社会開発協力部報告書

No. 8

PERU, VENTANILLA DISTRICT

WATER SUPPLY PROJECT
BASIC DESIGN SURVEY REPORT

MARCH 1981

JAPAN INTERNATIONAL COOPERATION AGENCY

PERU, VENTANILLA DISTRICT

WATER SUPPLY PROJECT
BASIC DESIGN SURVEY REPORT

MARCH 1981

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

It is with great pleasure that I present this report entitled "Peru, Ventanilla district, Water Supply Project, Basic Design Study Report" to the Government of Peru.

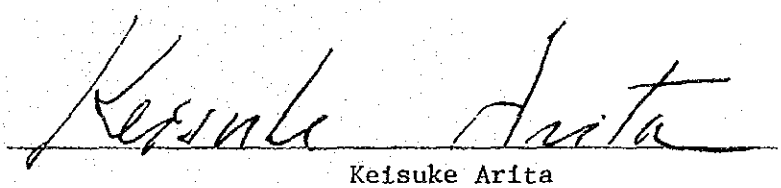
This report embodies the result of a survey which was carried out from September 18 to October 30, 1980 by a Japanese survey team commissioned by the Japan International Cooperation Agency following the request of the Government of Peru to the Government of Japan.

The survey team, headed by Dr. Toshihiko Ogaya, had a series of discussions with the officials concerned of the Government of Peru and conducted an extensive field survey and data analyses.

I sincerely hope that this report will be useful as a basic reference for development of the project.

I wish to express my deep appreciation to the officials concerned of the Government of Peru for their close cooperation extended to the Japanese team.

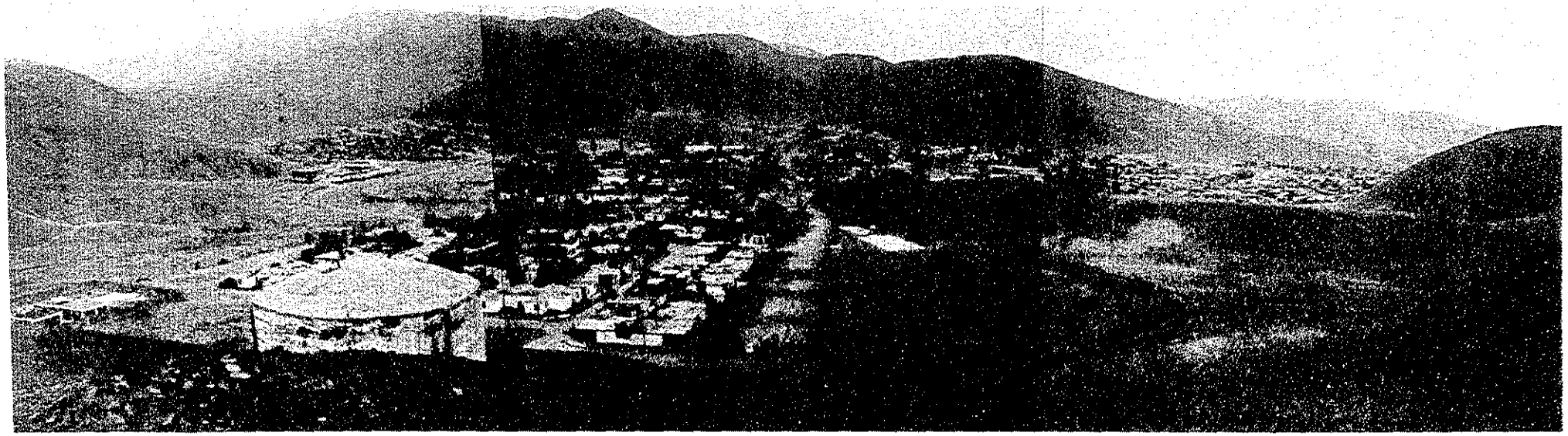
March, 1981



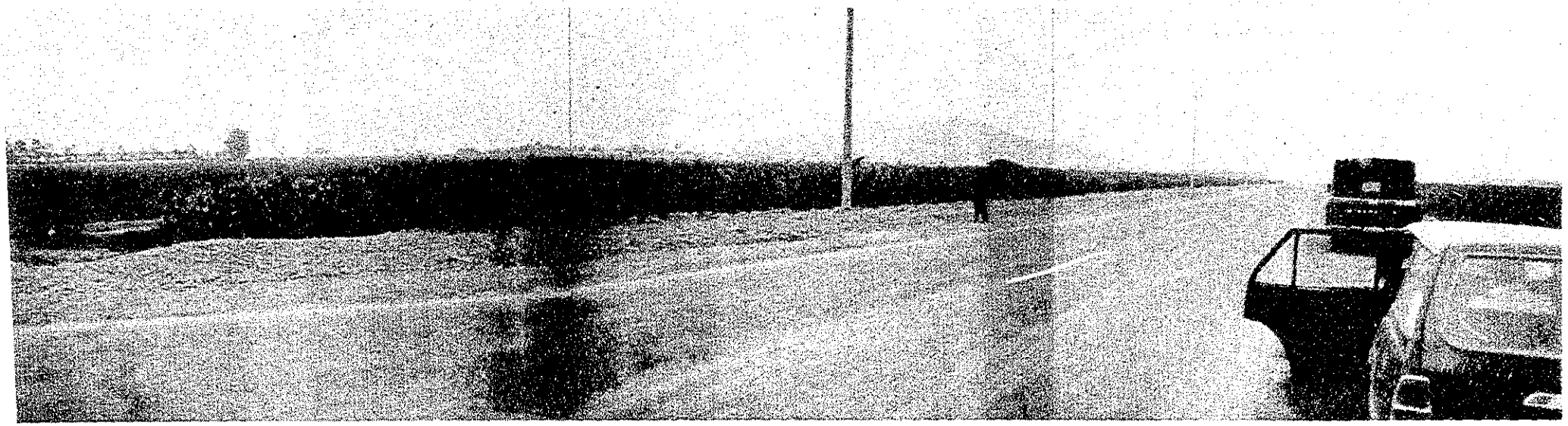
Keisuke Arita

President

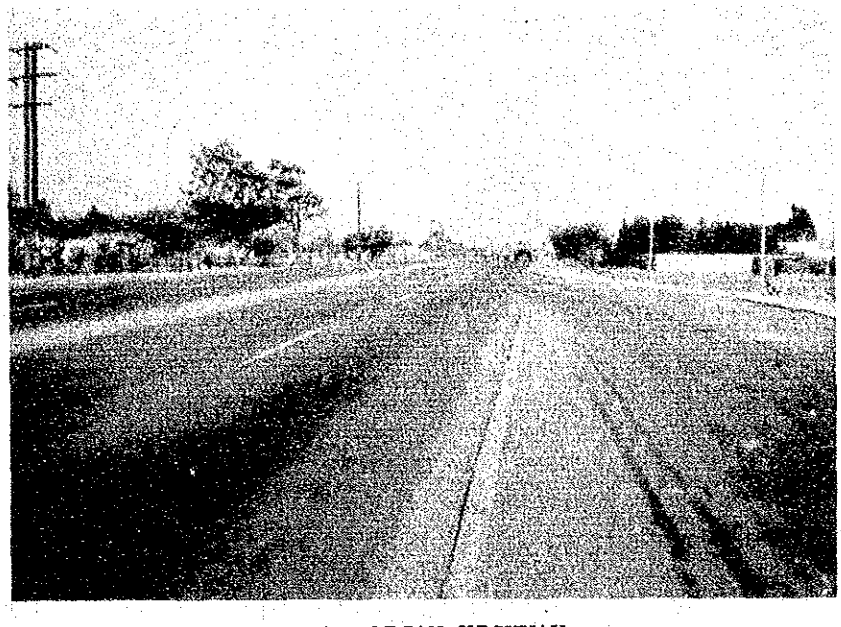
Japan International Cooperation Agency



PANORAMIC VIEW OF VENTANILLA

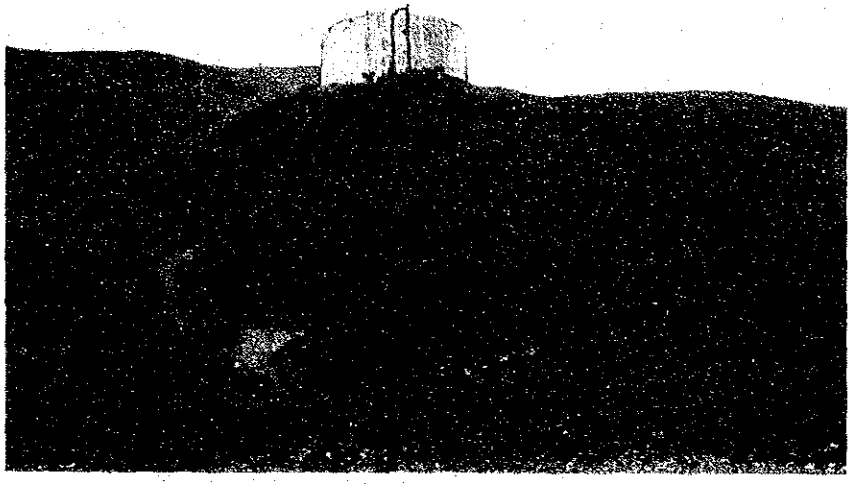


SITE OF NEW WELLS (PUENTE PIEDRA)

