation:																		
	a. Charts, tables, and maps of annual evaporation and evapotranspiration values		X	X	X	X		X	X	X	X			X	X	X	X	X	
	b. Charts, tables, and maps of monthly evaporation and evapotranspiration values.		X	X	X	X		X	X	X	X		X	X	X	X	X	X	
3.10	Rainfall:																		
	a. Charts and tables of average annual rainfall for reporting period for each recording station.	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	
	b. Charts and tables of average monthly rainfall for reporting period for each recording station.	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	
	c. Depth-duration curves based on storm analysis, and tables of rainfall intensities for each recording station.	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	
	d. Charts and tables of maximum, minimum, and average number of days without rainfall each month for each recording station.	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	
	e. Isohyetal map of average annual rainfall. Preferred map scale (1,000's):	250	250	500	500	-	50	500	-	1000	-	250	-	500	250	200	1,000	200	250
	f. Isohyetal map of average monthly rainfall. Preferred map scale (1,000's):	-	250	500	500	-	50	500	-	1000	-	250	-	500	200	1,000	200	250	
	g. Frequency charts of monthly precipitation for reporting period for each recording station.	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	

* In addition, the Direccion General de Agricultura, which is charged with the protection of agriculture, is interested in all climatological data to determine the ecology of plant diseases and thus better determine control methods. Area of primary interest is the Pacific Coast and other important agricultural areas.

CLIMATOLOGY DATA NEEDS

Remarks, Purpose of Data, and Indicated Survey Area Priorities

General: The diversity of climatological data finds a variety of applications in better understanding existing and potential agricultural production for road planning purposes; the study and design of bridges and drainage facilities; the design of oxidation ponds for sewage treatment; the study, site selection, design, and operation of reservoir projects and irrigation systems; and in agricultural, forestry, and colonization programs, including the study of the ecology and control of plant diseases. Specific uses range all the way from studies relative to the introduction of new crops to the application of wind and temperature data in the structural design of bridges and transmission lines. The following paragraphs outline the various agency preferences for areas in which to initiate inventories.

Carreteras: Climatology data will assist in better understanding existing and potential agricultural production for road planning purposes, and in the study and design of bridges and drainage works. Comments also indicate specific uses of wind and temperature data in the structural design of bridges; of charts and tables of average annual rainfall in the design of drainage facilities; of data on days without rainfall in estimating construction weather for scheduling and specifications; and frequency charts of monthly precipitation for deriving rainfall formulas more appropriate for design in Nicaragua. The survey area of first preference, as in the case of geology and geomorphology, is again the eastern region, particularly two strips between Juigalpa and Puerto Cabezas which would support consideration of roads to open up the east and connect the two coasts. The Central region is also of interest as in geology and geomorphology.

Servicio Municipales: Climatology data is needed in the design of oxidation ponds for sewage treatment. Rainfall data would be used in the study and design of local flood control and storm drainage facilities. The area of primary interest at the moment is Managua for storm drainage and secondly Rivas for sewage treatment.

ENALUF: Climatology data needs are to support studies, site selection, design, and operation of hydropower projects. Comments include specific uses such as wind and temperature data for design of transmission lines; sunshine data for estimating electric light usage; soil temperatures for design of underground cables; relative humidity for use in design of combustion machinery; and data on days without rainfall for information relative to reservoir operation and construction weather. Areas of first preference for survey are the Central, North, and Pacific coast regions, particularly the Tuma-Matagalpa-Viejo river complex.

Energia: Climatology data is needed for the investigation of hydropower, irrigation, and flood control projects. The North Central region is the area of first interest for survey purposes, followed by Chinandega, Leon, and the watersheds of Lakes Managua and Nicaragua.

Agricultura: As in the case of geomorphology, climatology data would support general agricultural experimentation and extension service activities, as well as those related to fisheries and forestry. It would also provide data for the study of the ecology and control of plant diseases. The fisheries and forestry group indicated that an isohumidity map would also be useful. The forestry and experimentation groups indicated a first preference for surveys in the Pacific coast, whereas the extension service preferred the North and Atlantic regions. The extension service indicated an additional interest in the Central region and the fisheries and forestry group has an additional interest in the Puerto Cabezas area.

IAN: Climatology needs are for the same reasons as geomorphology and in the same areas, that is, colonization and settlement studies in the area of Rama, Pena Blanca east of Jinotega, and the Villanueva-Puente Real area of Chinandega, in that order.

Accion Civica: This group will use climatology data in the siting and design of bridges and drainage facilities. They have indicated no areas of preference; however, in the cases of geology and geomorphology, the Pacific coast was given as the area of first priority.

Urbanismo: This agency is interested in climatology for general urban and regional planning purposes, and is interested first in areas which are presently under intensive human use.

Planificacion: The projects group is interested in soils temperature to support geothermal power studies, and in rainfall and evapotranspiration for studies in hydropower and irrigation. Their priority survey areas are the same as for geomorphology, that is, the Telica and Tipitapa areas for geothermal studies, the Lake Nicaragua watershed for irrigation, the Paigua area along the Rio Grande for hydropower. The Agropecuaria Group would use the data in agricultural investigations and programming. This latter group has also indicated an interest in inventorying data on dew in the dryer Pacific coast region. This latter group would like the whole country inventoried in this regional order: Pacific, Central, North and Atlantic.

Banco Central: This agency has a general interest in climatology because of its relationship to agriculture and thus to their agro-economic studies. They have indicated no areas of preference for surveys but, based on their geology comments, their first choice would be Carazo and Esteli for agricultural diversification, and Leon and the east and west coasts of Lake Nicaragua for irrigation.

INFONAC: Climatology data will support agricultural programs, particularly the introduction of new crops and the investigation of irrigation projects. It was requested that evaporation be measured by the standard Class A pan, and noted that sunshine data would be used in the Blaney-Criddle formula on evapotranspiration. Wind data would be useful in considering sprinkler irrigation. Areas of first preference for survey are the Pacific coast, Central, and North regions, in that order.

Banco Nacional: As in the case of geomorphology, data on climatology will be used in evaluating loan requests for agricultural projects. The preference for areas to be surveyed first is also the same: the Pacific coast and Central regions.

4.	Item	Carreteras			Serv. Munic.	ENALUF		Ener-gia	Agricultura			IAN	Accion Civica	Urban-ismo	Planifi-cacion		Banco Cent'l	INFONAC	Banco Nac'l
		B	E	P	E	E	F	P	A	F	T	P	E	P	P	S	S	T	T
4.1	Maps and tables of existing wells and surface springs with location, description, depth to water surface at end of dry and rainy seasons, yield, drawdown, description of materials perforated, and any contact with bedrock. Preferred map scale (1,000's):	-	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.2	The schematic presentation, on map bases, of estimated annual volumes of water infiltration by major catchments or regions. Preferred map scale (1,000's):	-	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.3	The schematic presentation, on map bases, of estimated groundwater potential in terms of depth to phreatic surface, surface water contours, recharge pattern, and volumes of flow, by major catchments or regions. Preferred map scale (1,000's):	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.4	Seismic subsurface continuous profiles in selected locations for localization of anomalous conditions indicating groundwater potential. Preferred locations:	-	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.5	Electrical resistivity tests by traverse methods, using both potential drop ratio and standard potential difference with the 4-point electrode system, completed concurrently with seismic profiling where required for further definition of subsurface conditions.	-	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.6	Sonic and electrical logs of deep drillholes, in selected locations, showing electrical and spontaneous potential of strata or material drilled in order to select and identify horizons and specific locations within each hole for further development and maximum groundwater yield. Preferred locations and depth:	-	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.7	Tables and charts of water quality analysis. Desired properties:	-	-	(6)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

- (1) Carazo; 200' below water table (1000' ± holes)
- (2) Tuma - Matagalpa - Viejo; 100'
- (3) Leon, Chinandega, Managua; 600' ±
- (4) Telica, Tipitapa; 2000'
- (5) Granada, Sebaco, Esteli, Jalapa, Managua, Nagarote, La Paz Centro
- (6) Irrigation qualities

