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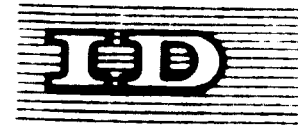
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Generation Units

Kathmandu, Nepal, 10 - 14 September 1979

-4 DEC 1979

PANAMA'S MINI HYDRO ELECTRIC PLANTS PROGRAMME*

by

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1.1.1. Introduction

The Republic of Panama is located in the southern end of Central America. It has an area of 75,517 km² and a population of 1,000,000 inhabitants, of which 50% live in the Metropolitan Area comprising the cities of Panama and Colon. This area is situated at the entrances of the Panama Canal.

Approximately 90% of the Gross National Product of the country is produced in the Metropolitan Area and almost 80% of the industries are located in this area. This is one of the causes of the strong migration of people from the countryside to the urban areas.

Besides, the oil crisis has been hitting the rural areas the most: their energy requirements are met almost entirely by diesel generating plants. This, of course, applies to those towns having diesel plants. Most of these communities are either too small or too far from the existing transmission lines and interconnection is not economical.

The Government, aware of the problems of the rural areas, has been funneling big amounts of resources into the rural areas, but the results have not met the expectations, so far. As part of this policy of reducing the migration and of decreasing the dependence of foreign energy sources, IRHE, the government electrical agency, started in 1977 a programme to install mini-hydro-energy plants in communities not interconnected to the National Power Grid.

1.2. IRHE's electrical system

The generation facilities include three main power plants: a 149.5 MW thermal generating plant and a 100 MW hydro-electric plant located both within 80 km of the Metropolitan Area. Besides, there is a 90 MW hydro-electric plant located about 200 km west of the Metropolitan Area and under construction there is a 200 MW hydro-plant, close to the last one. 230 kv transmission lines transport the power from the generation plants to the load centres.

Approximately 70% of the facilities in the country are connected to the National Power Grid and 30% of the facilities receive energy by means of isolated diesel generating plants.

The national average selling price was US \$ 0.074 per kwh in 1978, whereas the average selling price for the isolated systems was US \$ 0.095 per kwh, or 28% higher than the national average.

2. Mini-hydro plants programme

The figures discussed in the above section will surely help to understand the difficulties and the sacrifices imposed to the people living in the rural areas.

Panama is a tropical country, where precipitations over 2,000 mm a year are not uncommon. There are two markedly different periods in the hydrological year: the dry season, going from January to April and the wet or rainy season, from May to December. This high precipitation figures give an idea of the potential of the hydraulic resources in the country. Also a great percentage of the populated areas are very close to mountainous or hilly areas, where it is fairly easy to develop the head needed for power generations.

Although there is not a specific programme for the installation of mini-hydro plants, the following priorities are given to the development of said plants:

- 1) Communities already served by diesel plants: to date IRHE operates and sells electricity to 32 isolated communities. Transportation of diesel to the communities and maintenance of the plants is a major everyday problem. Of course the biggest of them all is the high cost of oil products.
- 2) Communities without electricity supply: these communities represent the majority of the communities in rural areas. Populations in these villages is either too small or the dispersion of the houses is too big to make economical the supply of power.

The major problems encountered in the development of these areas are:

- 1) Accessibility to the areas: most of them are far from existing roads or there is no regular boat service.
- 2) Potential sites not too close to the villages: normally the best development sites are several kilometers apart from the villages, and the cost of the access and the transmission line can, in some instances, make uneconomical the construction of mini-hydro plants.

4. Rate of return on the plants relatively low: because of the problems associated with position 1 and 2 above the rate of return of these sites (when compared to a diesel plant) is quite often in the 7% to 10% range whereas the average cost of capital for IRHE is estimated as 10%.