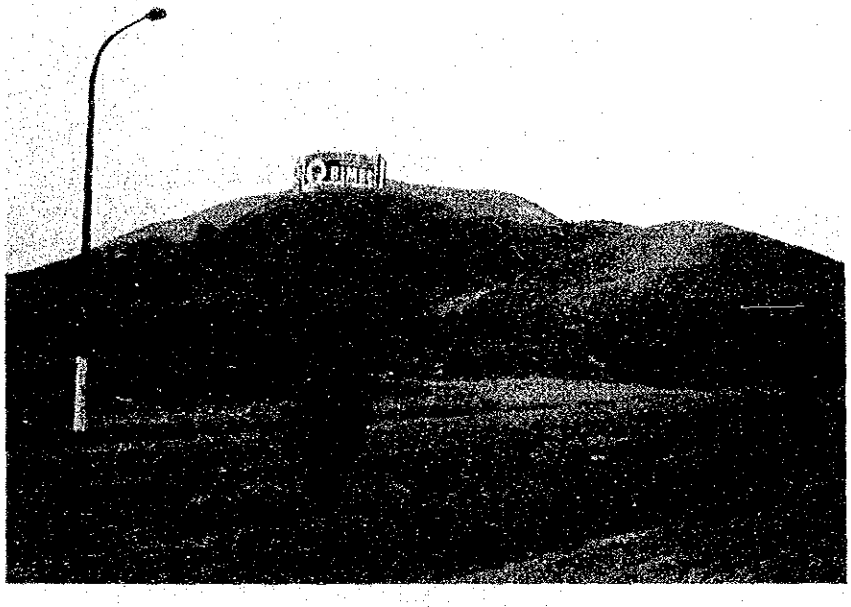


PAN-AMERICAN HIGHWAY

PRESSURE REDUCING TANK



STORRAGE RESERVOIR NO.1



STORAGE RESERVOIR NO.2

TABLE OF CONTENTS

SUMMARY

SUMMARY

1. Background to the Ventanilla Water Supply Project

Ventanilla was planned in 1961, with the purpose of absorbing some of the population concentrated on, and around Lima.

Ventanilla was to be developed as a satellite city of Lima, with an intended population of 110,000. However, at some point, development stagnated and the present population is only 25,000, with no likelihood of it increasing. The cause of all this can be attributed to a lack of drinking water. At present there is only a limited supply.

2. Inception of the Present Project

In January 1980, Peru sent a request to Japan for assistance, in connection with the above, and the Japanese Government consequently sent its first investigation team to Peru in July 1980 on a fact finding mission. Based on their conclusions and recommendations a detailed site investigation was undertaken and an appropriate preliminary design drawn up.

3. Investigations

Investigations were carried out from September the 18th.,1980. The site investigation ended on October the 30th. and besides a water analysis and surveys of the topography and geology it also included surveys of the natural and social conditions of the area and an assessment of the materials and machinery to hand. Technical competance was also examined. From these results a preliminary design was worked out and presented as a Progress Report.

4. Ventanilla's Natural and Social Conditions in Brief

Ventanilla is about 20 km. north of Lima; open to the sea in the

south-west and enclosed by hills inland. The area is made up of thin layers of Aeolian deposits on Jurassic rock. The rainfall is noticeable by its absence and there is almost certainly no groundwater. The area depends on water supplied from a groundwater source located in Zapallal some 4 km. away to the north-east.

The City Plan for Ventanilla provided residential, commercial, industrial and administrative zones and indicated a total population of 110,000 when complete.

At the moment the population is 25,000 and only a part of the residential and industrial zones are complete. Water services have been fully installed, but the amount of water supplied is extremely small. Sewage is treated and used for agricultural purposes.

5. Planned Water Supply

It is planned to supply water for the needs of 40,000 people. Taking the maximum supply requirement as 390 litres/person/day, the total requirement for residential use is about 15,600 m.cu./day. Adding to this the drinking water requirements in the industrial, commercial and administrative zones gives a figure of 21,950 m.cu./day, which is the basic figure used throughout this project.

6. Existing Water Facilities

The water for the existing facilities comes from 3 deep wells in Zapallal, however, the hydro-geological conditions are worsening and a steady supply cannot be expected in the future. There are both gravity and pressurized pipelines in the system. With regard to future water supplies, the gravity pipelines could, with some alterations, be used, but, the pressurized pipelines are not thought to be up to the new requirements. The distribution system has 3 reservoirs with a total capacity of 4,000 m.cu., each connected to the main supply pipeline. However, in the future, extra reservoirs may be needed.

7. Groundwater Conditions

For future water supplies, the existing source at Zapallal is quite

inadequate and the Peruvian Government have from some time before been considering using the water to be found in the Puente Piedra - Carabayllo area. The Puente Piedra - Carabayllo area is on the right hand side of the Chillon River and is made up of alluvial cone deposits of gravel to a depth of 100-200 m. The ground-water in this area comes from percolating water from the Chillon River. The value of the water bearing constant is hydro-geologically favourable and would indicate a steady and reliable water source. The planned volume of water to be extracted per well is 34 litres/sec On a 24 hr. operational basis, 7 wells are needed and on an 18 hr. operational basis, 10. A depth of 100 m. should be sufficient, but this will have to be determined from appropriate boring data.

8. Facilities and Maintenance

As part of the site investigation the state of Peru's Construction Industry, building materials, building regulations and standards, workmanship and maintenance and the technical competance of firms were looked at, and from the point of view of carrying out this project, it is considered that they are adequate for the intended works. However, for expidition and also economically, it is suggested that some materials and machinery should be imported from other countries.

9. Planned Facilities

From the results of the site investigation and taking into account present government policy the facilities required are as follows:-

WATER EXTRACTING FACILITIES	deep wells	10
	well dia.	350mm.
	depth	100m.
	pipes	14"-18", run of 9,550m.
PIPELINE FACILITIES	pumping stations	5
	pipes	24", run of 7,550m.
	pressure reducing tanks	2

STORAGE FACILITIES	2,000 m.cu. reservoirs (total capacity 6,000 m.cu.)	3
	connecting pipes	12" - 18"
	run of	3,130m.
BORING FACILITIES	top head drive type boring machine - 1 off	
	rotary excavator tanker lorry - 1 off	
	lift pumping test equipment	

SECTION 1 BACKGROUND

SECTION 1 BACKGROUND AND HISTORY OF THE PROJECT

1.1 Background of the Ventanilla Water Supply Project

Ventanilla was originally planned as a new satellite city to the city of Lima to absorb the laters congested population. It was built north of Lima in the midst of undeveloped desert.

This new city includes in its plan industrial and commercial districts and a city hall and schools. Ventanilla was also planned as an ideal city, which would provide dwelling units close to work areas, especially for those working at the fishing base and fish processing centre, being constructed west of Ventanilla and its industrial and commercial districts.

In 1961, work on the city started, and in 1969, after reviewing the city plan, Ventanilla was to have a future population of some 110,000. However this interesting city plan has not really developed since 1969, and at present the population is only about 25,000. This is due solely to the fact that the drinking water supply to the city is inadequate.

Ventanilla's water supply system was originally intended to provide sufficient water for all domestic and industrial needs in the area, and has even been enlarged. However, it has become evident recently that the water sources used by the city are erratic and that the water supplied for domestic use is insufficient, making up only 15% of the total supply. Understandably, people are obliged to rely on water vendors to make up their needs, a point that can not be ignored in regard to hygiene and economics.

It is thought that an ample supply of drinking water will enable the people of Ventanilla to lead healthier lives and more to the point allow the city to develop and consequently fulfill its purpose.

1.2 History of the Project

The project came about in 1980 because of a direct request from the Peruvian Government to the Japanese Government to improve the drinking water supply to Ventanilla, a satellite city of the city of Lima.

On receipt of the request, the Japanese Government sent the "First Mission" to Peru in July 1980 to look further into the background of their request and to examine the site conditions.

The present study was carried out in order to determine the most appropriate plan, and has been based both on the results of the first mission's investigations and more detailed investigations carried out for this study.

Site investigations were carried out in September and October, 1980. The purpose of these was to determine suitable well discharge locations, look at equipment necessary to extract groundwater, and also to work out the most rational water distribution system for the locality, and finally, to establish the precise water supply facilites capable of coping with increased water demand. To this end, investigations in Ventanilla, Puente Piedra and Carabayllo included a site survey, topographical and geological surveys together with a groundwater analysis.

In conjunction with this, extensive talks were held with all concerned, and past investigations and reports were looked over to throw some light on the hydrogeological conditions. In addition, discussions with E.S.A.L. staff and survey teams were also held to evaluate the existing water supply facilities and suggest ways for improving them.

Based on this fundamental data, the basic parameters in regard to a water supply master plan were established, as were the capacities of the facilities and their locations.

At the same time, the availability of materials and construction equipment was also looked into, and the data necessary for estimating the construction costs was collected together.

Since November 1980, the design drawings have been prepared in Japan, based on the results of site investigations. Design calculations and cost estimates which are to form the basis of detailed design work have also been done.

