No. 08

BASIC DESIGN STUDY
ON
HIGH-QUALITY SEED PRODUCTION PROJECT
IN
ARAB REPUBRIC OF EGYPT

MARCH 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

4142

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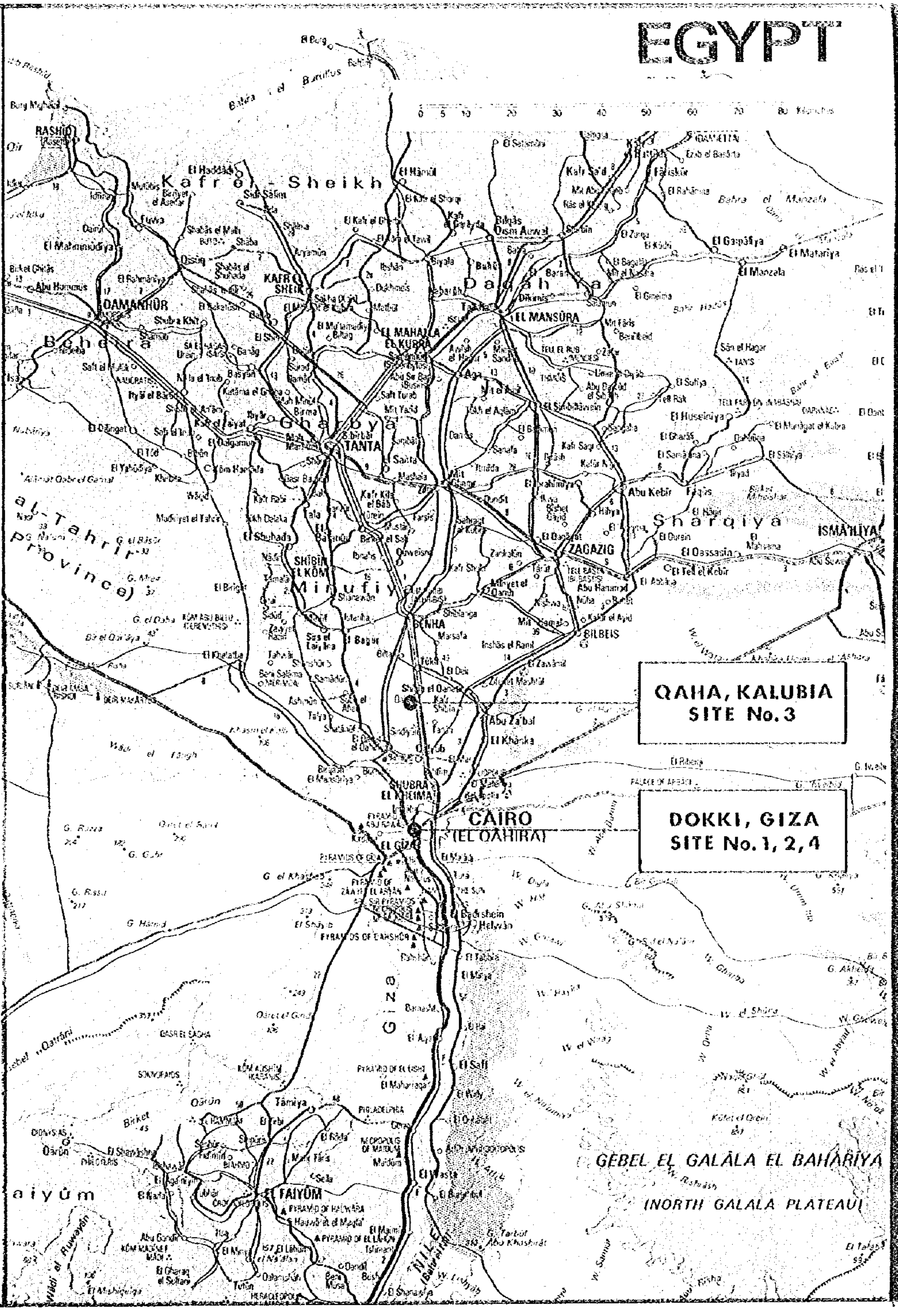
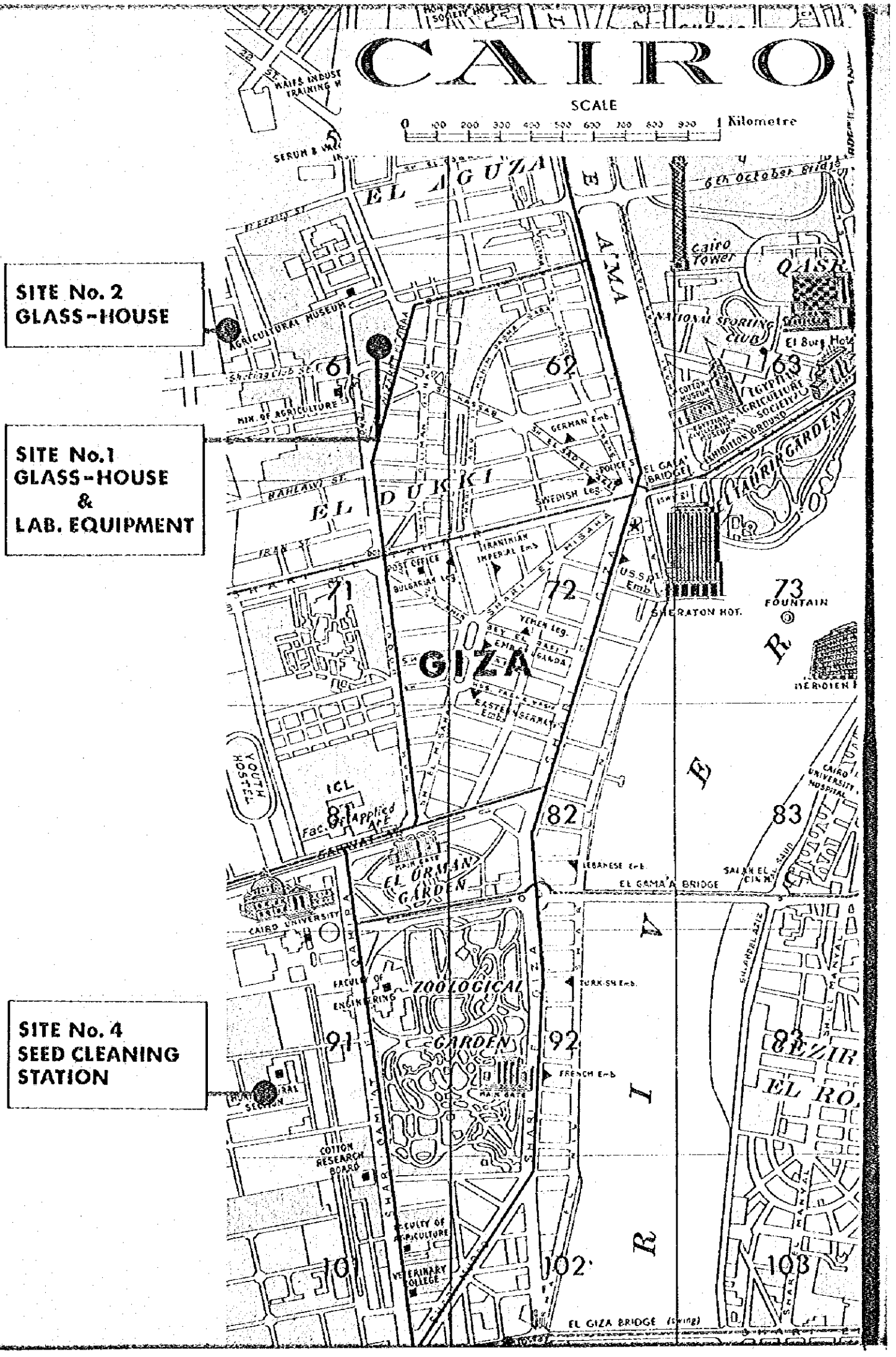

EGYPT
0 5 10 20 30 40 50 60 70 80 Kilometres
QAHA, KALUBIA
SITE No.3
DOKKI, GIZA
SITE No.1, 2, 4
CAIRO
(EL QAHIRA)
Kafr el-Sheikh
Sharqiya
Minufiya
al-Tahrir Province
GEBEL EL GALALA EL BAHARIYA
(NORTH GALALA PLATEAU)
RASHID
DAMANHUR
TANTA
EL MANSURA
ZAGAZIG
BENHA
BILBEIS
SHIBIN EL KOM
EL MAHALLA EL KUBRA
SHUBRA EL KHEIMA
EL GIZA
EL FAIYUM
Bahra el Manzala
Bahra el Burullus


CAIRO
SCALE
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SITE No. 2
GLASS-HOUSE
SITE No.1
GLASS-HOUSE
&
LAB. EQUIPMENT
SITE No. 4
SEED CLEANING
STATION
EL AGUZA
EL DOKKI
GIZA
ZAMALEK
AGRICULTURAL MUSEUM
MIN. OF AGRICULTURE
Cairo Tower
QASR EL NIL
NATIONAL SPORTING CLUB
El Borg Hotel
COTTON MUSEUM
EGYPTIAN AGRICULTURE SOCIETY
EGYPTIAN AGRICULTURAL MUSEUM
EXHIBITION GROUND
GERMAN Emb.
SWEDISH Leg.
POLICE S.
EL GAMA'A BRIDGE
EZBEKIEH GARDEN
IRAN ST.
POST OFFICE
BULGARIAN Leg.
IRANIAN IMPERIAL Emb.
U.S.S.R. Emb.
SHERATON HOT.
FOUNTAIN
YEMEN Leg.
EASTERN BEARING
ICL
Fac. of Applied Art
GARWAY
EL ORMAN GARDEN
CAIRO UNIVERSITY
CAIRO UNIVERSITY HOSPITAL
LEBANESE Emb.
SALAH EL DIN SQUARE
FACULTY OF ENGINEERING
ZOOLOGICAL GARDEN
TURKISH Emb.
FRENCH Emb.
AGRICULTURAL SECTION
COTTON RESEARCH BOARD
FACULTY OF AGRICULTURE
VETERINARY COLLEGE
EL GIZA BRIDGE (SWING)
EZBEKIEH
EL RO
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PREFACE

In response to the request of the Government of Arab Republic of Egypt, the Japanese Government decided to conduct a survey on High Quality Seed Production Project and entrusted the survey to the Japan International Cooperation Agency.