These problems are not easy to solve although we consider that some recommendations can be made in order to overcome them, such as:

- 1) Motivate the central government to intensify the construction of access roads in the countryside.
- 2) Give priority in the construction of the mini-hydro plants to the use of locally available materials and labor. In many instances it is recommended to set aside IRHE's standards for transmission lines and Ministry of Public Work's standards for roads, in order to reduce the costs of those facilities.
- 3) Study the possibility of local fabrication of mechanical elements, specially for the smallest units.
- 4) Financing for the construction of these plants shall be by means of low-interest long-term loans, so that revenues from these plants can help repay the debt.

In connexion with the last recommendation IRHE has made contacts with the Interamerican Development Bank (IDB) and the United States Agency for International Development (USAID) and got the following commitments:

- a) IDB will try to arrange a loan to help finance the construction of mini-hydro plants in the next five years.
- b) USAID will provide funds for feasibility studies for the development of micro-hydro plants, defined as plants with less than 50 kw of capacity and with the purpose of supplying power to very small productive groups or farms.

3. Current status

To date IRHE has under construction by its own resources two mini-hydro plants, namely:

- Coclesito: is a community located in the central region of Panama where the government has started a pilot project on agricultural and forestry development. There is an access road in bad condition.

IRHE will instal two - 125 kw Samson units. (fabricated by James Leffel Co.). Works started last February and completion is scheduled for October.

- Santa Fé: a small village, also in the central region of Panama. People work basically in farms. Access is by a road currently in good condition. Two - 175 kw Samson (fabricated by James Leffel + Co.) units will be installed in this village. Civil works started last March and the completion is planned for December.

Currently there are five projects under study:

- Puerto Obaldia: on the Caribbean side, close to the border with Colombia. Access is only possible by sea or air. 70 kw will be installed in this village.
- Coiba: the largest island in Panama, in the Pacific Ocean. Access is only possible by boat or airplane. Plans call for installation of 800 kw of hydro power.
- San Miguel: located in an island, also in the Pacific Ocean with about 1500 inhabitants. Installed capacity will be about 100 kw.
- Jaqué: located in the less populated province of Panama, on the Pacific Ocean. It is planned to install 100 kw.
- Río Sereno: on the mountains, close to the Costa Rican border. Main activity is coffee plantations. Our plans are to install about 800 kw.

Our compromise with IDB is to identify not less than 15 projects for the end of the year.

Summary

Panama's mini-hydro-electric plants programme started recently; to date IRHE does not have any experience with the operation and maintenance of these plants: two mini-hydro plants are currently under construction with expected completion date some time at the end of the year.