Table 1.1 INVESTIGATION FLOW CHART

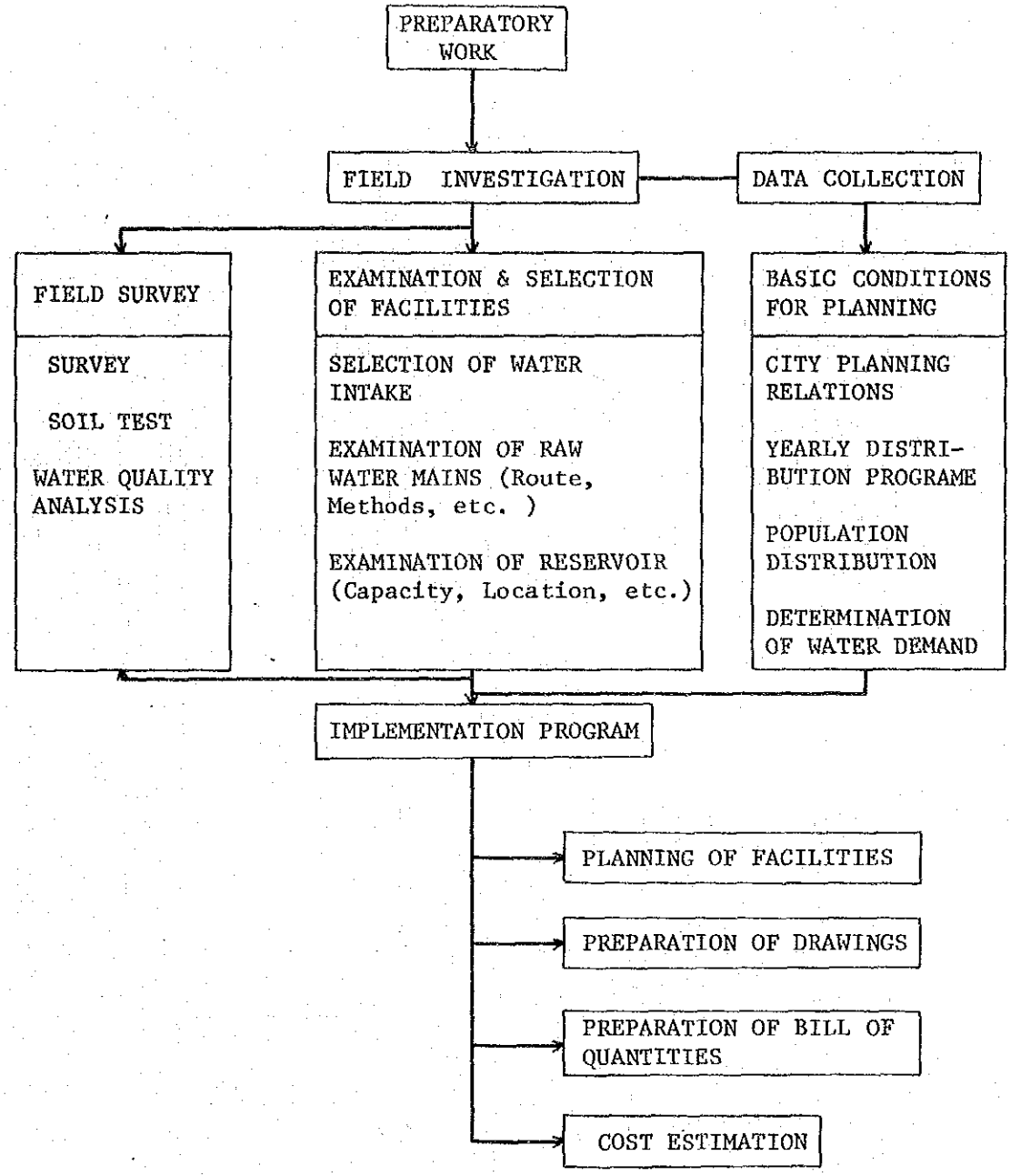


Table 1.2 Schedule of Basic Design Studies

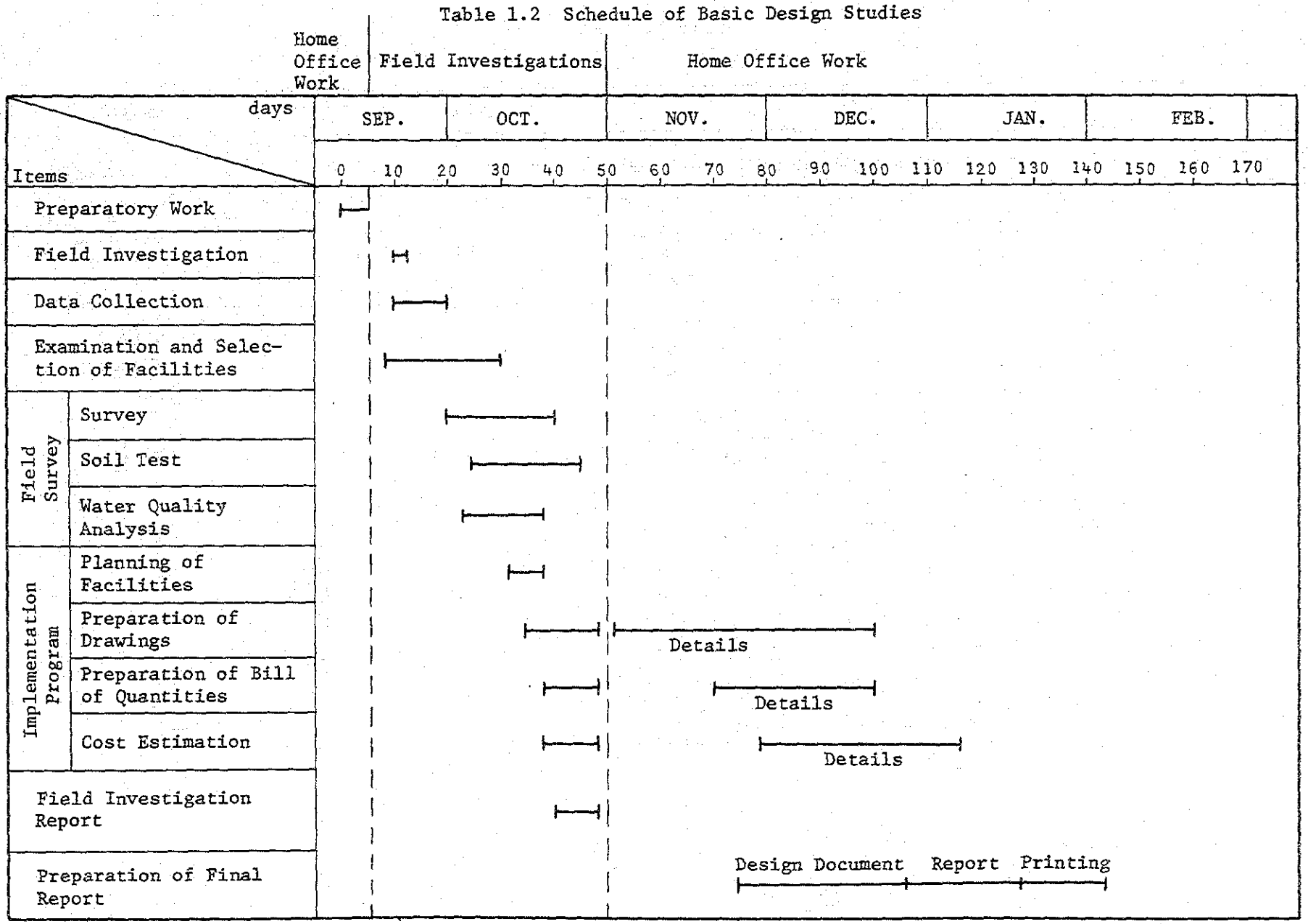


Table 1.3 SURVEY AND SOIL INVESTIGATION

	DESCRIPTION	SCALE	QUANTITY	LOCATION
SURVEYING	TRAVERSE	-	9.2 km	Raw water lines and all wells
	LEVELING (ROUTE)	H: 1/1000 V: 1/ 100	13.0 km	Raw water lines 9.2 km Transmission line 2.6 km Connection lines 1.2 km
	PLANNING (ROUTE)	1/1000	13.0 km	Raw water lines 9.2 km Transmission line 2.6 km Connection lines 1.2 km
	LEVELING CHECK	-	10 Points	Existing well No. 1 Existing valve chamber Existing reservoir No. 1, No. 2, No. 3 Others
	PLANNING (FACILITIES)	1/ 200	8,000 m^2	Pumping station and junction well 1,600 m^2 Presser reducing tank 1,600 m^2 Reservoir No. 4, No. 5, No.6 4,800 m^2
	CROSS SECTION	1/ 200	7 Sections	Transmission line
SOIL INVESTIGATION		-	5 Locations	Pumping station 1 Location Pressure reducing tank 1 Location Reservoir No.4, No.5, No.6 3 Locations (2 test pits for each location)

Table 1.4 INVESTIGATION OF EXISTING WELL

No.	WELL NUMBER	TEMPE-RATURE	WATER LEVEL		PH		RESIS-TIVITY	YIELD (ℓ/S)	SAMPLE NO.	REMARKS
			1980	1978	PH	RPH				
1	15-01-54	22°C	12.90	13.21	7.0	7.2	37	-	-	Deepwell Pump-Under Operating
2	15-01-40	21	21.03	9.0*	7.1	7.3	0.9	-	No.1	"
3	15-01-39	22	36.56	25.0*	7.2	7.4	29.5	56	No.2	"
4	15-01-175	22	12.01	7.0*	7.2	7.2	13.8	89.6	-	"
5	15-01-125	22.5	8.15	6.89	7.9	7.9	9.5	-	No.3	Shallow well Pump - Stop Sampling: from reservoir
6	15-01-142	23	-	18.24	7.2	7.2	-	-	-	Deepwell Pump - Under Operating
7	15-01-32	23	-	-	7.3	7.3	-	-	No.4	"