- (7) Total solids, pH, hardness, CO₂, physical analysis, N, Cl, Fe
- (8) pH, minerals
- (9) pH, hardness
- (10) Salinity (irrigation)
- (11) Agricultural, industrial, and potable qualities
- (12) Salinity

- (13) Potable and industrial qualities
- (14) Silicates and calcites; temperature
- (15) Solids and salinity
- (16) Irrigation qualities
- (17) Irrigation qualities
- (18) Irrigation and potable qualities

GROUNDWATER HYDROLOGY DATA NEEDS

Remarks, Purpose of Data, and Indicated Survey Area Priorities

General: The various uses for groundwater data include the design of foundations for roadbeds and structures; the exploitation of groundwater, particularly for community water supply and irrigation; the study of drainage projects; the study of geothermal power sources; the study of water balance in reservoir project studies; and forestry activities because of the the relationship between water table and certain tree species. Priority areas for initiating surveys vary with the different agencies and are outlined in the following paragraphs. However, based on exploitation potential, the priority areas would seem to be Boaco, Rivas, San Rafael del Sur, and Ocotal for community water supply, and the better agricultural lands in dry regions for irrigation purposes, particularly the Chinandega-Leon-La Paz Centro area and the Managua-Masaya-Granada area.

Carreteras: Interest in groundwater is limited to a groundwater map which would provide information useful in the design of foundations and roadbeds, and otherwise permit a better identification of irrigable areas to support road planning studies. In this latter case, data on water quality is also desired. The Planning Section was the only one to indicate areas of first preference for the survey; these were the Central and Northwest regions.

Servicios Municipales: Groundwater data, including information on artesian aquifers, would be very valuable in the exploitation of groundwater for community water supply. First preferences for survey areas are Boaco, Rivas, San Rafael del Sur, and Ocotal, in that order.

ENALUF: Groundwater data would be used in the design of foundations, the furnishing of groundwater for cooling purposes in generating equipment, and in considering well pump electrical services. The area preferred for initial survey; is the Pacific coast followed by the Central region.

Energia: Interest in groundwater data is indirect to furnish information relative to water balance for surface water multiple purpose development studies. The area of first choice for initiating the survey is the North Central region and the second choice is the watersheds of Lakes Managua and Nicaragua.

Agricultura: Groundwater data would support agricultural experimentation and extension service activities. In addition the forestry group is interested because there is a relation between water table and certain tree species. The experimental group is interested in initiating surveys first in the Pacific coast whereas the extension and renewable resources groups would prefer the North Central region followed by the North region. The

renewable resources group would then like the South Central region inventoried.

IAN: This agency's interest is indirect for irrigation and drainage which would actually be accomplished through INFONAC. Their area of first choice for survey is the Pacific coast.

Accion Civica: Groundwater data would be used for well drilling projects and to furnish information in the design of roadbeds. There are no areas of preference for initiating surveys.

Urbanismo: Groundwater interest is to support general regional and urban planning functions. This agency would prefer to have the Pacific coast surveyed first.

Planificacion: The Projects group is interested in groundwater data to support geothermal power studies. In this regard, water temperatures would also be useful. The Agropecuaria group's interest is related to irrigation uses. For initial surveys the Projects group is interested in the Telica and Tipitapa areas whereas the other unit is interested in the Pacific coast.

Banco Central: This agency has a general interest in groundwater because of irrigation possibilities but has no specific priority areas for initiating surveys.

INFONAC: Groundwater data would be used in well projects for irrigation uses. Areas of first preference for initiating surveys are Nagarote, La Paz Centro, Esteli, and Sebaco.

Banco Nacional: Groundwater data would be useful in evaluating loan requests for wells for domestic and irrigation uses. Areas of primary interest for initiating surveys are in the dry region, more specifically Chinandega, Leon, and Managua, in that order, but also Rivas, Masaya, and Carazo.

Item	Carreteras			Serv. Munic.	ENALUF		Ener-gia	Agricoltura			IAN	Accion Civica	Urban-ismo	Planifi-cation		Banco Cent'l	INFORAC	Banco Mac'l	
	B	E	P	E	E	P	P	A	F	T	P	E	P	P	S	S	T	T	
5. SURFACE WATER HYDROLOGY																			
5.1 Map delineating all major and intermediate watersheds. Preferred minimum size of watershed (Sq.Kms.): Preferred map scale (1,000's):	-	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.2 The location and arrangement of water control, utilization, and regulation structures.	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.3 The location of all major and intermediate irrigational distributaries and their classification as to type and volume.		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.4 The location of all stream gauging stations and evaporation stations.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.5 Surface runoff:																			
a. Charts, tables, and schematic presentation on map bases of estimated annual volumes of surface runoff of all major and intermediate watersheds.	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
b. Charts, tables, and schematic presentation on map bases of estimated monthly volumes of surface runoff of all major and intermediate watersheds.		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
c. Charts and tables of measured or estimated maximum and minimum annual flows of all major and intermediate streams.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.6 Tables and charts of sediment determination of representative major and intermediate streams for low, normal, and high water conditions.				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.7 Tables and charts of water quality analysis. Desired properties:	X	X	X	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
5.8 Typical one-year daily hydrographs of representative major and intermediate streams.		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.9 Unit hydrographs of representative major and intermediate streams for typical low, normal, and high runoff conditions.	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.10 Duration curves of monthly streamflows of all major and intermediate streams.		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5.11 Description of streamflow characteristics of all major and intermediate streams.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

(1) Total solids, turbidity, bacteria near towns, dissolved oxygen.
(2) Irrigation quality and effect on equipment.
(3) Hardness.

(4) Irrigation quality.
(5) Salinity.

(6) Potable and industrial qualities.
(7) Irrigation quality.

SURFACE WATER HYDROLOGY DATA NEEDS

Remarks, Purpose of Data, and Indicated Survey Area Priorities

General: Data on surface water is paramount for water and related land resources development as well as in the design of control and drainage works and bridges. The various data uses include the planning and design of road, bridge, and drainage facilities; and surface water projects for hydropower, water supply, irrigation, flood control, and navigation, including the transportation of timber. The areas of primary interest vary with the different agencies and are listed in the subsequent paragraphs. However, based on the important needs for hydropower and on the development possibilities, the Central region, particularly the North Central, becomes a priority region for surface water inventory. The Central region, along with the northerly watersheds of Lake Nicaragua may also have a surface water irrigation potential.

Carreteras: Surface water data will be utilized in the location and design of bridges, drainage structures, and roads. The area of primary interest for initiating the surface water survey is again the eastern region, particularly two strips between Juigalpa and San Juan del Norte and between Jinotega and Puerto Cabezas which would support consideration of roads to open up the east and connect the two coasts. The Central region is also of early interest.

Servicios Municipales: Surface water data would be used in developing community water supply where groundwater sources are not feasible, and would also be used in flood control work. Data on maximum floods and minimum dry season flows was also requested. Areas of primary interest for initiating surveys were listed as Nueva Segovia, Madrid and Boaco, in that order.

ENALUF: Surface water data would be used in hydropower and multiple purpose reservoir studies and design. Comments include specific uses such as information on existing irrigation works to assist in determining water rights; sedimentation data for use in reservoir design; and water quality to determine the effect on equipment and also its relationship to irrigation and thus to market studies. The area of preference for initiating surveys remains the Central region, particularly the Tuma-Matagalpa-Viejo river complex.

Energia: Here again, surface water data would support hydropower and multiple purpose reservoir investigations, and also navigation studies. It would also be useful in water balance studies. Water quality data would be of value in irrigation studies. The area of primary interest for initiating surveys is the North Central region followed by the watersheds of Lakes Managua and Nicaragua.

Agricultura: The agricultural experimentation and extension service groups have an interest in surface water because of its general relationship to soil conservation and agricultural activity. The renewable resources group has a more direct interest in this data because of its value in transporting timber by water, in the planning of forest roads, and in fisheries development. Data on irrigation and other water structures would also be of use in fire-fighting. The experimental division would prefer to see the survey initiated in the Managua, Leon, and Chinandega areas; the renewable resources group would prefer the Central region followed by the Pacific coast; and the extension service would prefer the North Central areas of Matagalpa, Jinotega, and Esteli followed by Granada, Masaya, and Carazo.