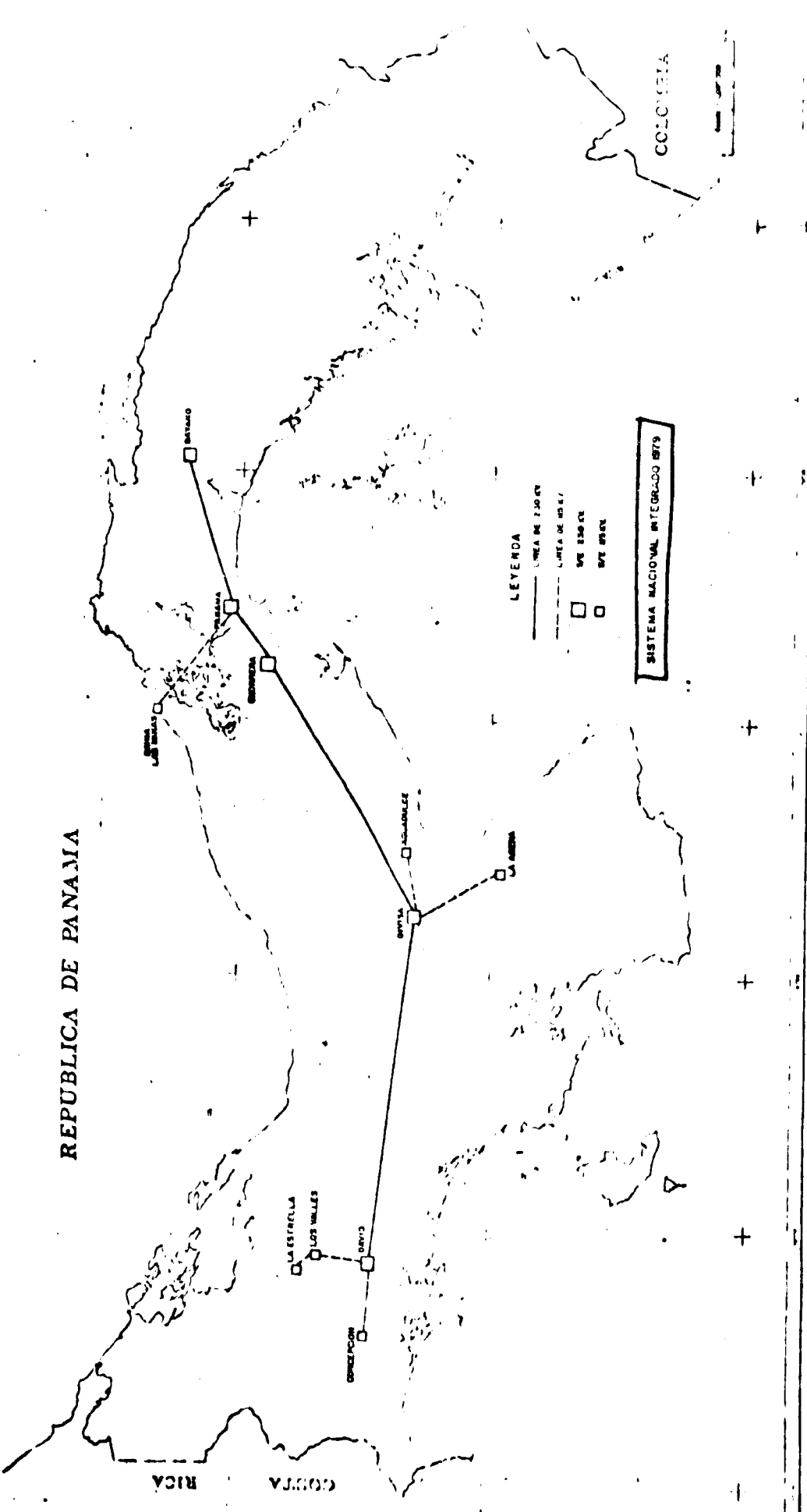
Co-operations in terms of financing and technical assistance has been and will be provided by USAID and IIB. PNUD, through its Central American Energy Programme, will also provide technical assistance.

The task of electrifying all the communities in the country is a complex one: only 50% of the families today are able to use electric energy. Regardless of all the problems that are found and will be found in the development of mini-hydro installations IRHE will continue its programme of supplying all the communities with a safe and reliable electric service with the use of Panama's own energy sources.