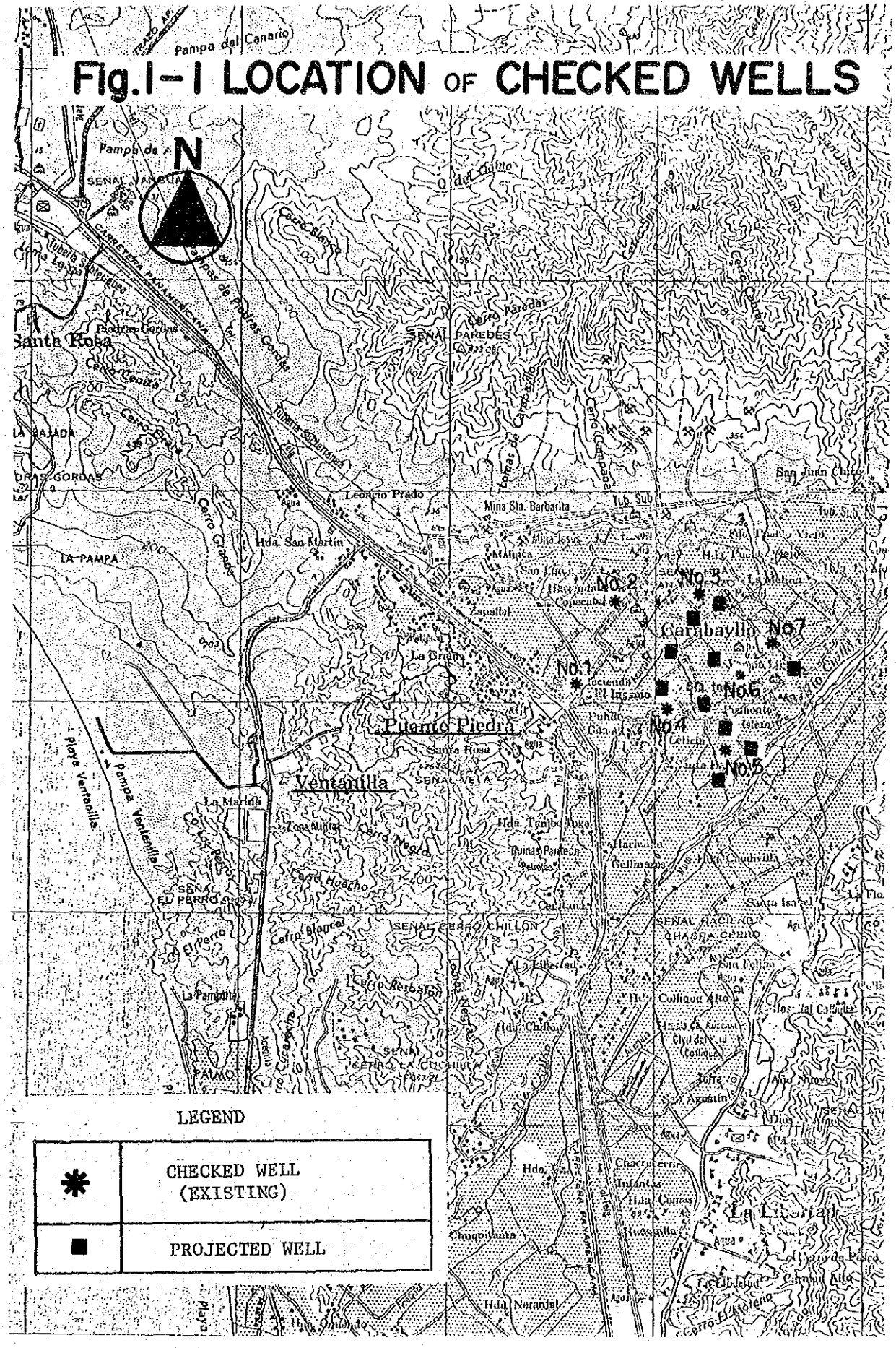
DATE OF INVESTIGATION 3/Oct./80 10.00 a.m. - 5.00 p.m.

TEMPERATURE 19°C - 21°C

WATER LEVELS OBSERVED IN 1978 SHOWS THE STATIC WATER LEVEL

* ESTIMATION FROM COUNTER MAP OF STATIC WATER LEVEL

Fig.I-1 LOCATION OF CHECKED WELLS



1.3 Members of the Project

1.3.1 Japanese Mission Team

Dr. Toshihiko Ogawa	(Project General Manager) Kyowa Consultants Co., Ltd.
Dr. Taijiro Konishi	(Geological Survey) Kajitani Study and Construction Co., Ltd.
Mr. Hideo Tomita	(Construction Planning) Kyowa Consultants Co., Ltd.
Mr. Suenori Isayama	(Cost Estimation) Kyowa Consultants Co., Ltd.
Mr. Kaoru Tomiyasu	(Facilities) Kyowa Consultants Co., Ltd

1.3.2 Peruvian Government (at the time of the basic design survey)

(a) Ministerio de Vivienda y Construcción

Ing. Jose Benavides Muñoz	Director Superior
Ing. Pedro Sarmiento Polo	Director Adjunto a la Dirección Superior
Ing. Carlos Forero Espinaza	Director General de Obras Sanitarias

(b) E.S.A.L.

Ing. Fernando Madueño G.	Presidents del Directorio
Ing. Mario Bustamante Ramos	Director Gerente General
Ing. Baltazar Navarro	Gerente del Area Técnica
Ing. Fortunato Lari	Gerente de Proyectos

(c) Ventanilla Project

Ing. Ernesto Petit Lecaros	Director de la Oficina del Proyecto Ventanilla Ministerio de Vivienda y Construcción
Ing. Carlos Valenzuela	E.S.A.L
Ing. Jorge Kawazo Tokuzo	E.S.A.L.
Arqto. Julio Baba Nakao	Ministerio de Pesquería
Senora (Secretaria)	Vilma Rivera Valega
Chofer	Fernando Choy

1.4 Schedule

Date	Schedule	Event
Sep. 19 Fri.	Narita - Lima by JL and AR flight	Japanese Survey Team arrived in Lima. Visit Japanese Embassy and JICA Office for courtesy call.
Sep. 20 Sat.	In Lima	Preparations for a meeting.
Sep. 21 Sun.	In Lima	Consultation among team members about schedule.
Sep. 22 Mon.	In Lima	Discussion with Ministerio de Vivienda y Construcción and inspection of Ventanilla.
Sep. 23 Tues.	In Lima	Study of hydrogeological condition. Inspection of existing transmission pipe line at Ventanilla and Zapallal.
Sep. 24 Wed.	In Lima	Consultation between Japanese team and Peruvian counterparts. Study of existing facilities. Preparations for data collection.
Sep. 25 Thurs.	In Lima	Study of past data (topographic data by Ministerio de Pesquería)
Sep. 26 Fri.	In Lima	Study of intake distribution at Puente Piedra and Carabayllo. Inspection of the sites.
Sep. 27 Sat.	In Lima	Sorting of Collected Data.
Sep. 28 Sun.	In Lima	Consultation among team members about schedule.

Date	Schedule	Event
Sep. 29 Mon.	In Lima	Consultation between Japanese team and Peruvian counterpart about location of intake.
Sep. 30 Tues.	In Lima	Visiting ESAL Office. Discussion with ESAL members. Inspection of LIMA water supply works.
Oct. 01 Wed.	In Lima	Inspection of Puente Piedra and Carabayllo to determine of intakes.
Oct. 02 Thurs.	In Lima	Study of existing facilities. Hydrogeological survey at Puente Piedra.
Oct. 03 Fri.	In Lima	Consideration of proposed report by surveyors. Decision to request Dr. Kuroiwa to do topographic and geological surveys.
Oct. 04 Sat.	In Lima	Sorting of collected data.
Oct. 05 Sun.	In Lima	Consultation among team members.
Oct. 06 Mon.	In Lima	Study of the intake capacity - and collecting pump. Preparation and arrangement for topographic and geologic survey. Inspection of Puente Piedra.

Date	Schedule	Event
Oct. 07 Tues.	In Lima	Sorting and consideration of collected data.
		Hydrogeological survey at Carabayllo.
Oct. 08 Wed.	In Lima	Sorting and consideration of collected data.
		Planning of proposed facilities.
Oct. 09 Thurs.	In Lima	Planning of proposed facilities.
		Discussion with a Peruvian architect about structure of P.C.Tank.
Oct. 10 Fri.	In Lima	Discussion with Dr. Kuroiwa and Inspection of Puente Piedra and Ventanilla.
		Visiting ESAL and discussion with ESAL member about population, water demand and new water supply system.
Oct. 11 Sat.	In Lima	Reconsideration of existing facilities.
Oct. 12 Sun.	In Lima	Consultation among team members.
Oct. 13 Mon.	In Lima	Dr. Konishi arrived in Lima.
		Inspection of Puente Piedra for geological survey with Dr. Kuroiwa.
Oct. 14 Tues.	In Lima	Dr. Konishi and Dr. Ogawa visited the Japanese Embassy and JICA Office on courtesy call.
		Planning of proposed facilities.

Date	Schedule	Event
Oct. 15 Wed.	In Lima	Planning of proposed facilities.
Oct. 16 Thurs.	In Lima	Consultation between Japanese Mission team and Peruvian counterpart.
		Visiting ESAL and discussion about capacity of new facilities and selection of equipment.
Oct. 17 Fri.	In Lima	Discussion with Director Superior Ing. Benavides.
		Planning and drawing up to the new water supply system.
Oct. 18 Sat.	In Lima	Preparation and arrangements for progress report.
		Analysis of collected data.
Oct. 19 Sun.	In Lima	Consultation among team members.
Oct. 20 Mon.	In Lima	Making out the progress report and drawing the facilities.
Oct. 21 Tues.	In Lima	Making out the progress report and drawing the facilities.
Oct. 22 Wed.	In Lima	Making out the progress report and drawing the facilities.
Oct. 23 Thurs.	In Lima	Making out the progress report and drawing the facilities.
		Estimation of construction cost.
Oct. 24 Fri.	In Lima	Binding the progress report into a book.
		Estimation of construction costs.