The J.I.C.A. sent to Egypt a survey team headed by Mr. Takejiro Sato, Examiner, Seeds & Seedlings Division, Ministry of Agriculture, Forestry and Fisheries from January 26 to February 12, 1982.

The team had discussions with the officials concerned of the Government of Egypt and conducted a field survey (in Dokki and Qaha area). After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of Arab Republic of Egypt for their close cooperation extended to the team.

March, 1982

Keisuke Arita

Keisuke Arita
President
Japan International Cooperation Agency

SUMMARY

SUMMARY

As in the case of many developing countries, Arab Republic of Egypt (referred to as Egypt) is an agricultural country based on mainly on primary industries. The Egyptian Government, aiming at the development of the national economy, is endeavouring to foster secondary industries which are basically supported by agriculture. This shows it important to develop agriculture to invite a take-off for the economic development of Egypt. The cultivation of vegetables, in particular, holds an important position in the solution of such problems as improvement of the people's diet, food self-sufficiency, and increased yield of agricultural products for export. Improving the system for the production of vegetables thus is of very big significance. The necessary improving points in the system of vegetable production are to increase the yield of profitable high-quality vegetable and to establish a modernized distribution structure from the farmer to the consumer. On the other hand, in order to solve this problem, it is strongly expected to arrange the facilities for the increase and careful selection of authorized high-quality seeds.

In view of this situation, the Egyptian Government requested this to the Government of Japan for grant aid. In response to the request, the Government of Japan decided to conduct a study, home and abroad, of the High-Quality Seed Production Project to Egypt and dispatched a basic design study team through the Japan International Cooperation Agency from January 26 to February 12, 1982.

The Project consists of fundamental vegetable seed production facilities for breeder's seed, basic seed, and seed cleaning, together with laboratory equipment for the inspection of basic seeds in Egypt. The basic design study team conferred with the authorities concerned of the Egyptian Ministry of Agriculture and conducted on-the-spot surveys of several indicated locations as candidate sites for the facilities. By keeping the results of this actual survey in mind, the basic concept was prepared as follows:

Purpose	Specifications	Scale	Location of Installation
Production of Breeder's Seed and Research	Glass-house with air control equipment	2 glass-rooms	Dokki area
Production of Breeder's Seed	Glass-house with temperature control equip.	6 glass-houses (Abt. 2,000m^2)	Dokki area
Production of Basic Seed	Plastic greenhouse	40 green-houses (Abt. 14,000m^2)	Qaha area
Cleaning Basic Seed	Annual processing amount	162 tons	Dokki area
Testing equipment for inspection of seeds & research			Dokki area

In drafting the basic design, full consideration was extended not only to related Egyptian laws, standards, climate, construction and site conditions but also to the actual state of the vegetable seed production structure. In terms of construction, the work is expected to start five months after the Exchange of Notes is efficially signed. The construction period is estimated to be nine months, including the period of manufacture in Japan.

Experimentation of this Project will make a remarkable advance in the vegetable seed production field, and complete a consistent basis for the vegetable production system in Egypt. But to prove the Project significant, there are many problems to solve, as to establish a production management system for certified seed which has direct connection with the vegetable crop, and to establish the distribution structure all through the country for the vegetable production. It is desired for the Government of Egypt to gain a better understanding of the consequency and the problems concerning the production of vegetable, to make effort for popularizing the basic policy and for advancing the technical guidance for the vegetable production and to take a sufficient financial measure for carrying them out in a sincere manner.

CHAPTER 1
INTRODUCTION

CHAPTER 1 : INTRODUCTION

As one measure of food security, one of the most important issues in the agricultural policy, Egypt is placing emphasis on the field of vegetable cultivation. Positioned as a part of this, the improvement of vegetable production system is of vital and urgent requirement to assure the product quality and to increase productivity in order to realize the modernization of the distribution structure. In line with this aim, the Egyptian Government requested the Government of Japan for grant aid in the form of facilities related to the production of vegetable seeds. In response to the request, the Government of Japan dispatched through the Japan International Cooperation Agency a basic design study team for the High-Quality Seed Production Project to Egypt.

This study team, led by Mr. Takejiro Sato, Examiner of the Seeds and Seedlings Section, Agricultural Production Bureau, Ministry of Agriculture, Forestry and Fisheries, visited Egypt for 18 days from January 26, 1982. (The list of members and itinerary of the survey team are given in Appendix I-1 and I-4).

Upon arrival in Egypt, the study team explained the purpose and policy of the study to the Japanese Embassy in Egypt and the Cairo office of the Japan International Cooperation Agency, and obtained their understandings.

Toward the Egyptian side, the purpose and policy of the study were explained to Dr. Ali M. El Hossary, Under-Secretary for Engineering Affairs, Ministry of Agriculture, as the "coordinator" in charge for international cooperation, and his understanding was obtained.

Substantial conferences concerning the basic design were held with the persons concerned (for those of the Egyptian side, refer to Appendix I-2 and I-3). Dr. Sayed Hassan Nassar, Under-Secretary for Horticulture, and Director, Vegetable Research Department, was in charge of the negotiations. Agreement was reached by Mr. Sato the Team Leader and

Dr. Nassar on February 9. The Minutes, with Dr. El Hossary's signature of confirmation attached, were signed by both sides. (The Minutes are shown in Appendix I-5).

In this report, based on the conference results, on-the-spot surveys and data collected, the Basic Design was drawn up, the execution drafted, and the project evaluated.

CHAPTER 2
BACKGROUND

CHAPTER 2 : BACKGROUND

Food security is the most important subject in Egypt's agricultural policy. In order to cope with this, the problems that need to be solved include: (1) the establishment of an irrigation system, and soil improvement; (2) the mechanization of agriculture; (3) multiplication and distribution of high-quality seeds; (4) the improvement of storage and distribution systems for agricultural product; (5) betterment of the cropping system; and (6) assurance of cultivation area. Among these problems, the purpose of the Project was the basic design study of the production and cleaning of high-quality vegetable seeds coming under item (3) "multiplication and distribution of high-quality seeds".

First of all, it is desirable, for the seeds used in vegetable production to be characterized by the capability for increased yield. In addition, the quality should be good, the harvesting period identical, and the seeds should have proper shape and enable labor-saving (mechanization) to be carried out easily. The supply of such kinds of seeds will not only "enhance productivity" but will also have a favorable effect on the problems of storage and distribution of agricultural product whose reform is considered urgent in Egypt today. In other words, the processing of harvested crops can be mechanized and it will become easier to arrange the packaging, storage and transportation system. This will also be of assistance in preventing unnecessary loss in the delivery to the consumer.

In order to give incentive to the cultivation and diffusion of high-quality and recommended varieties and those to be bred in the future, this plan is a project aiming at the multiplication of so-called Breeder's Seed* and Basic Seed**. In addition, Certified Seed***, suppliable for actual use, can be obtained from Basic Seed. On the other hand, the official qualifications for breeder's seed, basic seed, and certified seed are authorized to vest through the designated evaluation, otherwise they shall not be produced in public. It is, however, the actual state

that the facilities and equipment for both high-quality seed production and cleaning have not well been improved to the contrary of these kinds of comparatively well controlled vegetable seed administration system in Egypt. In the light of the above, the Egyptian government requested the Government of Japan for grant aid to provide them this time.

In addition to the Project, there are many other ones under implementation in Egypt recently, some of which are closely related with it like breeding projects. It goes without saying that the all-out realization to improve the existing state shall have to be achieved not only breeding vegetable products but also modernizing the facilities and equipment for high-quality seed production and cleaning.

In this field, the breeding for cold tolerance of vegetable crop is being carried out in the Barrage district with technical assistance from the American A.I.D.

* Breeder's Seed:

The initial collection of genotypes representing a new variety.