IAN: This agency's interest continues to be colonization and settlement. Surface water data would be used for drainage and irrigation work but this would actually be undertaken by INFONAC. The area of primary interest for initiating surveys is the Pacific coast.

Accion Civica: Surface water data will be utilized in the location of bridges, drainage structures, and roads. No priority areas were indicated for initiating surveys.

Urbanismo: Interest in surface water data is for general regional planning purposes. The area of priority interest for initiating surveys is the Pacific slopes and adjacent occupied areas.

Planificacion: The Projects group is interested in surface water data for general hydropower and irrigation studies. It has no areas of preference for initiating surveys. The Agropecuaria group is also interested in this data for irrigation possibilities. It's area of first preference for surveys is the Pacific coast, followed by the Central, North, and Atlantic regions, in that order.

Banco Central: This agency has an interest in this subject but has indicated no specific uses or areas of priority. Presumably the use would be irrigation possibilities.

INFONAC: Surface water data would be used in irrigation and drainage projects. The survey area of first preference is the Pacific coast.

Banco Nacional: This agency is interested in surface water hydrology for use in evaluating agricultural loan requests for irrigation. They are interested in surveying the northerly watersheds of Lakes Managua and Nicaragua first, followed by the Pacific coast region.

6.	Item	Carreteras			Serv. Munic.	ENALUF		Ener-gia	Agricultura			IAN	Accion Civica	Urban-ismo	Planifi-cacion		Banco Cent'l	INFONAC	Banco Nac'l
		B	E	P	E	E	P	P	A	F	T	P	E	P	P	S	S	T	T
6.1	Small scale map of ecological zones. Preferred map scale (1,000's):	-	X	X	-	X	X	X	X	X	X	X	X	-	X	X	X	X	X
		250	500		100	50	500	-	100	-	250	-	500	-	400	500	250	100	
6.2	Maps of present land use showing various categories of cultivated, grazing, and forest lands. Preferred map scale (1,000's):	X	X	X	-	X	X	-	X	X	X	X	X	X	X	X	X	X	X
		50	250	100		10	50		-	20	-	50	-	100	250	20	500	250	20
6.3	Maps of potential land use showing lands that can be more intensively used for cultivation, grazing, and forestry. Preferred map scale (1,000's):	X	X	X	-	X	X	-	X	X	X	X	X	X	X	X	X	X	X
		50	250	100		10	100		-	20	-	50	-	100	250	20	500	100/200	20
6.4	Small scale map of agricultural zones. Preferred map scale (1,000's):	-	X	X	-	X	-	-	X	X	X	X	X	X	X	X	X	X	X
		250	500		50	-	-	-	1,000	-	100	-	100	250	400	500	500	500	500
6.5	Small scale map of periods of vegetation growth for different zones, and zone graphs for potential crops. Preferred map scale (1,000's):	-	-	X	-	X	-	-	X	X	X	X	X	-	X	X	X	X	X
				500		50	-	-	1,000	-	100	-	-	-	400	500	-	500	

ECOLOGY AND LAND USE DATA NEEDS

Remarks, Purpose of Data, and Indicated Survey Area Priorities

General: Ecology and land use data will find general use in siting roads, including general road planning in relation to existing and potential agricultural production; power market studies; planning for rural electrification and transmission lines; reservoir studies; and agricultural and forestry programs. Geographic priorities for surveys are variable, as shown in the following paragraphs, but appear to be concentrated in the Central and Pacific coast regions.

Carreteras: Interest in ecology and land use data is for site selection for roads, including a knowledge of existing and potential agricultural production for general road planning studies. The data will also be useful in establishing present and future runoff coefficients for drainage structure design. For planning studies, the area of primary interest for initiating surveys is the Central and North regions; for design it remains the Central and Eastern regions, particularly two strips to connect with Puerto Cabezas and San Juan del Norte on the Atlantic.

Servicios Municipales: This agency has no interest in ecology and land use data.

ENALUF: Ecology and land use data would be used in power market studies and studies for rural electrification, transmission lines, and reservoirs. It would also be used in determining runoff coefficients. First preference survey areas are the Pacific coast, the Northwest, and the Central regions.

Energia: Data will be used in climate and hydrology studies and reservoir investigations. Preferred areas for initiating surveys are the watersheds of Lakes Managua and Nicaragua.

Agricultura: The experimentation and extension service groups are interested in general agricultural activities whereas the forestry unit would use the data in forestry studies followed by the development of more adequate forestry laws and more intensive inventories. The experimental division has expressed an interest in non-exploited areas whereas the extension service would like to see the surveys initiated in the Pacific coast, Central, and North regions, in that order. The forestry unit is interested first in Matagalpa, Jinotega, Esteli, Nueva Segovia, Boaco, and Chontales.

IAN: Interest continues to be natural resources exploitation studies for colonization and settlement purposes. No area of priority was indicated for initiating ecology and land use inventories.

Accior Civica: The data is to be used in determining road locations. No priority areas were indicated for initial inventories.

Urbanismo: The data is to be used for general regional planning. The area of first preference for initiating the inventory is the developed regions of the western zones.

Planificacion: The Projects group will use this data only for general reference and has no priority areas where they would prefer the surveys to be started. The Agropecuaria group is interested in the data for studies of better land use and for agricultural programming. Their preferences for survey priorities are the Pacific coast, Central, North, and Atlantic regions, in that order.

Banco Central: This agency has only a general interest in this data for evaluation of land use and for future agricultural programs. No areas of priority were indicated.

INFONAC: The data will assist in determining better land use programs including the introduction of new crops. The areas of preference for initial surveys are the Pacific coast and the Central regions.

Banco Nacional: Here again, the data will be used in evaluating loan requests for agricultural purposes. The area of primary interest is the Pacific coast and the Central regions.

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Item	Carreteras			Serv. Munic.	ENALUF		Ener-gia	Agricultura			IAN	Accion Civica	Urban-ismo	Planifi-cacion	Banco Cent'l	INFONAC	Banco Nac'l	
	<u>B</u>	<u>E</u>	<u>P</u>	<u>E</u>	<u>E</u>	<u>P</u>	<u>P</u>	<u>A</u>	<u>F</u>	<u>T</u>	<u>P</u>	<u>E</u>	<u>P</u>	<u>P</u>	<u>S</u>	<u>S</u>	<u>T</u>	<u>T</u>
7.1 Soil maps showing:																		
a. Geological origin and type of land form or rock mass on which the solum has formed. (From the geomorphology maps).								X	X	X	X			X	X	X	X	
b. General dominant textural categories which characterize the parent material and agriculturally significant layers of solum. (From the geomorphology maps).	X	X						X	X	X	X	X	X	X	X	X	X	X
c. The pedological classifications and estimate of profile maturities within the classifications.								X	X	X	X			X	X	X	X	
d. The estimated pH ranges of the agriculturally significant layers of the solum.		X			X			X	X	X	X		X	X	X	X	X	X
e. The estimated general salinity conditions of the solum or portions of the solum.		X			X			X	X	X	X		X	X	X	X	X	X
f. The estimated degree of internal drainability.	X	X	X					X	X	X	X	X	X	X	X	X	X	X
g. The soil series and/or soil association names.						X		X	X	X	X	X	X	X	X	X	X	X
h. The soil catena (soil series occurring together in regular or predictable patterns) names in lieu of soil series and/or soil association names.								X	X		X	X	X	X			X	X
Preferred soil map scale for all above (1,000's):	-	-	100	-	50	-	-	-	20	5	10/20	10	100	Small	10	50/100	100	20
7.2 Land capability class and subclass map to identify capability classes and subclasses and deficiencies or limiting factors in soils, topography, drainage, soil texture, and drainability.	X	X			X	X		X	X	X	X		X	X	X	X	X	X
Preferred capability classification system:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	SCS (USDA)
7.3 An interpretation table showing significant chemical and physical factors which influence the use of the soil for cultivation, grazing, forestry, roadbeds, farm ponds, erosion control works, irrigation, small building foundations, septic fields, utility lines and pipelines, and other uses.	X	X			X			X	X	X	X	X	X	X	X	X	X	X
7.4 Map of problem areas based on soils problems.		X			X			X	X	X	X		X	X	X	X	X	X
7.5 Desired laboratory analyses	-	-	-	-	-	-	-	(1)	(2)	(3)	-	-	-	-	-	-	(4)	(5)