Data	Schedule	Event
Oct. 25 Sat.	In Lima	Estimation of construction cost.
Oct. 26 Sun.	In Lima	Estimation of construction cost.
Oct. 27 Mon.	In Lima	Estimation of construction cost.
Oct. 28 Tues.	In Lima	Discussion with Ministerio de Vivienda y Construcción.
Oct. 29 Wed.	In Lima	Visits to the Japanese Embassy and JICA Office on courtesy call.
Oct. 30 Thurs	Lima - Los Angels by AR flight.	Stay in Los Angels in transit.
Nov. 01 Sat.	Los Angels - Narita by JL flight.	Departure for Japan.

SECTION 2 OUTLINE OF THE VENTANILLA DISTRICT

SECTION 2 OUTLINE OF THE VENTANILLA DISTRICT

2.1 Location

Ventanilla is located about 20km north of the city of Lima, the capital of Peru. It extends over an area of about 9 sq.km, being about 6km long from north to south and 1.5km wide from west to east. Nearby is Callao, bounded by latitudes 11°51'20" and 11°57'20" south and longitudes 77°4'25" and 77°12'00" West.

The only means of transportation to Ventanilla is provided by two main trunk roads from the capital, Lima. One runs through Callao, then north, up along the seashore, and the other is a panamerican highway called the Carretera Panamericana.

Ventanilla is therefore considered to be extremely well disposed as a satellite city of Lima in terms of transportation and its location.

2.2 Natural Conditions

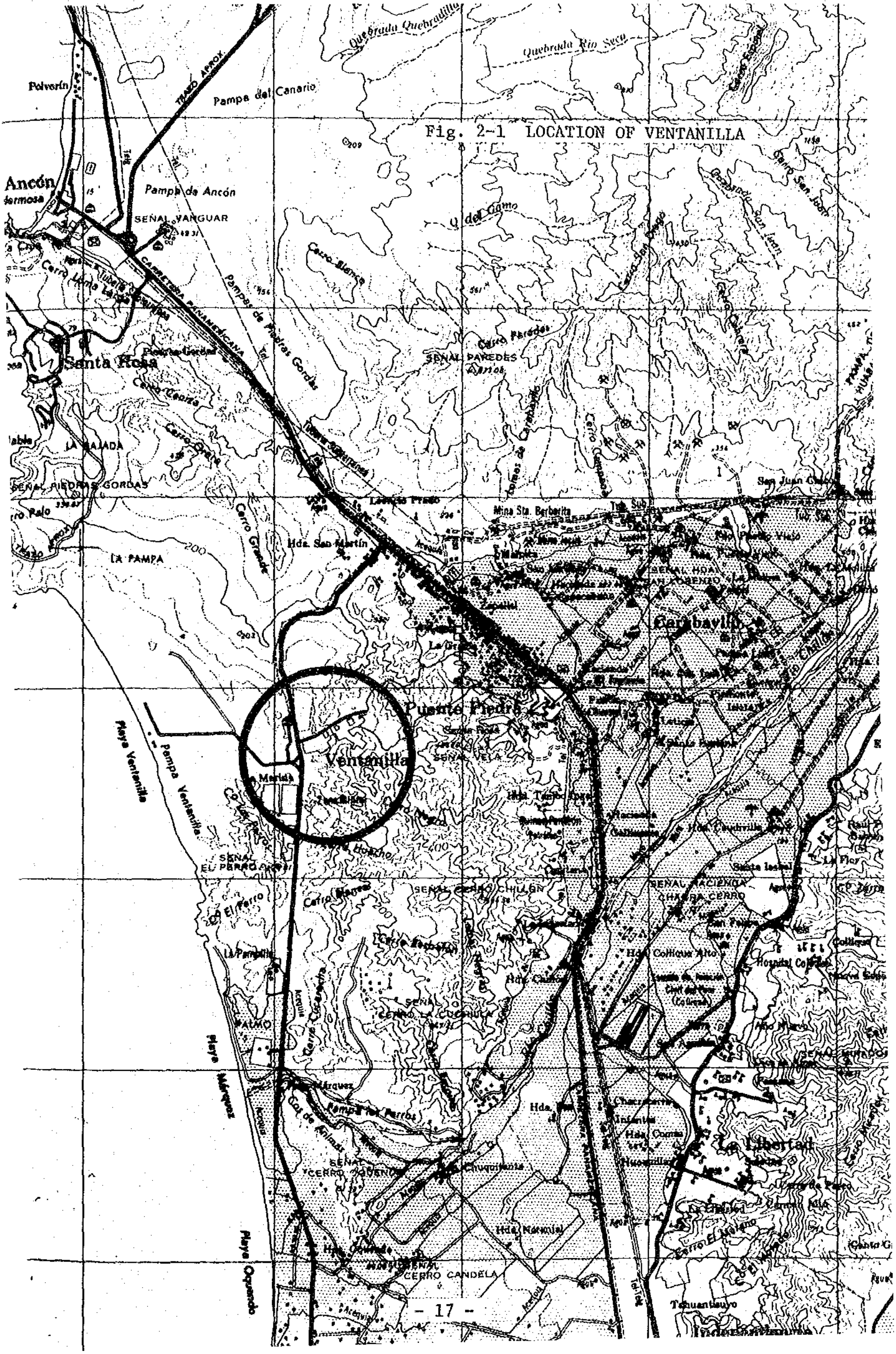
2.2.1 Topographical Features

Ventanilla's topography consists of an alluvial cone deposit, with its hinterland surrounded by hills. The southwest part faces and gradually slopes down to the sea. The city itself rises from 25 to 80m above sea level towards the northeast. It is enclosed in the north by mounts Cerro Palb (330.87m) and Cerro Orra (438.0m) and from the northeast to the east by the mountains of the Cerro Grade (300-350m), the hinterland of the city of Santa Rosa, and in the southeast by the mountainous region near mounts Seral Vila (426.78m) and Cerro la Chillon (347.21m). The southwest is exposed to the sea.

The city area of Ventanilla has a gentle slope of 1 to 1.5%, which becomes steeper, 6%, near the mountains.

The proposed new water source of Puente Piedra for the district of Ventanilla, is located on the otherside of the mountains in the northeast, in an alluvial plain extending on the right hand side of the Chillon River.

Fig. 2-1 LOCATION OF VENTANILLA



The plain extends northwards to the mountains topped by Cerro Diego (1430m) and westwards to those topped by Senal Cerro Chillon (534.56m) and it is enclosed in the northeast and southwest by the Chillon River. It is an alluvial cone deposit formed by the Chillon River and rises between 100 and 250m above sea level.

2.2.3 Geological Features

The geology of Ventanilla and the nearby Puente Piedra comprises of a baserock made up of Jurassic and Cretaceous deposits, Piroclastic and volcanic rocks, on which stand Quaternary alluvial, anemonoclastic and seashore deposits.

The area as a whole is classified into the following four major categories.

1) The Ventanilla District

Ventanilla's topography consists of a gentle slope composed of sand,gravel and sandhill deposits near the seashore and inland of aremonoclastic rock.

2) The mountainous District to the North

This district is mostly covered by mountains of more than 600m in height, including Cerro San Dieo (1430m) and Cerro Predas (823.08m), made up of late Cretaceous deposits. The gentle sloping area at the foot of the mountains is of Mid-cretaceous deposits i.e. Hirrandina, Marcavila, Pamplona and Atcongo layers.

3) The Mountainous District to the South

The mountainous district of southern Ventanilla running in an east-west direction on the right hand side of the Chillon River has Senal Cerro Chillon (534.56m) in the north and Senal Vila (426.78m) in the centre. The district is very weathered in comparison with the mountainous area in the north. The strata is composed of Puente Piendra layers belonging to the Jurassic and Cretaceous eras. The lower layers extend southeast and northwest around the mountainous area at the southwest limit of the right hand side of the Chillon River. The upper layers extend to the west and southwest, and consist of various kinds of volcanic rocks and deposits which have been dislocated and deformed through movements in the earth.

4) The Plain on the right hand side of the Chillon River
This area is one with a gentle slope from the northeast to the south, and contains alluvial cone deposits formed by the Chillon River. From outcrops of baserocks, observed in places, the lower limit of the baserock is considered to extend irregularly. Alluvial deposits consisting of clay, sand, and gravels are considered to have no horizontal continuity after taking into account the geological section shown in Fig. 2-4, which shows large horizontal variations in the layers. Although the baserocks have'nt been drilled down to, their depth is considered to be between 150 and 250m (based on the results of the electric prospecting survey).

2.2.4 Condition of the Chillon River

The Chillon River originates in the Andes mountains and accompanies a number of tributaries flowing down from the northeast to the southwest. The river valley, running from upper to middle stream, has steep narrow terrain on both sides, and is composed mainly of hard rocks.

The area of the total water shed is about 2,224 sq.km with a length of 118km, 1,800 sq.km of which is usually affected by rainfall.