** Basic Seed:

(a) which has been produced under the responsibility of the breeder according to accepted practices for the maintenance of the variety;

(b) which is intended for the production of seed of the category "certified seed";

(c) which, subject to the provisions and satisfies the conditions for basic seed; and

(d) which has been found by official examination.

*** Certified Seed:

(a) which has been produced directly from basic seed or, if the breeder so requests, from seed of a generation prior to basic seed which can satisfy and has been found by official examination to satisfy the conditions for basic seed;

(b) which is intended mainly for the production of vegetables;

(c) which, subject to the provisions and satisfies the conditions for certified seed;

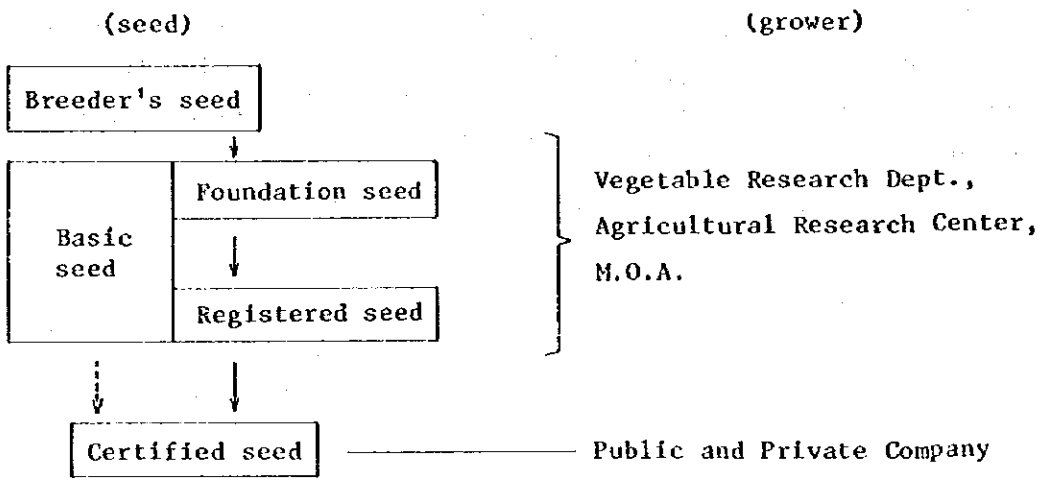
(d) which has been found by official examination to satisfy conditions;

(e) which is subject to official post-control by check inspection to verify its varietal identity and varietal purity.

2-1 Production of Vegetable Seed

According to the information obtained on-the-spot surveys, the production system of the vegetable seed in Egypt is shown in Fig. 2-1

Fig. 2-1 Vegetable seed production system in Egypt



According to this, the production of Breeder's Seed is carried out under full control at farms under the direct jurisdiction of the Ministry of Agriculture. In addition, Basic Seed is also produced in the same way.
Seed produced under such conditions should properly be of high-quality and be superior. Upon observing the present state, however, high-quality seeds are not always being produced.
These reasons for this are derived from; (1) Arrangement of the seed production system is lagging behind, and (2) Facilities are incomplete.

2-2 Seed Cleaning for High Quality Seeds

High quality is determined by undergoing a variety of tests. These tests are conducted to ascertain whether the seeds possess the essential conditions (described later). At present Egypt has a system of organs for conducting tests but the facilities for selecting and examining the seeds prior to the tests are incomplete. It became clear that this is the factor restricting the spread of high quality seeds.

The project for "multiplication and distribution of high quality seeds" in Egypt is not limited to products of vegetable horticulture. There are similar plans for other principal products. A part of this is already in the stage of implementation. Accordingly, it is necessary for this plan to be carried out and completed as rapidly as possible.

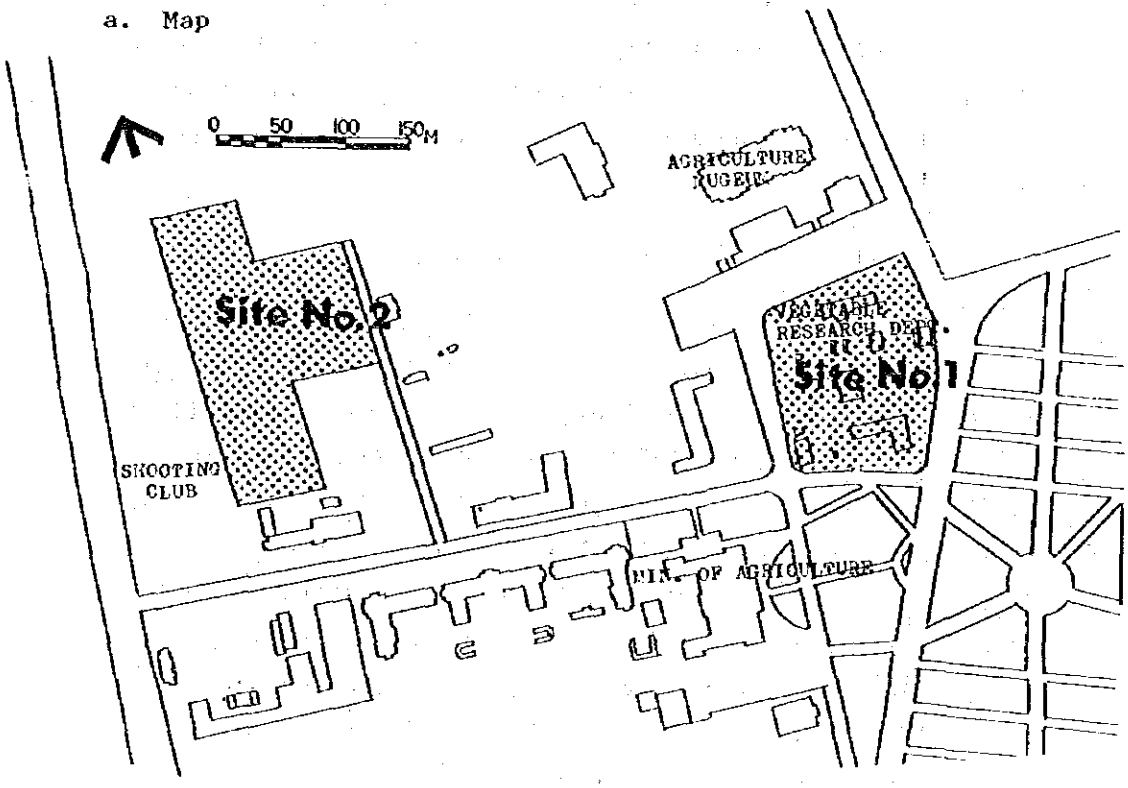
CHAPTER 3
CONDITIONS OF SITES

CHAPTER 3 : CONDITIONS OF SITES

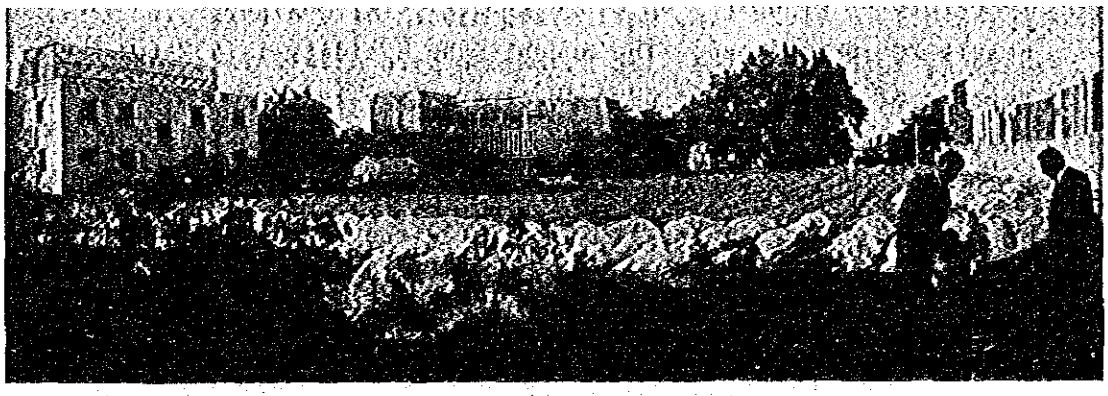
The sites for this plan are dispersed into four locations. Since individual conditions differ, they will be described separately.