(1) pH (with H₂O and KCl), % C in dry soil, % moisture in dry soil, Ca, Mg, K, Na, S, Ti, EC, % N, C/N (ammonium salts). Mechanical analysis, identification of clays, and usable P and K (with North Carolina solution).
 (2) Organic content, N-P-K content, capillary height of water table, and base-mineral index.
 (3) Physical and chemical analysis; the latter in relation to N-P-K content. Exchange capacity.
 (4) Chemical analysis for cation exchange, total N, exchange capacity, organic content, N/C relation, and pH.
 (5) Analysis of cation exchange to include: depth, pH, Ca, Mg, K, Na, Mn. Mechanical analysis to include: depth, % sand, % silt, % clay, and texture. Chemical analysis to include: depth, % moisture that can be removed at 100° - 105° C, organic content, % total carbon, % nitrogen, and C/N relation.

AGRICULTURAL SOILS DATA NEEDS

Remarks, Purpose of Data, and Indicated Survey Area Priorities

General: Agricultural soils data is of course valuable in all kinds of agricultural and forestry programs. However, it is also of value in determining existing and potential agricultural production for road planning purposes; in providing fringe data for roadbed design and in planning forest roads; in power market studies and rural electrification design; in colonization programming; and in the irrigation aspects of water resources development. It is noted that only INFONAC responded to the question relative to the preferred capability classification system; however, others deemed it essential that the system adopted show a dual capability classification covering both labor-intensive agriculture and mechanized agriculture. The indicated priority areas for initiating surveys vary with the different agencies, as discussed in the following paragraphs, but the Pacific coast predominates, followed by the Central region.

Carreteras: This agency has incidental interest in agricultural soils to provide fringe data in roadbed design and in determining existing and potential agricultural production for road planning studies. The area of interest remains the east, particularly in regards to two possible penetration roads to San Juan del Norte and Puerto Cabezas, and the Central region.

Servicios Municipales: This agency has no interest in agricultural soils.

ENALUF: Interest in agricultural soils is limited to use in power market studies and rural electrification design. The area of first preference for initiating soil surveys is the Pacific coast followed by the Northwest and Central regions.

Energia: This agency has indicated no interest in this subject.

Agricultura: Soils data would support agricultural experimentation and extension service activities, including better and more intensive land use. Additionally, the data would be used by the forestry unit in forestry land classification and development, including planning forest roads. This latter unit would also like to have a special land capability map for forestry, which would include an indication of nutrients available to trees and a description of the humus. A map of problem areas, based on soils and specifically developed for forestry, is also desirable. The preferred area for initiating surveys is the Pacific coast for both the experimental and extension groups. The forestry unit's preference is the North and Central regions, which is the second preference of the extension service.

IAN: Soils data would support resources exploitation through colonization and settlement studies and projects. No area of preference was indicated for initiating surveys.

Accion Civica: Data is of limited interest for its fringe value in road-bed design. The priority area is the Pacific coast.

Urbanismo: Soils data would be used in general studies for regional planning, expansion of urban areas, and identification of new areas. The Pacific coast is the preferred area for initiating surveys.

Planificacion: For the Projects group, soils data would be of limited value for general reference; no priority areas were indicated for initiating surveys. For the Agropecuaria group, the data would support agricultural programs for a better distribution of crops and land use. Their survey area preferences are the Pacific, Central, North, and Atlantic regions, in that order.

Banco Central: This agency has indicated no specific uses or priority survey areas. As indicated elsewhere, they are presumably interested in agro-economic studies with particular interest in Carazo and Esteli for agricultural diversification, and Leon and the east and west coasts of Lake Nicaragua for irrigation.

INFONAC: Soils data would indicate possibilities of increased cultivation. Their areas of preference for initiating surveys are Leon, Chinandega, Corazo, the Central region, Jalapa, the Rio Grande area of Zelaya, and the Rio San Juan area, in that order.

Banco Nacional: Data will be used in evaluating loan requests for agricultural projects. Primary interest for initial surveys is in the Pacific coast and Central regions.

8.	Item LAND CADASTER	<u>Carreteras</u>			<u>Serv.</u>	<u>ENALUF</u>		<u>Ener-</u>	<u>Agricultura</u>			<u>IAH</u>	<u>Accion</u>	<u>Urban-</u>	<u>Planifi-</u>		<u>Banco</u>	<u>INFONAC</u>	<u>Banco</u>
		<u>B</u>	<u>E</u>	<u>P</u>	<u>Munic.</u>	<u>E</u>	<u>P</u>	<u>gia</u>	<u>A</u>	<u>F</u>	<u>T</u>	<u>P</u>	<u>Civica</u>	<u>ismo</u>	<u>P</u>	<u>S</u>	<u>S</u>	<u>T</u>	<u>Nac'l</u>
8.1	Cadastral maps, prepared from aerial photographs and field checks, showing property lines and area measurements of individual properties. Preferred map scale (1,000's):	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		-	10	50	-	10	50	-	-	10	5	10/20	10	25 rural 1 urban	-	10	-	5/10	10
8.2	Land tenure data showing owner and registry reference of registered private lands, occupant of unregistered lands, national lands, and other.	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8.3	Land valuation based on an appraisal system which considers earnings potential, location or economic use, and home use.	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

LAND CADASTER DATA NEEDS

Remarks, Purpose of Data, and Indicated Survey Area Priorities

General: In addition to its primary purpose of land taxation, cadastral data is of value in many other activities, particularly land acquisition and rights-of-way for various public projects. Other uses include land tenure studies relative to agricultural production; establishment of water supply rates based on land values; estimating land costs in economic studies of projects; determining road alignments; and determining the value of properties used as security for bank loans. The inventory priorities listed by the different agencies are naturally variable, as shown below, but are concentrated in the more highly developed western regions.

Carreteras: Cadastral data will be used for land acquisition activities and for land tenure studies relative to production of minifundia and latifundia. The preferred areas for initiating surveys are in the Central and Northwestern regions.

Servicios Municipales: Interest is only in urban and built-up areas for the purpose of estimating water revenues and developing water rates based on land values. The areas preferred for initiating the cadaster are Granada, Leon, Chinandega, and Masaya.

ENALUF: Cadastral data is needed for land acquisition and right-of-way activities for transmission and distribution lines and reservoirs, and for power sales and promotion activities. The priority survey area is the Pacific coast.

Energia: Cadastral data is needed for estimating land costs in economic analyses made as part of water resources project studies. The North Central region is the area for which the data is desired first, followed by the watersheds of Lakes Managua and Nicaragua.

Agricultura: Cadastral data would be used in general orientation and programming of agricultural activities and in forestry exploitation and reforestation work, including economic studies and forest road planning and construction. For the extension service, the areas preferred for initiating inventories are the Pacific coast followed by the Central and North regions. The forestry unit is interested first in the Central and North regions. The experimental division indicated no priority areas for this type of data.

IAN: This agency would use this data for land acquisition activities relative to their colonization projects. Their first choice for initial cadaster areas is all of the Pacific slopes.

Accion Civica: Cadastral data would be used in determining road alignments and in land acquisition activities. No priority areas were indicated.

Urbanismo: Data would be used in general urban and regional planning. The Pacific coast is their preferred area for initiating the cadaster.

Planificacion: The Project group indicated no specific uses or priority areas. The Agropecuaria group would use the data in general agricultural planning work. Their preferences for an inventory schedule are the Pacific coast followed by the North, Central, and Atlantic regions.

Banco Central: This agency has indicated a need for this data but did not indicate any specific purpose or priority areas. Presumably the data would be used in agro-economic studies.