REPUBLICA DE PANAMA

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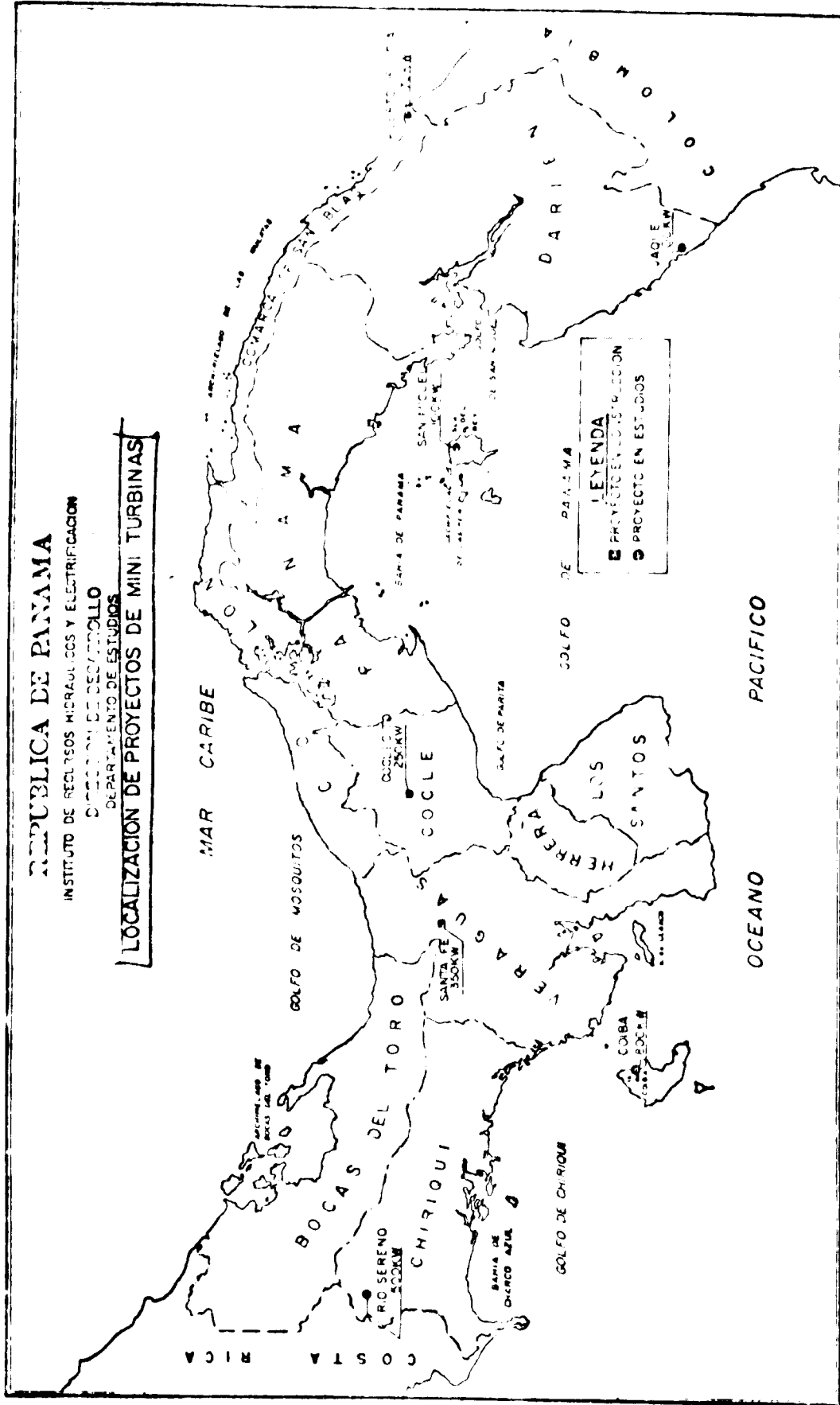
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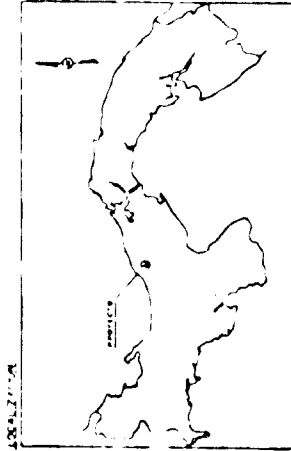
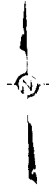


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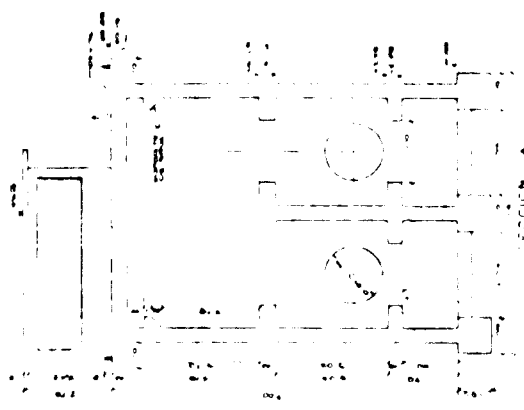
GOGLESITO