(1) Site No.1 Dokki, Giza El Zira Street

a. Map



b. Photo



Field view, Left side: Seed Tech. Sec. Bldg.

c. General Condition

The site is in the complex of M.O.A. Buildings. From the administrative zoning, this is outside Cairo City and is in the Dokki district of the governorate of Giza. It is a block that was developed along the west bank of the Nile in the 19th Century. The entire site belongs to the Vegetable Research Department. Located here are three buildings and a seed research/breeding farm. On the grounds are a worn-out greenhouse (with equipment for heating by warm water piping). Aside from this, the research facilities are extremely meager.

d. Weather Conditions (Common with Sites No. 2 and 4)

From the City of Cairo, it is about 20km to the desert on the west where the Pyramids of Giza stand. Located in this district, Sites No. 2 and 4 are in an area of desert climate. There is very little rainfall, only about 25mm annually. Positioned at 30° North Latitude and 31° 15' East Longitude, there is a clear distinction between summer and winter. The nighttime temperature in winter falls below 10°C. In all seasons, there is a difference of nearly 15°C between the daytime and nighttime temperatures. The wind blows generally from the north and it is rare for the wind velocity to exceed 10m per second. A seasonal wind called khamsin blows in spring, bringing in the heat and dust of the desert. At times this wind is accompanied by high temperatures of nearly 40°C and the velocity may reach nearly 20m per second. The annual mean humidity is 45%-60%. Because of this extreme dryness, there is a large amount of dust and some device to remove the dust falling on the roof of the planned greenhouse is necessary. As to hail, the balls are very small and it is believed that ordinary thickness will be sufficient for the glass of the greenhouse.

e. Soil (Common with Site No.2)

This site situated along the left bank of the Nile is in the area called the Valley of the Nile. A large quantity of sand, silt and clay transported by the Nile through long years since the Pliocene epoch has accumulated here. The topsoil at present consists of fine silt and is suitable for cultivation. In the construction of greenhouse, standard boring and other tests have not been conducted since the bearing capacity of the ground is considered sufficient. Since no earthquake perceptible by the body has occurred from the dawn of history, there is no need to take care of earthquakes.

f. Transportation

The distribution of agricultural production is limited to the Nile River basin. This distribution practically corresponds with the distribution of the transportation network. In the Nile delta area where agricultural production is concentrated, the road transportation and railway networks have developed greatly. The farm produce from these areas is transported mainly by trucks to Cairo over the expressway called the Delta Highway (also known as the Agricultural Highway). Old-fashioned horse-drawn wagons and ox carts are also used for transportation in Cairo's suburbs. Traffic condition in Cairo City although the urban expressway is being improved, there are frequent traffic jams. In this project, Sites No.1 and 2 are within walking distance. Sites No. 1 and 4 are within a 10-minute drive from each other. Site No. 3 is linked with Site No. 4 and Site No. 1 in about 40 minutes by the Delta Highway. The transport of commodities and exchange of staff can be carried out without hindrance.

g. Infrastructure

* Electricity

Although 380V 3-phase 4-line electric power is being supplied to the premises, the supply reserve is not clear. Moreover, because of frequent power failures, an independent power plant is essential. There are 220V 50 C/S wall sockets in the rooms where experimental and research equipment is set up but a shortage of capacity is foreseen. New wiring from the distribution board will be required together with a 100V transformer to handle the newly installed equipment.

* Water

City water of comparatively good quality is being supplied. There is no problem in using this in the greenhouses and laboratories.

* Drainage

Drainage from the greenhouses can be used as irrigation for the surrounding farms and there is no problem in connection with surrounding waterways. The laboratory drainage will also be free from pollutants and since it will conform with the general level of sewerage, this can be utilized.

(2) Site No. 2 Dokki, Giza Shooting Club Street

a. Map Same as Site No. 1

b. Photo

North side view

c. General Condition

This site is about 350m west of Site No. 1. It is being used as a seed production farm under the jurisdiction of the Vegetable Research Department. The west side is adjacent to the green tract of the Shooting Club. The remaining three sides are enclosed by public buildings. It is located in a comparatively favorable environment for a cultivated field in an urban area. An advantage from the phase of maintenance control is that the personnel of the Vegetable Research Department can engage in the work directly and it is suitable for seed production requiring intensive advanced techniques. At present there are four netted greenhouses in the northwest part of the site. Although becoming worn-out, they are still in use.

d. Weather -- Soil -- Transportation Same as Site No. 1

e. Infrastructure

* Electricity

Since electricity is not being used for the present facilities, service to the site must be newly installed. Although 3-phase 380V will be required, there is wiring up to the Ministry of Agriculture's Training Center under construction in the southeast part of the site. An extension will be capable.

* Water

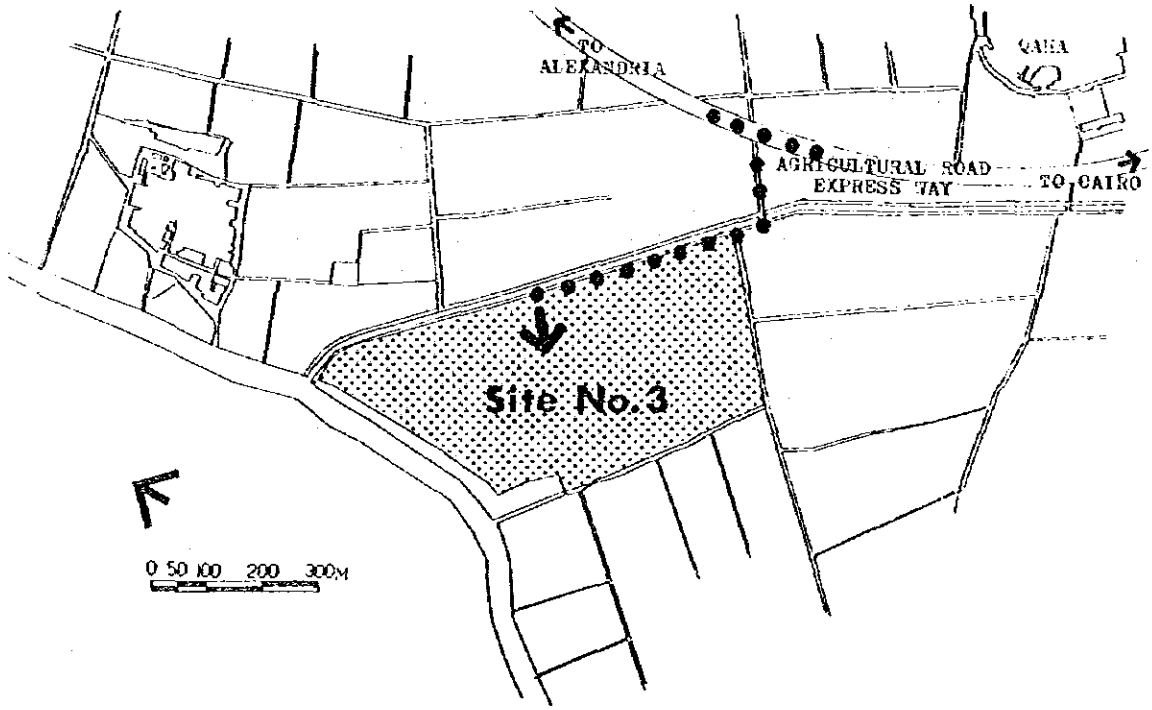
There are city water intakes and are used for sprinkling in the netted greenhouses and for sprinkling to the field. it is possible for these to be extended and a connection made for the supply of irrigation to the glass-houses.

* Drainage

There are small waterways for irrigation to the farm. These can be used for drainage.

(3) Site No. 3 Qaha, Kalubia

a. Map



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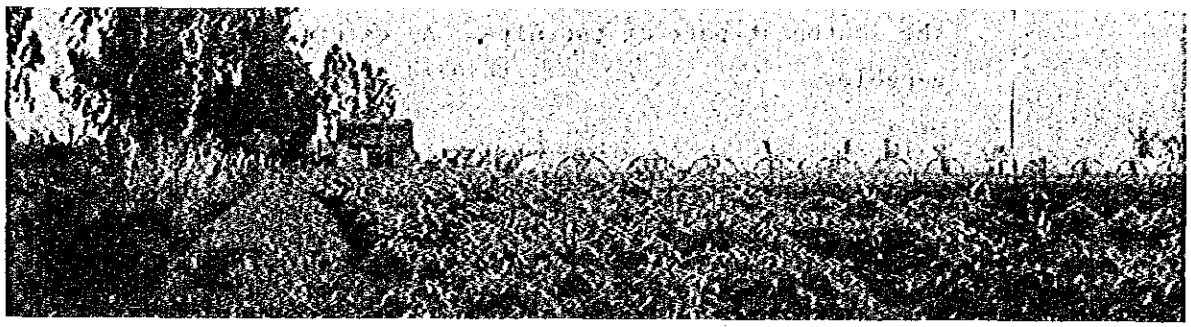
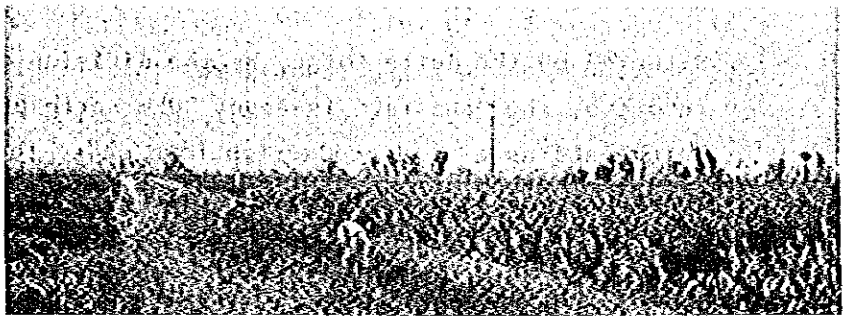
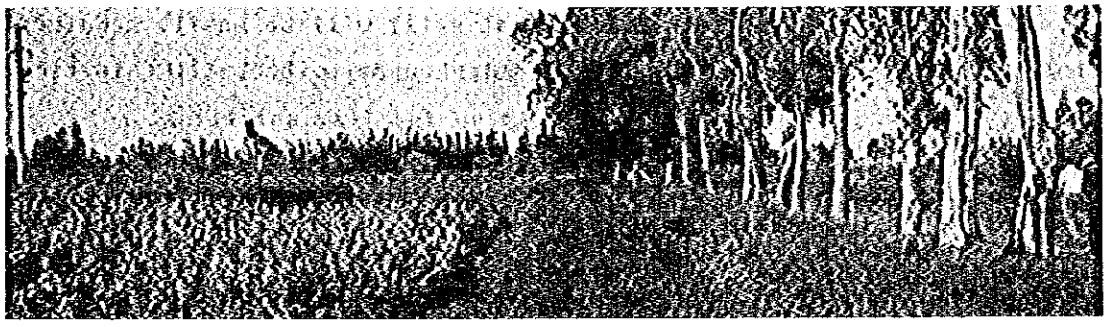