The maximum flow recorded in 1965 was 180.13 m.cu./sec., and the minimum flow recorded in 1960 was 0.3 m^3/sec. (measured at Magdalena Bridge). The quantity of available water is a potential 171,550,000 m.cu./year, with about 96,590,000 m.cu. draining off in to the sea. The surface water flow of the Chillon River is used for agricultural purposes, irrigating an area of some 12,000 ha. In the new water basin of Puente Piedra, the water flows as surface water for the period January-March every year, but for the period April-December it flows underground, and judging from the groundwater table, there is no replenishment from the Chillon River to the groundwater during this period.

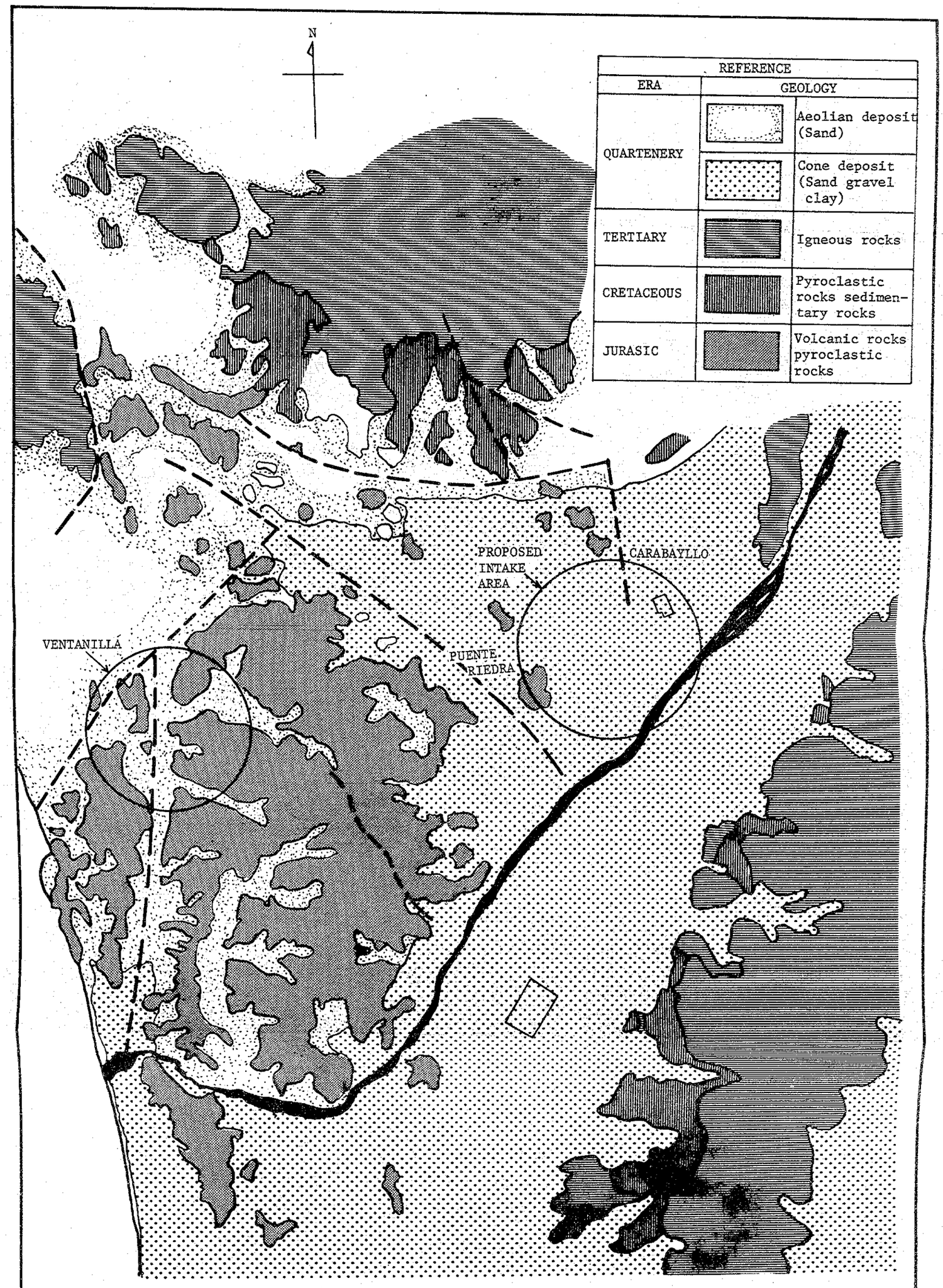


Fig. 2.2 GEOLOGICAL MAP OF VENTANILLA

2.2.5 Climatic Conditions

Ventanilla is located between latitudes 11 and 12 deg. south and belongs to the subtropical zone. However, there is very little precipitation, giving mild weather.

The climatic factors which are dominant in this area are consist of a cold current called the Peru Current, (Humbolt Current), and the Andes mountains, laying along the Pacific coast, with heights of more than 6,000m. Accordingly, the wind blowing in from the Atlantic Ocean is hindered by the Andes, resulting in the east side being quite wet and the west side remaining dry.

(1) Precipitation

In the past 15 years (1966-75), only 348 days of rain have been recorded. The total precipitation being 122.7 mm with an annual average of 8.2 mm. Seasonal variations cause the rainfall and precipitation to be higher in winter than in summer.

(2) Temprature

The highest temperature recorded in the summer season was 30°C. with a daily average of 20-22 °C.

The lowest temperature in winter was around 10 °C. with an daily average of 16-17 °C. As for the yearly average, it is about 16-deg. C. with little variation.

(3) Humidity and Pressure

The average Humidity is fairly high at 82-85%, with only slight seasonal variation. The atmospheric pressure isn't seen to change much either, varying within 4 mb.

For most of the year, the plain is shrouded by fog and mist and cloud reaching close to the surface of the sea. Because of this, vision is severely restricted, hampering the movement of ships.

According to the records at Lima International Airport, the south wind have been dominant throughout the year for the period 1960-75. The average wind speed is about 5 m/sec and the maximum about 10 m/se There are no tropical typhoon generating depressions, and therefore, the atmospheric conditions are quite stable.

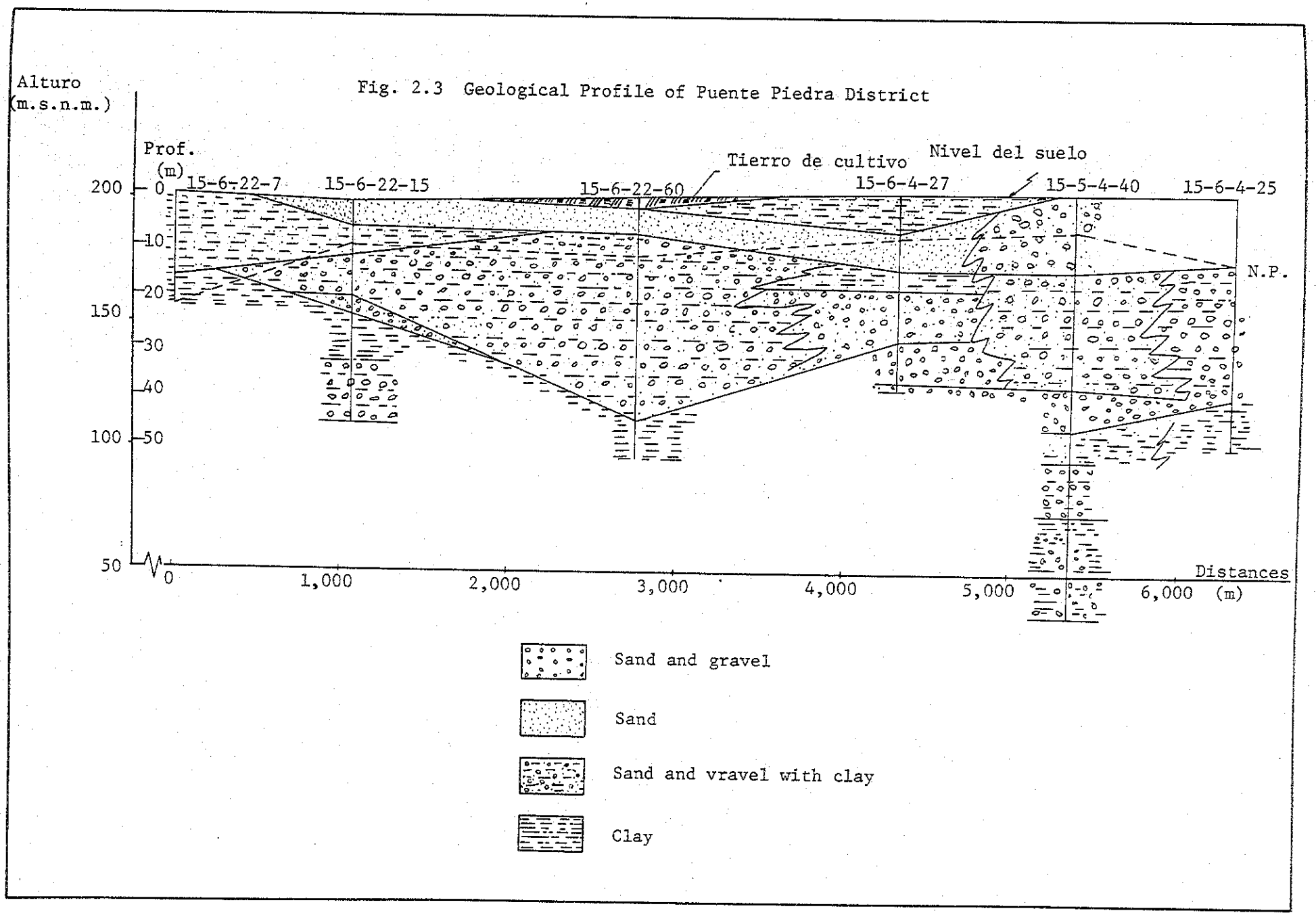


Fig. 2.3 Geological Profile of Puente Piedra District

Peru's Andean mountains belong to the circum-panpacific earthquake belt and together with Chile and other such areas, are well known for their earthquakes. During the period 1913-63, earthquakes with a magnitude of more than 7.5 occurred no less than 12 times, among which the biggest in 1942 was of magnitude 8.1.