ESTADO	CANTON	MUNICIPIO	LOCALIDAD	PROYECTO	FECHA
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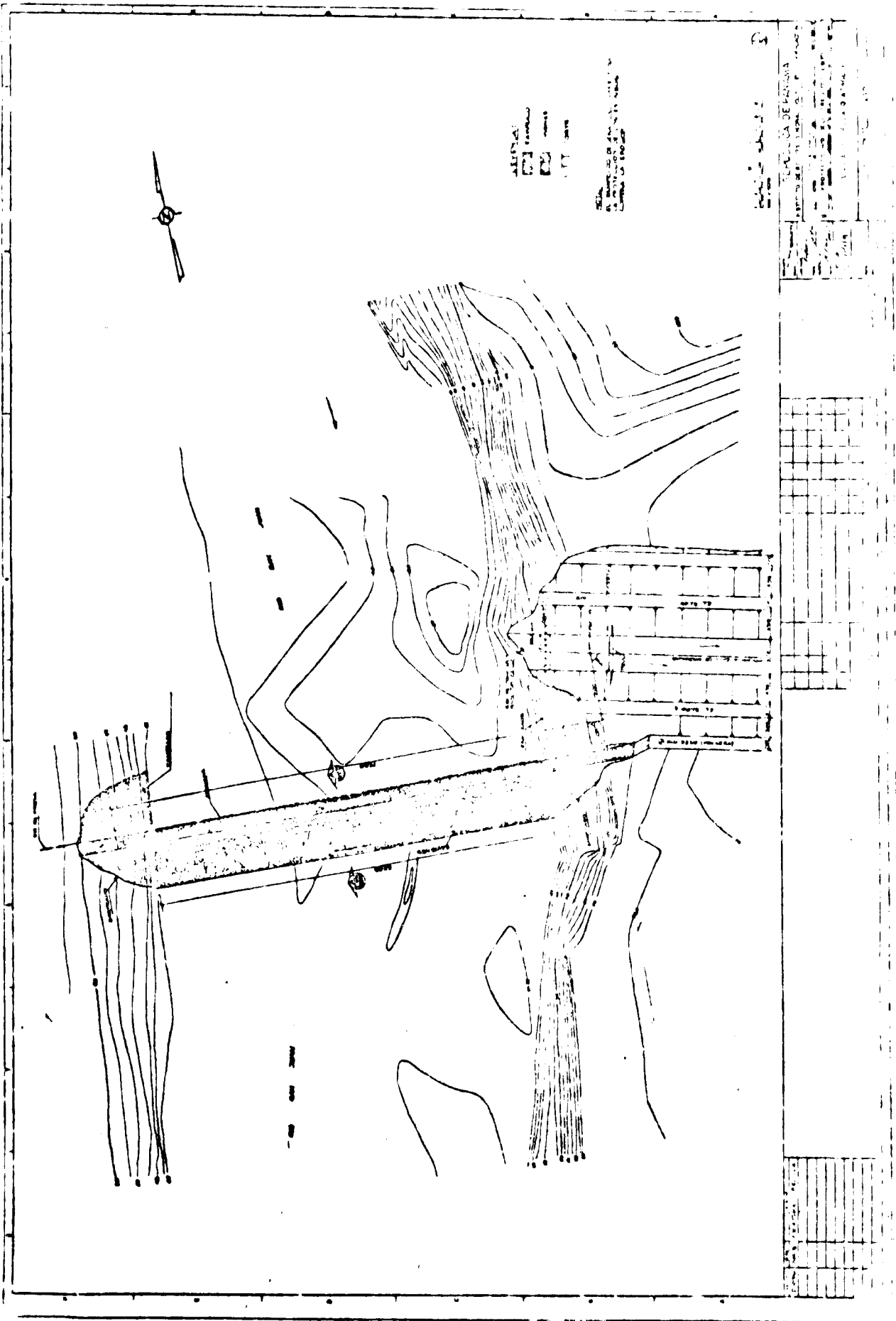