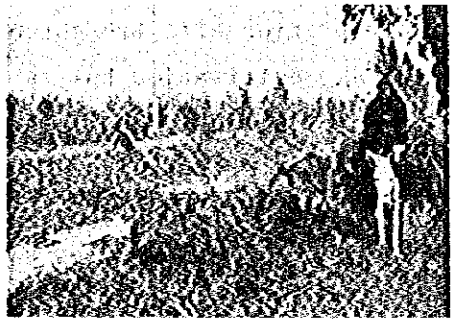
South side view



West side view



North side view



Canal

c. General Condition

Situated on the delta formed by the division of the Nile River into two, the Qaha farm is about 30km north of Cairo. It is being used as a seed production farm under the jurisdiction of the Vegetable Research Department. The farm, which is about 100m away from the Delta Highway, is 17 ha in size. There is an irrigation canal on the east side of the site. When filled with water, the waterway has a width of about 7m. Although the water volume is sufficient, since the water level is low, it is being pumped up for use at the present time.
A administration building (2-story ferroconcrete structure) to maintain the farm is under construction. Seed cultivation is being carried out in simple plastic-houses (semi-cylindrical shape). It is anticipated that skill will be easily acquired for the operation of the plastic-houses to be built this time.

d. Weather

Generally the same as the Cairo area but the annual humidity is higher. Particularly from June to September, the mean humidity is 72%, being about 10% higher than Cairo. It is believed that this is caused by the topography.
The temperature, wind direction, wind velocity and amount of rainfall have a close resemblance with Cairo.

e. Soil

As in the case of the Cairo area, the topsoil is composed of fine silt brought by the Nile River. It is suitable for cultivation but as seen in other regions, there is an actual decline of soil fertility and soil improvement with the use of fertilizers and other means is constantly required. In a part of the other areas, the rise of the underground water level is causing salt damage but this has not taken place

at this site. Bearing capacity of the ground for the structural construction of the greenhouses and warehouse can be assured with a ferroconcrete foundation.

f. Transportation

The site is connected with Cairo in about 40 minutes by the Delta Highway but there is only a farming road 2.5m wide to connect with the highway. The bridge spanning the canal is also deficient. It is believed that during construction, a road for the construction and a temporary bridge will be necessary.

g. Infrastructure

* Electricity

High-voltage power lines run through the site but the planned facilities will not be making use of electric power.

* Water

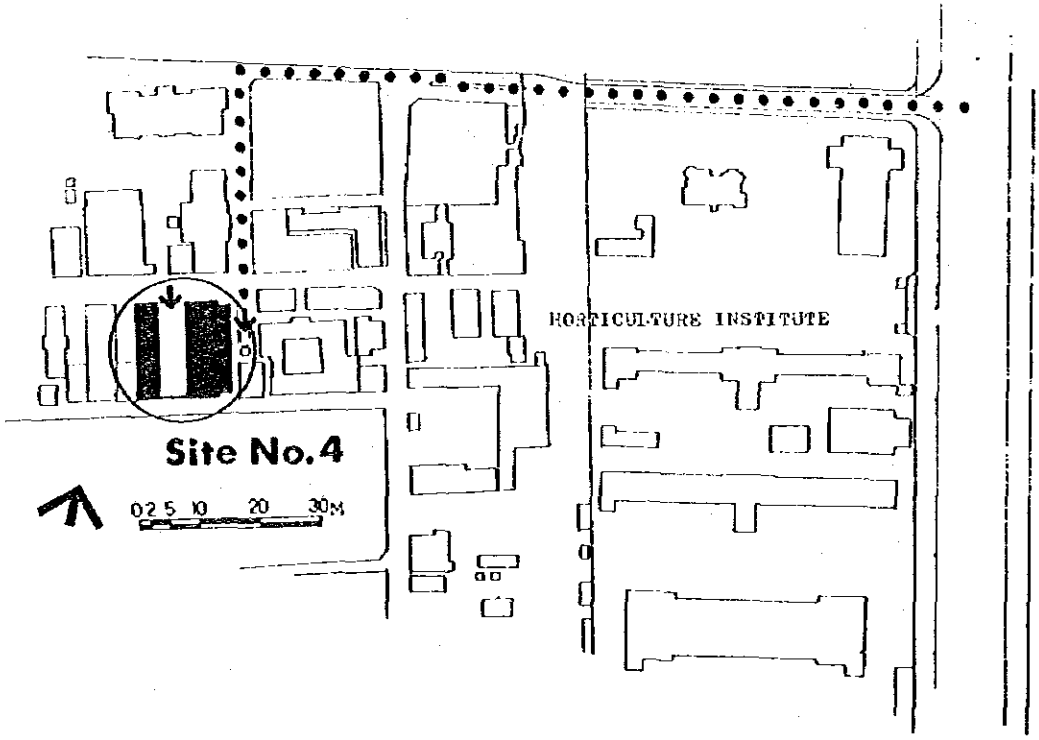
There are no provisions for city water supply and sewage. Use of the canal water for irrigation is being planned.

* Drainage

The inside of the greenhouses is cultivated soil. Irrigated water will be percolated through the soil and drainage facilities will be unnecessary.

(4) Site No. 4 Dokki, Gaza Shahri Gamiat Street

a. Map



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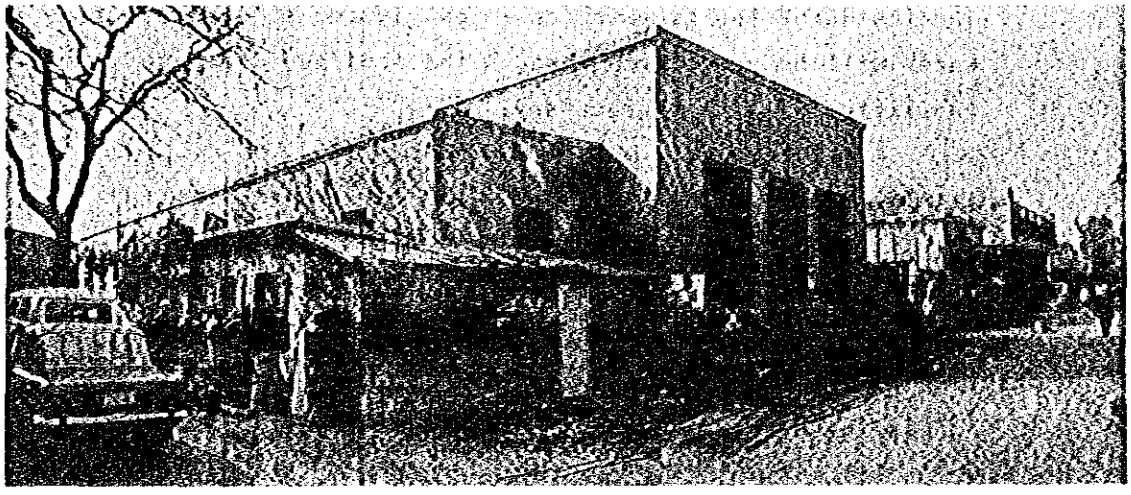
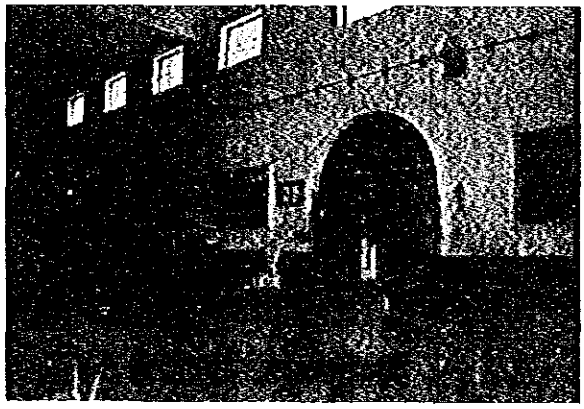
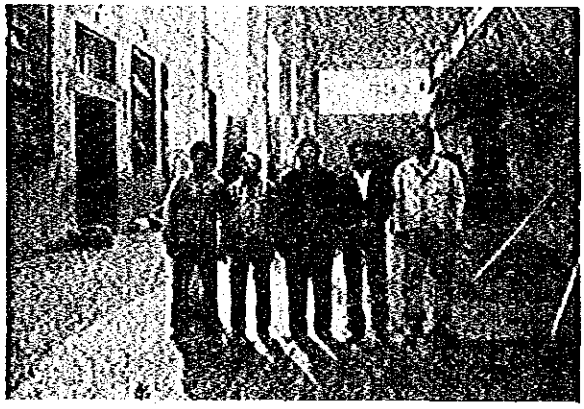


Existing seed cleaning station Bldg.