INFONAC: Cadastral data would be used in determining the values of properties used as loan security. The Pacific coast is their first choice for initial survey.

Banco Nacional: As in INFONAC above, this agency would also use this data in determining values of properties for loan security. Their first choice for initial survey is the Pacific coast followed by the Central region.

D. PART II OF QUESTIONNAIRE (BASE MAPS)

D.1 General

This section presents a compilation of Part II of the questionnaire dealing with the preferences of the various functional units for the different types of map bases for the various natural resources data. The choices which they were given included (a) planimetric maps in one or two colors; (b) photomaps, with or without traced planimetry, in one or two colors; and (c) existing topographic maps, with or without the contours, in one, two, or multiple colors. Without its contours the topographic map actually becomes a first class planimetric map. The comments made on the questionnaires and during the interviews lend themselves to four general observations or conclusions as follows:

(1) There was a tendency to consider map reproduction costs and thus the answers given in the questionnaire occasionally indicate minimum choices rather than preferences. This could mean, for example, that traced planimetry would be desired on photomap bases where none was indicated, or that greater use of color would be desirable where it would be of graphical value.

(2) As in the case of the details and depth of the inventory, as well as its form of presentation, the responding agencies are generally willing to place a high degree of reliance on the capability of the inventory or survey specialists to make the best selection regarding map bases. Here again this is because these specialists will have a better knowledge of the factors involved because of their closeness to the work. However, it assumes again that they will have a good knowledge of the practical uses of the maps and the data thereon.

(3) Topographic map bases are generally a strong choice, partly because there is a familiarity with them but also because of their clarity, the inclusion of contour data, and the ease of comparing different types of maps with each other or with the original topographic maps if all use the same common topographic map base.

(4) The use of photomap bases is viewed with mixed feelings. While conceding that they may be preferable in specific instances because of the qualitative nature of aerial photography, it is felt that this same characteristic makes them generally more difficult to read. Also, the qualitative character of photomaps is based largely on vegetation and land use factors which rapidly become outdated. One major exception is for land cadasters where the photomap was a strong choice, but it was preferred with traced planimetry and it otherwise competed with planimetric maps as a choice.

D.2 Compilation of PART II of Questionnaire

The tabular presentation of PART II of the questionnaire follows on the next eight pages.

COMPILATION OF PART II OF QUESTIONNAIRE
BASE MAP PREFERENCES

1. GEOLOGY

<u>Organization</u>	<u>1st Choice*</u>	<u>2nd Choice*</u>
Carreteras		
Puentes	Topographic/w/M	Photo /w/2
Localizacion y Diseno	Topographic/w/M	Planimetric /2
Planificacion	Topographic/w/M	Planimetric /2
Servicios Municipales		
Planeamiento y Diseno	Planimetric /2	Topographic/0/M
ENALUF		
Ingenieria	Topographic/w/M	Planimetric /2
Desarrollo	Planimetric /2	Photo /w/1
Energia		
Planeamiento	Topographic/w/1	Photo /0/1
Agricultura		
Centro Experimental	--	--
Rec. Naturales Renovables	Topographic/w/M	Planimetric /2
Extension	--	--
IAN		
Desarrollo	--	--
Accion Civica		
Ingenieria	Topographic/w/M	Photo /w/2
Urbanismo		
Planeamiento	Topographic/w/1	Planimetric /1
Planificacion		
Proyectos	Topographic/w/M	Photo /w/1
Programacion Agropecuaria	--	--
Banco Central		
Estudios Economicos	--	--
INFONAC		
Departamento Tecnico	Topographic/w/M	Photo /w/2
Banco Nacional		
Departamento Tecnico	--	--

w : with planimetry (photomap base) 1 : one color
 : with contours (topographic base) 2 : two colors
 0 : without planimetry (photomap base) M : multiple colors
 : without contours (topographic base)

2. GEOMORPHOLOGY

<u>Organization</u>	<u>1st Choice</u>	<u>2nd Choice</u>
Carreteras		
Puentes	Topographic/w/M	Photo /w/2
Localizacion y Diseno	Topographic/w/M	Planimetric /2
Planificacion	Topographic/w/M	Planimetric /2
Servicios Municipales		
Planeamiento y Diseno	Planimetric /2	Topographic/0/M
ENALUF		
Ingenieria	Topographic/w/M	Planimetric /2
Desarrollo	Planimetric /1	Topographic/w/M
Energia		
Planeamiento	Topographic/w/2	Photo /0/2
Agricultura		
Centro Experimental	--	--
Rec. Naturales Renovables	Topographic/w/M	Planimetric /2
Extension	--	--
IAN		
Desarrollo	Topographic/w/2	Photo /w/2
Accion Civica		
Ingenieria	Topographic/w/M	Photo /w/2
Urbanismo		
Planeamiento	Topographic/w/1	Photo /w/1
Planificacion		
Proyectos	Photo /w/2	Planimetric /2
Programacion Agropecuaria	--	--
Banco Central		
Estudios Economicos	--	--
INFONAC		
Departamento Tecnico	Topographic/w/M	Photo /w/2
Banco Nacional		
Departamento Tecnico	--	--

3. GROUNDWATER

<u>Organization</u>	<u>1st Choice</u>	<u>2nd Choice</u>
Carreteras		
Puentes	--	--
Localizacion y Diseno	Planimetric /1	Topographic/0/1
Planificacion	Topographic/0/M	Planimetric /2
Servicios Municipales		
Planeamiento y Diseno	Topographic/w/2	Planimetric /2
ENALUF		
Ingenieria	Planimetric /1	Topographic/w/2
Desarrollo	Planimetric /1	Topographic/w/M
Energia		
Planeamiento	Topographic/0/1	Photo /0/1
Agricultura		
Centro Experimental	--	--
Rec. Naturales Renovables	Topographic/w/2	Planimetric /2
Extension	--	--
IAN		
Desarrollo	Photo /w/1	Topographic/w/1
Accion Civica		
Ingenieria	Topographic/w/2	Photo /w/2
Urbanismo		
Planeamiento	Topographic/w/1	Planimetric /1
Planificacion		
Proyectos	Planimetric /1	Photo /w/1
Programacion Agropecuaria	--	--
Banco Central		
Estudios Economicos	--	--
INFONAC		
Departamento Tecnico	Topographic/w/M	Planimetric /2
Banco Nacional		
Departamento Tecnico	--	--

4. ECOLOGY

<u>Organization</u>	<u>1st Choice</u>	<u>2nd Choice</u>
Carreteras		
Puentes	--	--
Localizacion y Diseno	Topographic/w/M	Planimetric /2
Planificacion	Topographic/w/M	Planimetric /2
Servicios Municipales		
Planeamiento y Diseno	--	--
ENALUF		
Ingenieria	Planimetric /2	Topographic/w/M
Desarrollo	Planimetric /1	Topographic/w/M
Energia		
Planeamiento	Photo /0/1	Topographic/0/1
Agricultura		
Centro Experimental	--	--
Rec. Naturales Renovables	Topographic/w/M	Planimetric /2
Extension	Topographic/w/2	Planimetric /2
IAN		
Desarrollo	Topographic/w/M	Photo /w/2
Accion Civica		
Ingenieria	Topographic/w/M	Photo /w/2
Urbanismo		
Planeamiento	Topographic/w/M	Photo /w/2
Planificacion		
Proyectos	Planimetric /1	Photo /w/1
Programacion Agropecuaria	--	--
Banco Central		
Estudios Economicos	--	--
INFONAC		
Departamento Tecnico	Topographic/w/M	Planimetric /2
Banco Nacional		
Departamento Tecnico	--	--