2.3 Social Conditions

2.3.1 Population Distribution

Ventanilla was established in 1961 by the Ministerio de Fomento, as a satellite city of the capital, Lima. However, its development is presently at a standstill because of the shortage of drinking water. A census in 1972 gave the population as 16,000. Although the present population is now estimated to be 25,000, it must be remembered that the planned population was intended to be 110,000 in the review of 1969.

2.3.2 Land Use

The Ventanilla City Plan divides areas into residential, commercial, industrial and administrative zones.
The residential zone is in turn divided into section A1 to A5, B, C, D1 to D3, E and F. However, at present there has been no development except for one part of A and D and part of the industrial zone. The commercial and administrative zone remain as yet undeveloped.

2.3.3 Industrial Development

One purpose of the City Plan was to establish a city structure that placed work areas near dwelling areas. To this end, there was a positive drive to attract industries to the area and so far there is a Toyota car factory, fishing net factory and fish oil processing plant in operation. In addition, there is the La Panpilla oil refinery in the south of Ventanilla and at the mouth of the Chillon River, and industrial belt to which people commute.

The present industrial development plan allows for expansion of industrial estates within the city, and includes a plan to construct a fishing base west of Ventanilla along with a fish processing centre.

2.3.4 Water Supply and Sewerage

1) Water Supply

Ventanilla's water supply system was originally designed to supply water to consumers from three deep wells at Zapallal, by way of distribution and storage facilities. However, the inhabitants of Ventanilla are facing the prospect of an extreme water shortage due to the limited capacity of the present water source. At the moment, the water supply is only 15% of the estimated water requirement, with a daily supply period of only several hours. The people therefore supplement the water by either storing it buying it from tanker lorries.

The system was handed over by the Ministerio De Vivenda y Construccion to the Lima Water and Sewerage Corporation (E.S.A.L.) in July 1980. Since then, E.S.A.L. has been in charge of running the system.

2) Sewerage

The sewerage system is largely completed in the areas which have so far been developed in accordance with the city plan. Drained off sewage is collected in lagoons on the outskirts west of Ventanilla, and susequently treated. It is then used for agricultural purposes. Sludge produced in the course of sewage treatment is used to enrich and improve the soil in the desert region. It can be said, that the water from the supply is completely recycled. As a result of these efforts, areas which have previously been barren are now producing a variety of crops such as alfalfas, corn, wheat and some fruits etc.

2.3 City Plan

Ventanilla, located 25km north of Lima, was planned in 1961, as a satellite city of the Lima-Callao metropolitan area. (present population about 5 million). Later the plan was reviewed in 1969, and restructured to accomodate a population of 110,000. By the Lima Plan, the population was to be 220,000, based on the assumption that

construction of housing along with intensive land development materialised. Both of which depended on the water supply being realised through the Mantaro Project.

The Ventanilla City Plan is recognised as that of a new town accomodating dwelling and working area within the city and also including industrial and commercial areas in addition to incorporating the oil refinary base between Callao and Ventanilla and the northwestern fishing district.

The planned land use provides for a residential area of 408 ha., and industrial area of 160 ha., a commercial area of 16 ha., and a public utility area of 28 ha., giving a total planned area of 612 ha. Of the above, 155.5 ha. of the residential area and 40 ha. of the industrial area are in use.

The present population in developed areas of A and D together with people living in surrounding areas gives a population of 25,000. The people in A and D districts live in low height houses (about 2,550 in number) and the number of people per house is 7∿15, 9.1 persons on average. Accordingly the residential density is about 150 people per ha. The figure is comparatively high in an area where low height housing is predominant, which indicates a tendancy to big family units. Considering the type of housing and the family structure in the area, the density of 150 people per ha. is thought unlikely to change in the near future. Therefore a population increase of about 15,000 people is expected in areas A3, A5, B, D1 and F where residential development is now being planned. Hence once these houses reach completion in 1987 the population is expected to be about 40,000.

SECTION 3 ESTIMATION OF PLANNED WATER DEMAND

SECTION 3 ESTIMATION OF PLANNED WATER DEMAND

3.1 Planned Service Population

3.1.1 Approach to estimating Future Population

According to the request from the Peruvian Government submitted through the Japanese Embassy in January 1980, the present population of Ventanilla is 25,000 and the likely future population 40,000.

In general, projections of future populations are made based on past trends of population increases, taking into account development plans prepared for the areas. Naturally the present mission tried to collect such data, but it was found that there wasn't any relevant to the past population trends except for a census in 1972 which gave the population as 16,784.

It therefore seems difficult to project any future population by this method, and even if it weren't it might be inappropriate to do so in this particular region when water has been in short supply. This water shortage has prevented the development of commerce and industry as well as failing to attract permanent settlers. The projection therefore will be based on the future development plans, taking into consideration the present population.

3.1.2 Present Population and Future Plans

Fig. 3.1 shows the planned land use and population distribution for Ventanilla. At present, people are seen to occupy five zones, i.e. A1, A2, part of A3, A4 and D2 with a total of 23,320 inhabitants. In the future when water will be available in sufficient quantities, zones A5, B, D1, F and part of A3 are planned as residential with a population of 15,000.

As to areas C, D3 and E, they are to be developed under a long range plan. However, at the moment the contents of this plan are not clear and therefore, settlement of people in these areas is not forseen in the next ten years. A summary of the above is shown in table 3.1.