Work shop



Open work shop

c. General Condition

A building situates in part of the Horticultural Research Institute is under the direct control of the Vegetable Research Department and carries out seed cleaning. The one-story concrete structure has a sufficiently high ceiling of 7m.

Although it is old, it can continue to be used by making repairs. The worn-out windows and doors should be reinstalled. There is also a need for a ventilation opening connected with the dust collection device. The warehouse can also continue to be used with repairs. The warehouse with air-conditioner is a double walled structure with insulation. Preservation of seeds here is possible.

d. Weather -- Soil -- Transportation Same as Site No. 1

e. Infrastructure

* Electricity

The present electric power distribution is 380V 3-phase.

* Water

City water supply and sewage are provided.

CHAPTER 4
DESIGN CONCEPT

CHAPTER 4 : DESIGN CONCEPT

This Project is forming a part of Egypt's food security. "Production and Distribution of High Quality Seeds" are set forth as objectives in the "General Strategy for Agriculture, Irrigation and Security 80/81 -- 84/85" which was revised in 1979. The Project includes the establishment of facilities for the production of high quality vegetable seeds, and installation of inspection apparatus for the cleaning, testing and research of vegetable seeds. In regard to the former, the plan calls for facilities to increase Breeder's Seed and Basic Seeds. For the latter, the plan seeks seed cleaning facilities together with facilities and equipment for basic research. It is a consistent plan running through from the production of high quality seeds to the stages of cleaning and packing.

4-1 High Quality Vegetable Seeds

Crops are propagated by seeds or nutrients. Vegetables are the crops which are the subject matter of this plan. They are in all cases propagated seed crops.

4-1-1 Conditions of High Quality Seeds

It is well known that the quality of seed will have a big effect on the growth and yield of agricultural products. Accordingly, the seeds used for vegetable production must be of as high quality as possible. The conditions that high quality seeds should possess are as follows:

(1) Equipped with favorable character and also possessing phenotypical stability

(2) No varietal mixture

(3) Does not contain seeds of weeds or invert matter

(4) Good degree of maturity.

(5) High germination rate.

(6) Not susceptible to disease

(7) Recent year of growth

(8) Others.

4-1-2 Seed Growing Conditions

In vegetable production, even if the same variety of seed is used, a big difference in yield and quality may arise, depending on the seed farm or natural environment in the year of growth.

As the causes for this, (1) change in the character of the seeds and (2) difference in the physiological condition of the seeds have been pointed out as problems.

Nevertheless, in the case of vegetable seeds with a high degree of genetical purity, if efforts are made to obtain mature high quality seeds, it should be possible to ignore the effect of seeds on vegetable production.

This is a problem that can be solved if attention is given solely to the production of seeds in a good atmosphere under strict observation.

If thought is now given to seed farm conditions, what is desirable are that (1) it should be favored by a natural environment and (2) it should possess a high level of production techniques. It is only when these conditions are fulfilled that high quality seeds can be supplied in large quantity and in a stable manner,

The following natural condition should be essential to yield high quality vegetable seeds:

* Fertile soil.
* Stable weather in the flowering and ripening stage.
* Suitably day light can be obtained.
* Pest control can be carried out easily.
* Changes in the natural environment can be coped with easily.
* Intervarietal crossing can be prevented.
* The genetical character of the seed can be fully expressed.
* Use of pollinator (bees, drone flies) is possible.
* Water of good quality (water supply) for washing seeds can be obtained.

The following points can be thought of as the technical conditions should be met to produce high-quality vegetable seeds:

* Varietal feature.
* Preventing degeneration of variety.
* Preventing varietal mixture.
* Suitable cultivation control.

4-2 Growth and Physiological Propagation of Vegetable Crops

There is a large variety of vegetable crops which react natural environmental conditions, especially temperature in different manners and reproduction physiology under various given conditions, which shall be applied for in the growth of vegetables. Vegetable crop are classified as follows under various given temperature during the growing period, shown in Table 4-1.

Table 4-1 Classification of temperature adaptation

Heat tolerance	Intermediate	Cold tolerance
Watermelon	Tomato	Pea
Cucumber	Bean	Broad bean
Squash		Lettuce
Sweetmelon		Cabbage
Eggplant		Cauliflower
Sweet pepper		Radish
		Turnip
		Spinach

In this Project the vegetables can be classified, as shown in Table 4-2, by their propagated habit.

Table 4-2 Classification of propagated habit for vegitable crops in the Project

Self pollinated propagation crop (completely)	Cross pollinated propagation crop	Cross pollinated propagation crop (completely)	Unisexual flower crop
Tomato	Watermelon	Cabbage	Spinach
Eggplant	Cucumber	Cauliflower	
Sweet pepper	Squash	Radish	
Okra	Sweetmelon	Turnip	
Pea		Carrot	
Cowpea			
Broad bean			
Lettuce			

4-3 Facilities and Equipment

The planned facilities and equipment as confirmed by the results of consultations between the Egyptian side and the Study Team were:

(1) Facilities for production of high-quality vegetable seeds (research facilities included partially).

(2) Vegetable seed cleaning facilities (research facilities included partially).

4-3-1 High Quality Vegetable Seed Production Facilities

These facilities are of the following three kinds:

(1) Inspection of specific character and production facilities of Breeder's Seed (Site No. 1).

a. Content

These facilities are glass-houses with air-conditioning and adjustment of day-light length. With the scale of temperature control assumed to be 15°C. The following inspections and research will be conducted. The units to be accommodated are about 20 to 25 plants in (300mmφ Diamater) or containers. The space is suitable enough for enabling several researchers to exercise control.

b. Uses

By using these facilities, the following tests of variety and research can be carried out:

* Sensitivity to temperature test.

* Sensitivity to day-light length test.

* Cold and freezing tolerance test.
* Heat tolerance test.
* Drought tolerance test.
* Performance test.
* Water relation test.
* Mother plant selection,
* Test for specific character.

These inspections and research are to conduct basic investigation indispensable for high-quality seed production of Breeder's seed by inspecting required conditions and also to get the basic data on newly bred varieties for the distribution in public. Then again, in the production of Breeder's Seed, these are facilities able to accelerate and/or restrain a new generation. The crops to be the subjects are vegetables as a whole but the tests will be particularly effective for salanaceous and pulse crops, and cole herbs.

(2) Facilities for Production of Breeder's Seed (Site No.2)

a. Content

These facilities are glass-houses with temperature control. Depending on the use, they can be partitioned. Temperature control will keep the temperature inside at 30°C-35°C during periods of torrid heat. During the severe winter period, the temperature is kept at about 10°C.

b. Uses

The purpose of these facilities is multiplication of Breeder's Seed. As to their function, by planting a variety among summer varieties not easily subject to heat injury (Table 4-3), these are facilities that will be effective in multiplicate that seed.
Among winter varieties, cold injury can be prevented and the effect of shortening the growth period can be anticipated. In the production, with the use of a pollinator (honey bees or drone flies), enhancing the efficiency of pollination and labor-saving can be anticipated. The facilities can also be used for the isolated cultivation of the mother plant in the seed production for other crops. They are believed to be particularly suitable for solanaceous, pulse and crucifer crops, and cole herbs.
According to the Egyptian proposal, the amount of Breeder's Seed desired by the use of these facilities is about 0.5 ton annually.

Table 4-3 Kind of vegetable crop for high temperature injury

Crop	Temperature	Damage
Cucumber	30°C<	Pollen function
Squash	35°C<	Flower development
Tomato	30°C<	Pollen function
Eggplant	"	"
Bean	"	"
Cabbage	25°C<	Growth
Cauliflower	"	"

c. Production Amount

If production is carried out by using these facilities, the production amount shown in Table 4-4 can be expected for the respective vegetables.

Table 4-4 Expected amount of Breeder's seed in Site No. 2

Crop	Expected amount (Kg/10a)	Crop	Expected amount (Kg/10a)
Watermelon	35	Cow pea	100
Cucumber	30	Bean	120
Squash	40	Lettuce	20
Tomato	25	Cabbage	40
Eggplant	30	Cauliflower	30
Sweet pepper	20	Radish	100
Okra	150	Turnip	80
Pea	100	Spinach	100
Broad bean	100	Carrot	60

(3) Facilities for Multiplication of Basic Seed (Site No. 3)

a. Content

These facilities are permanent plastic-houses. The scale of each greenhouse is estimated at about 7m x 50m. Then again, by the use of a pollinator (honey bees or drone flies), these facilities can enhance the efficiency of pollination and also provide for labor-saving.

b. Uses

These facilities are plastic-houses intended for the production of Basic Seed by using Breeder's Seed.

c. Production Amount

The crops that can be produced efficiently with the use of these facilities and the expected production amount is shown in Table 4-5.