5. LAND USE

<u>Organization</u>	<u>1st Choice</u>	<u>2nd Choice</u>
Carreteras		
Puentes	--	--
Localizacion y Diseno	Planimetric /2	Photo /w/2
Planificacion	Topographic/w/M	Planimetric /2
Servicios Municipales		
Planeamiento y Diseno	--	--
ENALUF		
Ingenieria	Photo /w/2	Planimetric /2
Desarrollo	Photo /0/1	Planimetric /1
Energia		
Planeamiento	--	--
Agricultura		
Centro Experimental	--	--
Rec. Naturales Renovables	Photo /w/2	Topographic/w/2
Extension	Topographic/w/2	Planimetric /2
IAN		
Desarrollo	Topographic/w/M	Photo /w/2
Accion Civica		
Ingenieria	Topographic/w/2	Photo /w/2
Urbanismo		
Planeamiento	Topographic/w/M	Photo /w/2
Planificacion		
Proyectos	Photo /w/1	Planimetric /1
Programacion Agropecuaria	--	--
Banco Central		
Estudios Economicos	--	--
INFONAC		
Departamento Tecnico	Topographic/w/M	Photo /w/2
Banco Nacional		
Departamento Tecnico	--	--

6. AGRICULTURAL SOILS

<u>Organization</u>	<u>1st Choice</u>	<u>2nd Choice</u>
Carreteras		
Puentes	--	--
Localizacion y Diseno	Photo /w/2	Planimetric /2
Planificacion	Topographic/w/M	Planimetric /2
Servicios Municipales		
Planeamiento y Diseno	--	--
ENALUF		
Ingenieria	Topographic/w/M	Photo /w/2
Desarrollo	--	--
Energia		
Planeamiento	--	--
Agricultura		
Centro Experimental	--	--
Rec. Naturales Renovables	Topographic/w/M	Photo /w/2
Extension	Topographic/w/2	Planimetric /2
IAN		
Desarrollo	Topographic/w/M	Photo /w/2
Accion Civica		
Ingenieria	Topographic/w/M	Photo /w/2
Urbanismo		
Planeamiento	Topographic/w/M	Photo /w/2
Planificacion		
Proyectcs	Photo /w/1	Planimetric /1
Programacion Agropecuaria	--	--
Banco Central		
Estudios Economicos	--	--
INFONAC		
Departamento Tecnico	Topographic/w/M	Planimetric /2
Banco Nacional		
Departamento Tecnico	--	--

7. LAND CAPABILITY

<u>Organization</u>	<u>1st Choice</u>	<u>2nd Choice</u>
Carreteras		
Puentes	--	--
Localizacion y Diseno	Photo /w/2	Planimetric /2
Planificacion	Topographic/w/M	Planimetric /2
Servicios Municipales		
Planeamiento y Diseno	--	--
ENALUF		
Ingenieria	Topographic/w/M	Photo /w/2
Desarrollo	Photo /0/1	Planimetric /1
Energia		
Planeamiento	--	--
Agricultura		
Centro Experimental	--	--
Rec. Naturales Renovables	Topographic/w/M	Photo /w/2
Extension	Topographic/w/2	Planimetric /2
IAN		
Desarrollo	Topographic/w/M	Photo /w/2
Accion Civica		
Ingenieria	Topographic/w/M	Photo /w/2
Urbanismo		
Planeamiento	Topographic/w/M	Photo /w/2
Planificacion		
Proyectos	Photo /w/1	Planimetric /1
Programacion Agropecuaria	--	--
Banco Central		
Estudios Economicos	--	--
INFONAC		
Departamento Tecnico	Topographic/w/M	Planimetric /2
Banco Nacional		
Departamento Tecnico	--	--

8. LAND CADASTER

<u>Organization</u>	<u>1st Choice</u>	<u>2nd Choice</u>
Carreteras		
Puentes	--	--
Localizacion y Diseno	Planimetric /1	Photo /w/1
Planificacion	Topographic/w/2	Planimetric /2
Servicios Municipales		
Planeamiento y Diseno	Photo /0/2	Planimetric /2
ENALUF		
Ingenieria	Photo /w/2	Planimetric /2
Desarrollo	Photo /0/1	Planimetric /1
Energia		
Planeamiento	Planimetric /1	Photo /0/1
Agricultura		
Centro Experimental	--	--
Rec. Naturales Renovables	Photo /w/2	Planimetric /1
Extension	Topographic/w/2	Planimetric /2
IAN		
Desarrollo	Planimetric /1	Photo /w/1
Accion Civica		
Ingenieria	Topographic/w/M	Photo /w/2
Urbanismo		
Planeamiento	Photo /w/1	Planimetric /1
Planificacion		
Proyectos	Photo /w/1	Planimetric /1
Programacion Agropecuaria	--	--
Banco Central		
Estudios Economicos	--	--
INFONAC		
Departamento Tecnico	Topographic/0/1	Planimetric /1
Banco Nacional		
Departamento Tecnico	--	--

E. PART III OF QUESTIONNAIRE (METEOROLOGICAL AND STREAM GAUGING STATIONS)

E.1 General

This section presents a compilation of PART III of the questionnaire dealing with needs for additional meteorological and stream gauging stations in specific locations, indicating also the reason or project for which each station is desired. Precipitation, evaporation, and other stations are also included. The responses were somewhat sketchy, with the notable exception of the Comision Nacional de Energia which also furnished the data on Plate 3.

There appears to be a recognition of the need for more climatological and surface water data but a limited knowledge of the specific numbers and locations of needed stations. Actually it is not surprising that this part of the questionnaire produced generally superficial results. Developing an adequate system of data producing stations on climate and surface water requires considerable analysis by experts in this field and a close coordination with the data users. Nevertheless, this part of the questionnaire has made an initial contribution regarding the needs for additional stations and has also set the respondents to thinking more about locations and types of stations which would best serve their needs.

E.2 Compilation of PART III of Questionnaire

The following pages present a compilation of PART III of the questionnaire on the needs for additional meteorological and stream gauging stations. No effort has been made to determine if any of these would duplicate existing stations, or otherwise if they would be justified.

COMPILATION OF PART III OF QUESTIONNAIRE

ADDITIONAL METEOROLOGICAL AND STREAM GAUGING STATION NEEDS
IN SPECIFIC LOCATIONS

1. METEOROLOGICAL STATIONS

Carreteras: The Seccion de Puentes indicated a need for more meteorological stations in the Central region and the Chinandega area but listed no specific locations. These would furnish data for the planning and design of bridges and drainage facilities. The other sections did not list any needs.

Servicios Municipales: No needs listed.

ENALUF: This agency would like more coverage in the area of the Tuma-Matagalpa-Viejo river complex and in the Rio Coco area to support hydropower studies, but listed no specific locations.

Energia: See Plate 3 for data furnished on existing and proposed meteorological stations. Comments indicate that a station at San Carlos would furnish data on control of the lakes and for waterway studies and that another at Hacienda San Francisco in Carazo would also furnish data for waterway studies.

Agricultura: The Division de Recursos Naturales Renovables indicated that they would like stations at Slilma Sia, Bonanza, Alimicamba, Bluefields, El Recreo, San Juan del Norte, Managua, Dario, Matagalpa, Ocotal, Puerto Morazan, Leon, Diriamba, Puerto Masachapa, and Rivas which are 15 significant locations each representing a typical climate. The Servicio de Extension listed nine locations: Matagalpa, Leon, Ocotal, Jinotega, Jinotepe, Managua, Rivas, Puerto Cabezas, and Chontales. The Centro Experimental did not list any needs.

IAN: No needs listed.

Accion Civica: No needs listed.

Urbanismo: No needs listed.

Planificacion: The Division de Proyectos stated that they had no requirement for additional meteorological stations. There were no needs listed by the Departamento de Programacion Agropecuaria.

Banco Central: The Departamento de Estudios Economicos indicated a desire for general coverage by three to five stations per Department.

INFONAC: No needs listed.

Banco Nacional: No needs listed.

2. PRECIPITATION STATIONS

Carreteras: The Seccion de Puentes indicated a need for more precipitation stations in the Central region and the Chinandega area but listed no specific locations. These are the same general locations for which they indicated a need for more meteorological stations. The data would be used in the planning and design of bridges and drainage facilities. The other sections did not list any needs.

Servicios Municipales: This agency indicated a need for more precipitation stations on the south side of Managua for developing data for storm drainage and local flood control facilities.