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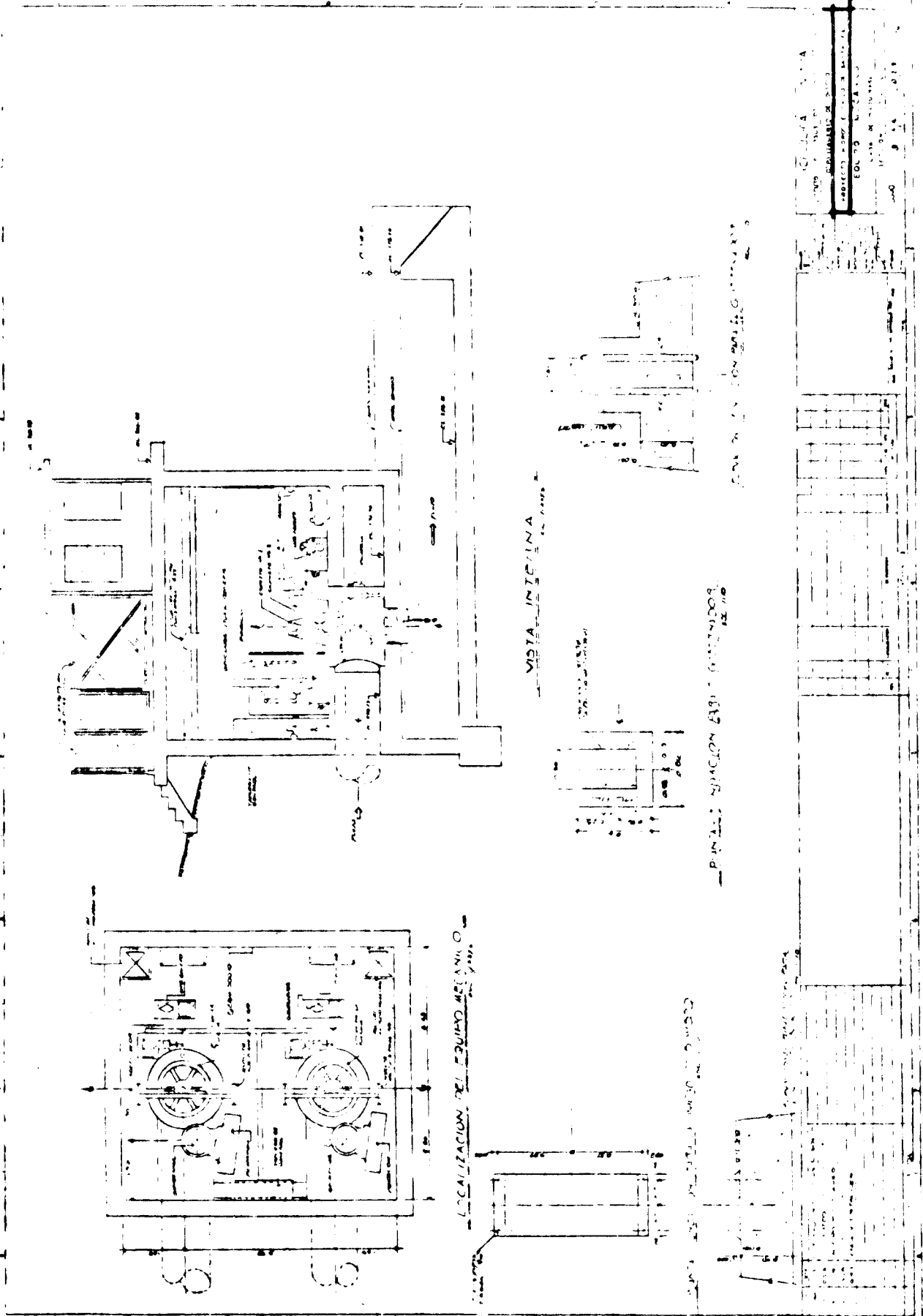
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