Table 4-5 Expected amount of Basic seed in Site No. 3

Crop	Expected amount (kg/ha)	Crop	Expected amount (kg/ha)
Watermelon	250 ∿ 400	Cow pea	750 ∿ 1,000
Cucumber	250 ∿ 350	Bean	1,000 ∿ 1,500
Squash	300 ∿ 450	Lettuce	150 ∿ 200
Tomato	200 ∿ 300	Cabbage	300 ∿ 450
Eggplant	250 ∿ 350	Cauliflower	250 ∿ 350
Sweet pepper	150 ∿ 200	Radish	750 ∿ 1,000
Okra	1,000 ∿ 1,500	Turnip	600 ∿ 850
Pea	750 ∿ 1,000	Spinach	750 ∿ 1,000
Broad bean	750 ∿ 1,000	Carrot	450 ∿ 650

4-3-2 Vegetable Seed Cleaning Facilities (Site No. 4)

It is to install new cleaning equipment inside the existing seed Cleaning building under the direct control of the Egyptian Ministry of Agriculture. That is, to clean collected seed to meet the international standard. The annual processing amount will be 150 tons of large seeds and 12 tons of small seeds.

(1) Content

a. Cleaning System for Large Seeds

The seeds to be handled will be those of pulse and large-sized melon varieties.

Hourly processing capacity -- 250kg

Daily processing amount -- maximum 1.5 ton

Annual processing volume -- 150 tons

Days of operation per year -- 60 days

b. Cleaning system for small seeds

Cabbage, radish, cauliflower and other seeds will be handled.

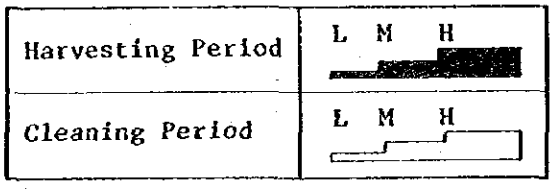
Hourly processing capacity -- 50kg
Daily processing amount -- maximum 300kg
Annual processing volume -- 12 tons
Days of operation per year -- 60 days

(2) Amount and Period by the Crop

The cleaning amount and period by the crop are shown in Table 4-6.

Table4-6 HARVESTING AND CLEANING TABLE

CROPS	AMOUNT OF BASIC SEED Ton	Kg	MONTH 1 2 3 4 5 6 7 8 9 10 11 12
Watermelon	10	-	
Cucumber	2	-	
Squash	2	-	
Sweet melon			
Tomato	1	-	
Eggplant	-	25	
Sweet pepper	-	250	
Okra	3	-	
Jew's mallow	3	-	
Pea	60	-	
Broad bean	2	-	
Cow pea	14	-	
Bean	60	-	
Lettuce	-	20	
Cabbage	-	50	
Cauliflower	-	60	
Radish	1	-	
Turnip	-	500	
Spinach	-	500	
Carrot	1	-	



4-3-3 Vegetable Seed Cleaning/Inspection Equipment for Experiment and Research

This equipment is to be installed as inspection and research/experiment apparatus in the Seed Research Room of the Egyptian Ministry of Agriculture's Vegetable Research Department.
It can also be used for prior inspection of the vegetable seeds cleaned in 4-3-2.

(1) Vegetable seed cleaning equipment for inspection -- one set

(2) Testing equipment for seed inspection -- one set

CHAPTER 5
BASIC DESIGN

CHAPTER 5 : BASIC DESIGN

5-1 Policy

As stated in the previous Chapter, the specifications and scale will be decided for the facilities to satisfy the necessary conditions in producing high quality vegetable seeds. It is important for the policy to be determined with the recognition that agricultural techniques have been fostered in a historic background of several thousands years.

The scale of agricultural management in Egypt is comparatively close to that of Japan. There is little familiarity with large-sized mechanized agriculture. Accordingly, it is believed that the medium and small-scale agricultural facilities generally being used in Japan at present can be easily accepted in Egypt.

The facilities and especially the incidental equipment will be simplified as much as possible and their handling will be made easy. At the same time, these facilities provide for lightening the burden of operation.

5-2 Design of Facilities

5-2-1 Standards, Regulations

Although Egypt does not have complete laws pertaining to architecture, there are various individual regulations. None of them applies, however, to the greenhouses this time for horticulture.

Accordingly, for standards and criteria, JIS, JEM JAES (the Japanese standards for agricultural facilities) will be applied as safe structural standards.

5-2-2 Summary of Facilities

(1) Greenhouse

a. Site No. 1 (Glass-houses with Air-Conditioning Equipment)

None of something like Phytotron (artificial weather room), greenhouses able only to adjust temperature, especially cooling in summer, will be built.
Generally when a glass-house is air-conditioned, large-scale refrigerating equipment is required. In this case, a sunshade will be installed to the inside and outside of the glass. Large-sized refrigerating equipment has been avoided. Air-conditioning is carried out in all respects by the most simple equipment. It is carried out by a combination of an air cooling/heating pump chilling unit and an air handling unit.

b. Site No. 2 (Glass-houses with temperature adjustment equipment)

Methods for cooling the greenhouses are:

(1) Evaporation cooling method
- Pad and fan method
- Mist and fan method
- Fog and fan method (fine mist cooling)
- Roof spray method

(2) Air-cooling with cold water method.

(3) Air-cooling with refrigerator method.

Among these methods, the one most generally used is the evaporated cooling-- pad and fan method. This has spread to a considerable extent in the United States and elsewhere.

Nevertheless, because its length of service is short and it is also expensive, its use entails difficulties. There is anxiety, in the case of the mist and fan method, that

there will be a bad effect on crops on the water spray side. The roof spray method has a low cooling effect, and besides, algae are likely to appear on the glass. Much time will be required for cleaning. Air-cooling with cold water and air-cooling with large-scale refrigerating equipment will not be practical. Fine mist cooling is a method in which pure water is sprayed inside a greenhouse as fine mist and cools the interior with evaporation energy. By providing suitable ventilation, the entire interior can obtain a cooling effect. The high humidity arising in the greenhouse with the generation of fine mist is regarded as being suitable for the cultivation of crops under solar radiation. Besides, water of good quality can be obtained easily at this site and so this can be said to be the most suitable cooling method.

On the other hand, heating is very easy. Use will be made of a warm air heater (with kerosene as fuel) which is inexpensive both to install and to operate.

In the irrigation facilities, by restricting the amount of ventilation, first of all, the fine mist cooling device can also serve for irrigation, but water supply pipes for irrigation will also be installed between furrows so as to enable sprinkling or dripping.

c. Site No. 3 (Plastic Greenhouses)

* Covering Material

Plastic material will be used as the covering of these facilities which are the most numerous among the structures to be built this time. Since plastic covering material comes in a great variety of quality and shapes, the selection should be made very carefully.

In other words, the unit cost of the covering materials that appears in the construction cost will differ greatly depending on the material. Attention should also be given to durability. The durability of soft plastic film is only one-tenth that of hard material and should therefore not be used on the parts of the roof where re-covering work will be difficult.

It will be used, however, on the side walls since it has the advantage of being easily lifted and removed for the sake of ventilation.

* Irrigation Equipment

At the east side of these facilities is a canal for irrigation. At present there is a pumping device for drawing up water. A furrows irrigation method is being carried out.

The existing equipment will continue to be used. In addition, a storage tank will be newly installed and a part of the drawn up water will be stored and by using a newly installed water conveyance pump (driven by an engine) and pipes, irrigation water will be supplied to the various greenhouses. Since the irrigation method differs according to the planted variety, measures will be taken so that all the available methods, including overhead sprinkler, water sprinkling pipes, drips and others can be handled.

The past method of irrigation between furrows will be retained but in order that water can be drawn easily into the greenhouses, water conveying pipes will be installed in the building foundations.

The water pressure of the supply pipes for irrigation will be used for operation of the mobile type water gun, a device for washing out of falling dust.

(2) Seed Cleaning Design

Seed cleaning machine will be installed in the existing building in the Horticultural Research Institute.

With this, a cleaning process can be carried out by which 20 varieties of vegetable seeds can be separated into groups and cleaned by scale and shape.

Since the existing building will be used for installation of the cleaning machine, repairing work to accommodate the new equipment will be necessary.

Use will be made of the existing power source for electricity. The wiring inside the building will be made entirely renew.

5-2-3 Specifications of Facilities

(1) Site No. 1

* Glass-houses (with air-conditioning equipment)

Use of Facilities

1) Sensitivity to temperature test.
2) Sensitivity to daylight length test.
3) Cold tolerance test.
4) Heat tolerance test.
5) Drought tolerance test.
6) Performance test.
7) Water relation test.
8) Specification character inspection.