Fig. 3.1 DISTRIBUTION OF POPULATION

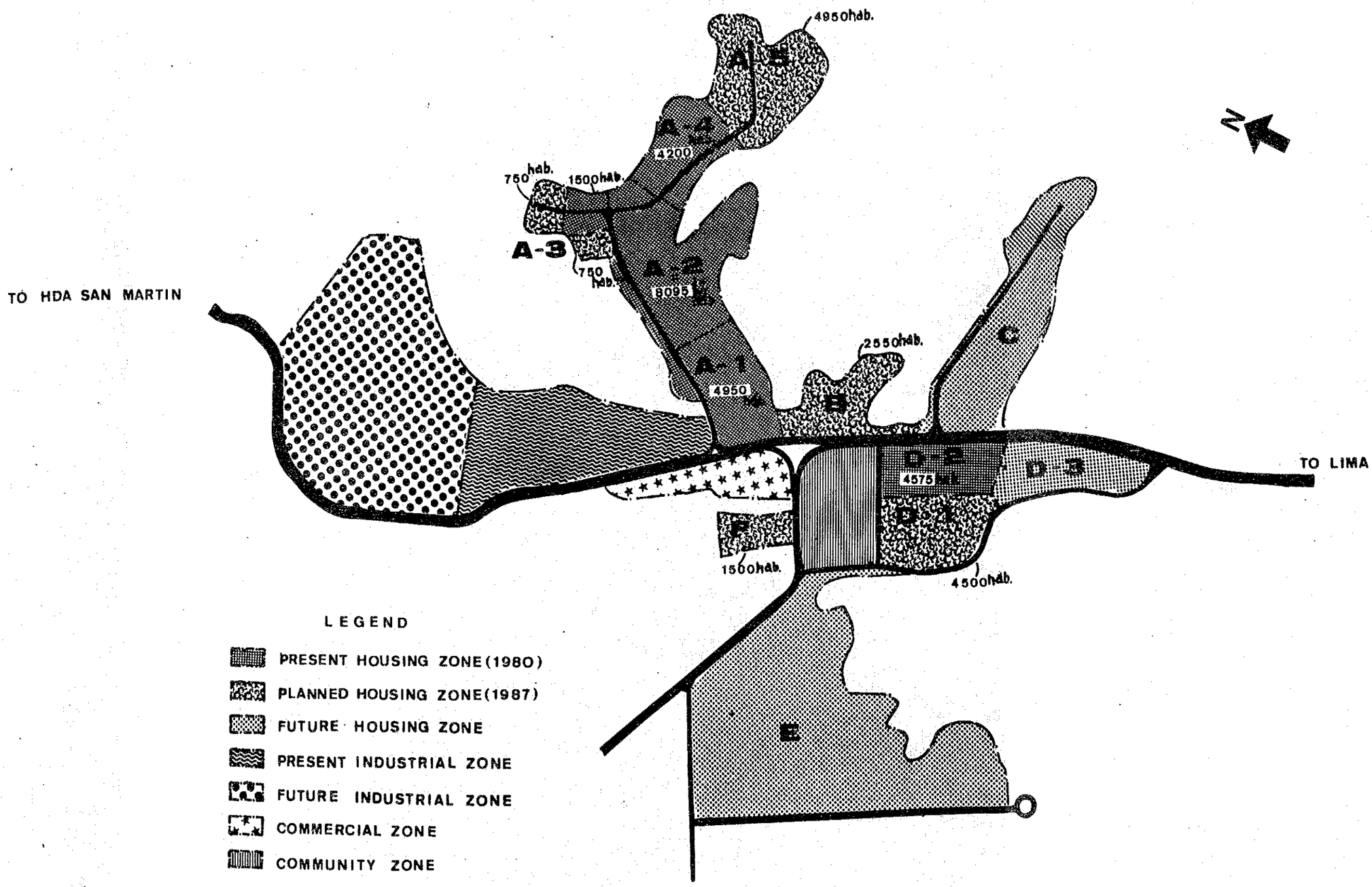


Fig. 3.1 DISTRIBUTION OF POPULATION

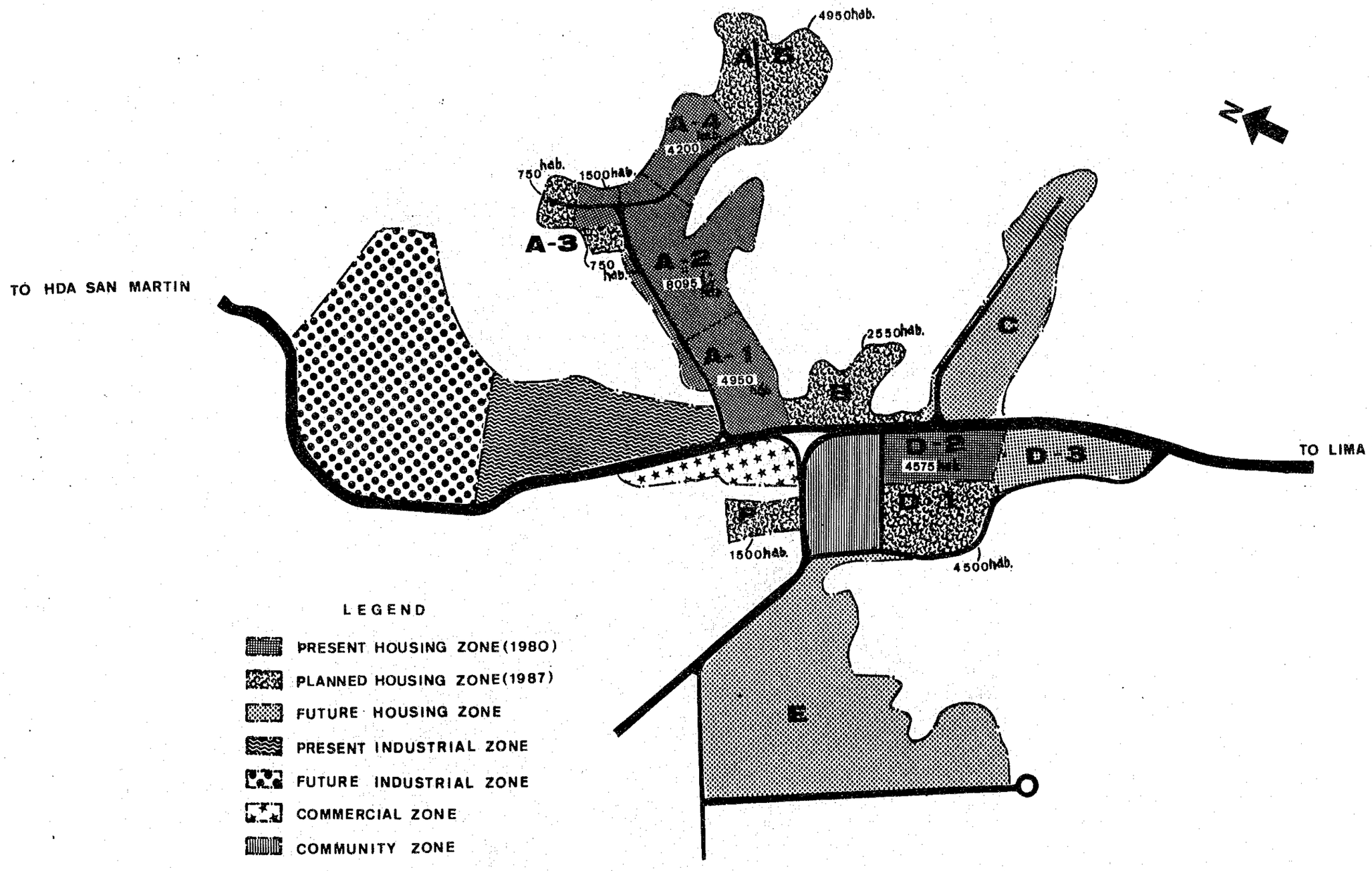


Table 3.1 Population Dispersion by Area

Area	Present Population	Future Increase	Total	Remarks
A - 1	4,950	-	4,950	
A - 2	8,095	-	8,095	
A - 3	1,500	1,500	3,000	
A - 4	4,200	-	4,200	
A - 5	-	4,950	4,950	
B	-	2,550	2,550	
D - 1	-	4,500	4,500	
D - 2	4,575	-	4,575	
F	-	1,500	1,500	
ZAPALLAL	1,680	-	1,680	*
TOTAL	25,000	15,000	40,000	

* Water is supplied since the water source is available at Zapallal.

3.1.3 Planned Year for Completion

Planned year for the present study will be determined in 1987, based on material to be provided by the Government of Peru.

3.2 Planned Supply Amount

3.2.1 Unit Demand

The general practice in Japan when determining the water demand of a particular town is to analise the existing water consumption taking into account its singularities. Then, to establish the unit consumption for each catergory of use. In Peru however, E.S.A.L. gives the average daily demand per capita to be 300 litres and the maximum daily demand per capita to be 1.3 times this, and hourly maximum demand per capita to be twice the maximum daily demand per capita.

Therefore, in this study, estimations are based on the above.

3.2.2 Planned Maximum Daily Demand per Capita

300 litres/cap/day x 1.3 = 390 litres/cap/day

3.2.3 Planned Maximum Daily Demand

For domestic use, then

0.39 m.cu./cap/day x 40,000 = 15,600 m.cu./day
= approx.181 litres/sec

For commercial and industrial areas and public facilities.

Of these non-domestic uses, industrial use is the largest. At present there are car and textile factories in Ventanilla, which together with other industries require a water supply of 4,000 m.cu./day (about 46 litres/sec). At the moment there are no definite plans as to what factories will be opened, however, if the water problem is solved then industrialization will be accelerated, especially as there are already trunk roads, creating a large industrial estate.

Although the water demand for industrial use can not be estimated as for domestic use, E.S.A.L.'s report "Abastecimiento de Agua

Potable Ala Giudad" in which a study on industrial areas features, indicates that the future requirement will be about 73 Litres/sec, approximately 6,300 m.cu./day. Therefore, the total water demand including domestic use is estimated to be : -

181 litres/sec + 73 litres/sec = 254 litres/sec

= 21,950 m.cu./day.

Table 3.2 shows the planned service population and the planned supply amount up to the planned year.

Table 3.2 Planned Population and Water Demand

Year	Population	Daily Mean				Daily Maximum			
		Residential		Commercial Industrial Public ℓ/s	Total ℓ/s	Residential		Commercial Industrial Public ℓ/s	Total ℓ/s
	person	ℓ/c/d	ℓ/s			ℓ/c/d	ℓ/s		
1980 (Present)	25,000	300	87	35	122 (10,540 m^3/d)	390	113	46	159 (13,740 m^3/d)
1981	25,750	300	89	36	125 (10,800)	390	116	47	163 (14,080)
1982	34,520	300	120	48	168 (14,520)	390	156	62	218 (18,840)
1983	35,540	300	123	49	172 (14,860)	390	160	64	224 (19,350)
1984	36,605	300	127	50	177 (15,290)	390	165	65	230 (19,870)
1985	37,700	300	131	52	183 (15,810)	390	170	68	238 (20,560)
1986	38,835	300	135	54	189 (16,330)	390	175	70	245 (21,170)
1987	40,000	300	139	56	195 (16,850 m^3/d)	390	181	73	254 (21,950 m^3/d)

SECTION 4 EXISTING WATER SUPPLY FACILITIES

SECTION 4 EXISTING WATER SUPPLY FACILITIES

4.1 History of the Ventanilla Water Supply System

The Ventanilla water supply system was planned and implimented in 1961 by the Ministerio de Formento under the city development plan. The system started initialy with the construction of two deep wells (total discharge 120 litres/sec) at Zapallal; a water reservoir, No. 1, (1,000 m.cu.) at Ventanilla, and a water main to connect the water source with the reservoir. This was followed with the construction of reservoir No. 2 (1,000 m.cu.) and distribution pipelines from the reservoirs to housing area A and to the industrial and commercial districts, establishing a series of intakes and distribution facilities. Later construction of reservoir No. 3 (2,000 m.cm.) and pipelines to supply the southerly situated housing area D was carried out.

Since then, another deep well at Zapalla, making three wells in all, and accompanying pipelines have been added to the system based on the augumentation plan implimented by the Ministerio De Vivienda in 1970.

However, due to the fall in the groundwater table, and troubles with intake facilities, it has been difficult to get the water necessary to meet the requirements of Ventanilla, leaving the inhabitants to worry about the lack of this vital necessity and has in addition brought city development to a standstill.

During this time the Ministerio De Vivienda changed its name to the Ministerio De Vivienda Y Construccion, and with the cooperation of the Ministerio De Agricultura who were in charge of groundwater development rights, carried out investigations to try and locate new water sources to alleviate Ventanilla's shortages.

As a result of their endevours, new sources were found to be available in a district located 6km east of Ventanilla and a further 3km north-east of Puente Piedra.

Based on taking and distributing water from this source, a new plan was proposed. However, this plan has not so far been realized, due