ENALUF: This agency would like more precipitation stations in the area of the Tuma-Matagalpa-Viejo river complex and in the Rio Coco area to support hydropower studies, but listed no specific locations. These are the same general locations for which they indicated a need for more meteorological stations.

Energia: This agency would like a precipitation station at San Juan del Norte to furnish data for waterway studies. As a minimum, ten additional stations are needed to obtain an adequate density of data for an analysis of the country's rainfall regimen. These additional locations are at the villages of El Gallo on the Rio Grande de Matagalpa, Yaosca on the Rio Tuma, Garrobo on the Rio Bocay, Caserío Bocay on the Rio Coco, Siska on the Rio Cucalaya, Mocoto on the Rio Tuma, San Dionisio in the Departamento de Matagalpa, La Flor in the Departamento de Zelaya, Los Encuentros in the Departamento de Carazo, and Villa Salvadorita in the Departamento Chinandega. Presumably these precipitation stations would be supplemental to similar equipment installed as part of the additional meteorological stations listed on Plate 3.

Agricultura: No needs listed except that Extension indicated a desire for coverage of the whole country.

IAN: No needs listed.

Accion Civica: No needs listed.

Urbanismo: No needs listed but a desire expressed for better distribution of stations.

Planificacion: The Division de Proyectos stated that they had no re-

quirement for additional precipitation stations. There were no needs listed by the Departamento de Programacion Agropecuaria.

Banco Central: No needs listed.

INFONAC: This agency indicated a need for eleven additional precipitation stations in Nandaime, Granada, Masaya, Tipitapa, Nagarote, La Paz Centro, north of Chinandega, southeast of Chinandega, Esteli, Sebaco, and Jalapa. These would furnish data for studies of small individual irrigation projects.

Banco Nacional: No needs listed.

3. EVAOPRATION STATIONS

Carreteras: No needs listed.

Servicios Municipales: No needs listed.

ENALUF: This agency would like more evaporation stations in the area of the Tuma-Matagalpa-Viejo river complex and the Rio Coco area to support hydropower studies, but listed no specific locations. These are the same general locations for which they indicated a need for more meteorological and precipitation stations.

Energia: This agency expressed a need for an evaporation station at Altigracia on the island of Ometepe to furnish data for hydrological studies of Lake Nicaragua. They also expressed a need to re-equip the station at San Francisco del Carnicero to furnish data for similar studies of Lake Managua.

Agricultura: No needs listed except that Extension indicated a desire for coverage of all the western regions with particular reference to Matagalpa, Chontales, and Alili.

IAN: No needs listed.

Accion Civica: No needs listed.

Urbanismo: No needs listed.

Planificacion: The Division de Proyectos indicated that they had no requirements for additional evaporation stations. There were no needs listed by the Departamento de Programacion Agropecuaria.

Banco Central: No needs listed.

INFONAC: This agency indicated a need for eleven additional evapora-

tion stations in Nandaime, Granada, Masaya, Tipitapa, Nagarote, La Paz Centro, north of Chinandega, southeast of Chinandega, Esteli, Sebaco, and Jalapa. These are the same locations for which they indicated a need for more precipitation stations and, similarly, these stations would furnish data for studies of small individual irrigation projects.

Banco Nacional: No needs listed.

4. STREAM GAUGING STATIONS

Carreteras: No needs listed.

Servicios Municipales: This organization expressed a need for a stream gauging station on the Rio Fonseca upstream from Boaco and another on the Rio Mosonte near Ocotal. Both stations would provide data for community water supply studies.

ENALUF: This organization expressed a need for more stream gauging stations in the Tuma-Matagalpa-Viejo river complex and on the Rio Coco to support hydropower studies, but listed no specific locations.

Energia: See Plate 3 for data furnished on existing and proposed stream gauging stations. Comments indicate that the stations at Pilares on the Rio San Juan and at Rama on the Rio Escondido would furnish data for waterway studies.

Agricultura: No needs listed.

IAN: No needs listed.

Accion Civica: No needs listed.

Urbanismo: No needs listed.

Planificacion: The Projects group stated that they had no requirement for additional stream gauging stations. There were no needs listed by the Agropecuaria group.

Banco Central: No needs listed.

INFONAC: This agency indicated a general need for stream gauging data in Nandaime, Granada, Masaya, Tipitapa, Nagarote, La Paz Centro, north of Chinandega, southeast of Chinandega, Esteli, Sebaco, and Jalapa. No specific streams or locations were indicated. These eleven locations are the same ones for which they indicated a need for more precipitation and evaporation stations, and, similarly, these stations would furnish data for studies of small individual irrigation projects.

Banco Nacional: No needs listed.

5. OTHER STATIONS

INFONAC: This agency is the only one which indicated a need for stations other than those covered in the previous paragraphs. They indicated a general need for more anemometers to furnish wind data for use in considering sprinkler irrigation. No specific locations were listed.

F. PART IV OF QUESTIONNAIRE (TECHNICAL AND PROFESSIONAL STAFF)

F.1 General

This section presents a compilation of PART IV of the questionnaire dealing with needs for additional technical and professional staff, including specialized training for existing personnel. It covers only the staff of the key, or line, units responding to the questionnaire and not the administrative or other supporting units. It should be clearly understood that this represents only a preliminary investigation into this problem area, and is intended to reveal the extent of personnel needs to insure the best use of resources data when it becomes available and more effective planning and development. A deeper study of this subject should be made, particularly in relation to a longer term view and possibly reorganization or expansion. For example, see Section B.2 on three important functional needs in the total resources development activity.

Although of a preliminary nature, the survey reveals the following minimum specified need for additional professional personnel in the functional units contacted:

- 3 photointerpreters
- 2 hydrologists
- 9 civil engineers
- 2 electrical engineers
- 10 foresters
- 8 economists
- 8 agronomists
- 1 soil conservation specialist
- 1 sociologist

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See the compilation for more information on their specialization, use, and distribution, as well as for other needs indicated but not specified. In addition, the compilation identifies twenty present staff professionals who are in need of specialized education or outside on-the-job training. The last part of the compilation on "Other Personnel Needs" lists miscellaneous requirements for new personnel or training of existing personnel in the support category, such as drafting and technical aides. This last part is not comprehensive since needs for subprofessionals and other personnel were not specifically requested.

Apart from a listing of personnel needs, the questionnaires and interviews also reveal the five following points:

(1) Inadequacy of funds is one reason, but not the only reason, for staff shortages.

(2) Where funds are available, particularly in agencies which generate their own, qualified personnel may not be available locally.

(3) It is difficult to spare personnel for specialized training because of thin staffing and the unavailability of replacements.

(4) Existing competent personnel need more experience in their present jobs.

(5) Personnel needs are probably greater than indicated, at least over the long term and for possible new functions.

F.2 Compilation of PART IV of Questionnaire

The following pages present a compilation of additional technical and professional staff needs. As stated above, it represents a preliminary investigation and a deeper study should be made.

COMPILATION OF PART IV OF QUESTIONNAIRE

ADDITIONAL TECHNICAL AND PROFESSIONAL STAFF NEEDS

1. ADDITIONAL PERSONNEL NEEDS

Carreteras:

Puentes: No additional personnel needs.

Localizacion y Diseno:

- a. One photointerpreter.
- b. One hydrologist for assisting in the design of drainage facilities.

Planificacion:

- a. Two more civil/highway engineers will be needed in about three years because this section is new and needs to expand in order to do more intensive planning.
- b. One more conomist will be needed in about three years for the same reason as above.

Servicios Municipales:

Planeamiento y Diseno:

- a. Two civil engineers with experience in groundwater development for community water supply projects.
- b. Two civil engineers with education in sanitary engineering and hydraulics for community water supply and sewage projects.

ENALUF:

Ingenieria:

- a. Two photointerpreters for work in reservoir studies, land acquisition and rights-of-way activities, market studies, and distribution line design.
- b. One civil engineer for design of hydroelectric projects.
- c. One electrical engineer for studies of network, substation coordination, and stability of electrical system operations.
- d. One electrical engineer for production management.

Desarrollo: This Division is only two months old and its functions and staff needs are not yet well established. Electroconsult is presently doing a \$140,000, 12-month prefeasibility hydropower study in the TMV area under a World Bank loan.

Energia:

Planeamiento: One hydrologist to support water development studies.

Agricultura:

Centro Experimental: No needs listed but it was indicated that a major need for new personnel is being studied to support a proposed large expansion in the experimental program.

Recursos Naturales Renovables: Ten foresters for a program of detailed inventories, conservation, reforestation, and public education. It was noted that there are no native foresters in the country.

Extension:

- a. One soil conservation specialist.
- b. One agronomist.
- c. One agricultural economist.
- d. One specialist in extension evaluation.
- e. One farm management specialist.

IAN:

Desarrollo:

- a. Two to four regional planning engineers for the project development program.
- b. Three or four agricultural economists for the project development program.
- c. Two agronomists for the project development program.

Accion Civica:

Ingenieria: No response.

Urbanismo:

Planeamiento:

- a. One economist educated in urban and regional planning.
- b. One agronomist educated in urban and regional planning.
- c. One sociologist.

Planificacion:

Proyectos: No additional personnel needs. However, the staff is presently supported by contract help.

Programacion Agropecuaria:

- a. Two economists.
- b. Two agronomists.

Banco Central:

Estudios Economicos: No additional personnel needs.

INFONAC:

Departamento Tecnico: Expansion of the staff and of agricultural programs in the Departamento Tecnico is desirable but no specific needs were listed.

Banco Nacional:

Departamento Tecnico: No additional personnel needs.

2. SPECIALIZED TRAINING NEEDS

Carreteras:

Puentes:

- a. Ing. Francisco Centeno, BSCE pending thesis, bridge designer. Needs on-the-job training in construction methods with a contractor.
- b. Ing. Roger Araica, BSCE, bridge designer. Needs one year on-the-job training in hydrology with a foreign highway department.

Localización y Diseno: No specialized training needs.

Planificacion: No specialized training needs.

Servicios Municipales:

Planeamiento y Diseno:

- a. Ing. Alejandro Jeres Berrios, BSCE pending thesis, design engineer in groundwater development for community water supply. Needs a three- to six-month course in groundwater.
- b. Ing. Roger Mejia Briceno, BSCE pending thesis, design engineer in groundwater development for community water supply. Needs a three- to six-month course in groundwater.
- c. Ing. Franklin Gavarrete, BSCE, Chief of the Division de Diseno y Planeamiento. Needs a 3-month course in groundwater development and utilization.
- d. Ing. Juan Bosco Ordones, BSCE pending thesis, design engineer. Needs an MS in sanitary engineering.

ENALUF:

Ingenieria:

- a. Ing. Ramiro Medal, BSCE, engineer in network studies and design of substations. Needs one year on-the-job training in the design of power projects with a U.S. engineering firm to

- develop a familiarity with U.S. equipment and methods.
- b. Ing. Reinerio Montiel, BS in electrical and mechanical engineering, engineer in switching and substation coordination studies. Needs one year on-the-job training in switching and substation coordination studies with a U.S. engineering firm or power company.
 - c. Lic. Leon Perez, BS in economics, engaged in feasibility and regional development studies. Needs on-the-job training in economics and feasibility studies.

Desarrollo: This Division is only two months old and its functions and staff needs are not yet well established.

Energia:

Planeamiento: No specialized training needs.

Agricultura:

Centro Experimental: No response.

Recursos Naturales Renovables: No specialized training needs.

Extension: No specialized training needs.

IAN:

Desarrollo:

- a. Ing. Elpido Tijerino, BSCE and MS in soils, Chief of the Seccion de Ingenieria. Needs one year of study in regional planning.
- b. Ing. Agron. Andres Mejia, BS in Agronomy, Chief of the Seccion de Asistencia Tecnica. Needs one year on-the-job training in rural settlements administration in Spain or Israel.
- c. Lic. Juan Rodriguez, BS in Economics, Assistant Program Officer. Needs MS in agricultural economics with a major in project evaluation at a U.S. University such as U. of Wisconsin or U. of Iowa.
- d. Ing. Agron. Alfonso Blandon, BS in Agronomy and MS in Agricultural Economics, Program Officer. Needs to take the 2-month Agricultural Program Evaluation course given in Washington, D. C. by the World Bank.

Accion Civica:

Ingenieria: No response.

Urbanismo:

Planeamiento:

- a. Arquitecto Roberto Sanson, BA in architecture, engaged in city

- planning work. Needs two years of university study in urban and regional planning.
- b. Arquitecto Jose Cuadra, BA in architecture, engaged in city planning work. Needs two years of university study in urban and regional planning.

Planificacion:

Proyectos:

- a. Ing. Roberto Zelaya, BSME, Project Engineer. Needs 3 months study and/or on-the-job training in economic feasibility studies.
- b. Ing. Edgar Pereira, BSCE, Project Engineer. Needs 3 months on-the-job training in economic feasibility studies.
- c. Sr. Roger Angulo, 5th year BSCE student, Assistant Project Engineer. Needs 3 months study and/or on-the-job training in economic feasibility studies.
- d. Sr. Juan Arcia, 5th year student in Economics, Assistant Project Economist. Needs 3 months on-the-job training in economic feasibility studies.

Programacion Agropecuaria: Lic. Francisco Cerda, BS in economics. Needs one year of study in agricultural programming.

Banco Central:

Estudios Economicos: No specialized training needs.

INFONAC:

Departamento Tecnico: This Department indicated that it had six specialists which could benefit from postgraduate study and ten other staff members which could benefit from specialized study, but no specific needs were listed.

Banco Nacional:

Departamento Tecnico: No specialized training needs.

3. OTHER PERSONNEL NEEDS

Carreteras:

Puentes: Two structural draftsmen needed.

Servicios Municipales:

Planeamiento y Diseno: Four drilling rig operators needed for community water supply projects.

ENALUF:

Ingenieria: Sr. Hugo Balmaceda, draftsman, Chief of the Seccion de Dibujo. Needs six months of study and on-the-job training in drafting and as an engineering technician.

Energia:

Planeamiento:

- a. Two estimators needed to support water development studies.
- b. One draftsman needed to support water development studies.

Agricultura:

Recursos Naturales Renovables: Fifty forestry aides needed to support the foresters required for a program of detailed inventories, conservation, reforestation, and public education.

Urbanismo:

- a. Five draftsmen needed.
- b. Sr. Horacio Garcia, accountant in community water supply program. Needs six months training in public administration.
- c. Sr. Juan Benevides, accountant in community water supply program. Needs six months training in public administration.

G. RECOMMENDATIONS

There are four major recommendations that can be made as a result of the survey. They relate to the use and extension of the survey information contained herein in order to develop an effective inventory of natural resources, both in terms of execution and subsequent utilization. These recommendations are as follows:

(1) The large amount of information contained in this report should be carefully reviewed and utilized in preparing the scope of work, specifications, and work plan for the inventory project. The Natural Resources Division of IAGS is prepared to assist in the review and to provide guidance to the group responsible for developing the scope of work and specifications.

(2) A technical assistance committee composed of representatives from the principal user agencies should be organized to advise and coordinate in the preparation of the scope of work, specifications, and work plan, including the determination of survey area priorities. The committee would continue to function during the course of the inventory. It would similarly advise and coordinate in the planning of meteorological and related stations as well as stream gauging stations. The purpose of such a committee would be to insure that the needs and views of the user agencies are well known and clearly coordinated at all times. Their participation would be separate and distinct from that of the inventory organizations.

(3) As the resources data produced by the inventory project becomes available, training sessions should be instituted for the benefit of the personnel of the user agencies. The objective would be to thoroughly explain the data and demonstrate its various uses.

(4) A more intensive study should be made of the technical and professional personnel needs of the user agencies. Such a study would also consider overall organizational functions and possible reorganization, expansion, and the establishment of new functions. The Natural Resources Division of IAGS is prepared to collaborate in the execution of a study of this type.