Table 5-1

Item	Specifications/ Measurements	Design Conditions
Greenhouse measurements	5m x 5m x 3.2m x 2 rooms	
Main construction materials	Galvanized light-gauge steel	
Covering material	Glass, 3mm thickness Aluminum sash	
Insect control net	Plastic net	Prevention of intervarietal crossing. Use of pollinator
Light and heat interception curtain	Exterior and interior extension	
Foundation	Ferroconcrete	
Flooring	Concrete	
Machine room	Measurements: 4m x 10m x 4.4m(H) Ferroconcrete and red brick	
Design conditions of outdoor temperature	Summer 40°C (DB) 27.9°C (WB) 40% (RH) Winter 2°C (DB) 0.3°C (WB) 76% (RH)	
Design conditions of temperature inside greenhouse	Summer 20-35°C (DB) Variable Winter 5-25°C (DB) Variable	

Humidification equipment	50-80% (RH)	
Ventilation equipment	Opening/shutting of ridge and side windows Combined with forced ventilation with power-operated ventilator	
Air-conditioning equipment	Air-conditioning: Air cooling/heating pump; chiller unit and air handling unit	
Irrigation	City water pipes	
Electrical equipment	Electric power: 380V, 3-phase, 50Hz Low tension: 220V, 1-phase, 50Hz	
Emergency generator	Generator linked directly with diesel engine (package type) 380V, 3-phase, 50Hz, 4W 220V, 1-phase, 50Hz	

* Vegetable seed cleaning equipment for inspection

1) Gravity separator
2) Grader
3) Vacuum seed blower
4) Scarifier

* Equipment for seed inspection

1) Fixed thermostatic germinator
2) Constant thermostatic germinator
3) Thermostatic water shaker
4) Grain sample divider
5) Vacuum seed counter
6) Dissecting binoculars
7) Stalk balance
8) Direct reading balance
9) Infrared moisture tester
10) Drying oven
11) Seed refrigerator
12) High pressure soil sterilizer
13) Steam sterilizer
14) Laboratory seed blower
15) Temperature and moisture indicator
16) Agrichemical mixer (pesticide)
17) Grain grinding mill
18) Microscope specimen making instrument set
19) Biological microscope
20) Microphotographic equipment
21) Labo. washer
22) Universal projector

(2) Site No. 2

* Glass-houses (temperature adjustor attached)

Use of Facilities

1) Production of Breeder's Seed
2) Production of pure bred seed
3) Production of high purity seed
4) Production of seed with high averaged germination rate; non-susceptible to disease

Table 5-2

Item	Specifications/ Measurements	Design Conditions
Greenhouse measurements	7m x 50m x 3.5m(H)	
No. of greenhouses	6	
Main construction materials	Galvanized light-gauge steel	
Covering material	Glass 3 mm thickness Aluminium sash	
Insect control net	Plastic net	Prevention of intervarietal crossing; pollinator used
Ridge and side windows	Manual operating	Conforms with sensitivity to temperature
Light interception and insulating curtain	Interior extension style (manual)	Conforms with sensitivity to day light length
Foundation	Ferroconcrete	
Design conditions of outside temperature	Same as for Site No. 1	
Design conditions of indoor temperature	Summer: Cooled (DB) to outside temperature Winter: 20°C (DB)	

Cooling method	Fine mist method (fog and fan) Air intake; plastic wool with insect control net and water sprinkler Air outlet (power-operated)	
Heating method	Warm air heating method; Boiler (kerosene) Warm air with polyethylene duct	
Irrigation facilities	City water pipes	
Dust removal	Mobile type water gun	

(3) Site No. 3

* Plastic greenhouse

Use of Facilities Production of Basic Seed

Table 5-3

Item	Specifications/ Measurements	Design Conditions
Greenhouse measurement	7m x 50m x 3.5m(H)	
No. of greenhouses	40	
Main construction materials	Galvanized light-gauge steel	
Covering material	Roof : hard plastic Wall : soft plastic	
Insect control net	Plastic net	

Ridge window	Manual opening/shutting device attached	
Light interception and insulating curtain	Interior extension style (manual)	
Foundation	Ferroconcrete	
Dust removal equipment	Mobile type water gun	
Office and storeroom for materials	Ferroconcrete and red-brick Office : 6m x 7m Storeroom: 6m x 15m	
Machines for cultivation	Rotary Cultivator 5HP tiller 15-20HP tractor With rotary set and attachments Furrowing Tiller, tractor Set and attachments Transport For tractor With trailer set and attachments Insect Control Portable engine sprayer	
Soil sterilization equipment	Soil Sterilization Sterilizer with chemicals carried out tractor Attachments for tractor	

	Crops Sterilization Spray carried on back Spraying nozzle and other attachment	
Irrigation facilities	Irrigation water storage tank Water conveying pump (driven by engine) Piping (with branch valve)	

(4) Site No. 4

* Seed Cleaning Facilities

First system ---- Seeds: watermelon, cucumber, squash, melon, eggplant, pepper sweetmelon, cauliflower, cabbage, turnip

1) Bucket elevator
2) Destone
3) 2-way separator
4) Gravity separator
5) Blower
6) Shaker

Second system --- Seeds: sweetmelon, cauliflower, cabbage, turnip

1) Bucket elevator
2) Sorter
3) Destone
4) Blower
5) Shaker

Third system --- Seeds: okra, cowpea, pea, bean, broad bean, radish, spinach

1) Bucket elevator
2) Sorter
3) Destone
4) Gravity separator
5) Blower
6) Shaker

Drying, Weighing, Packaging Stages

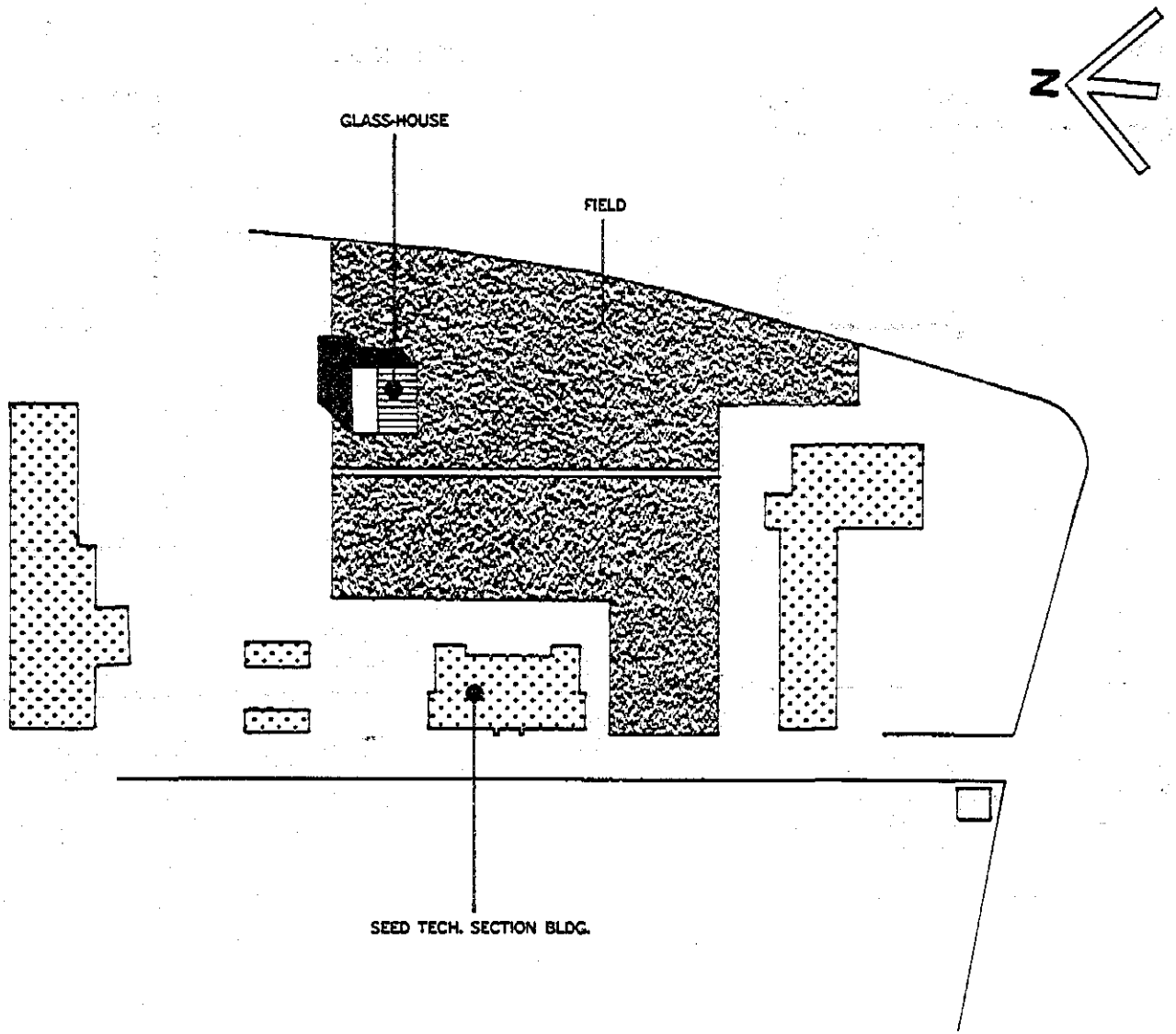
1) Seeds dryer
2) Bucket elevator
3) Automatic scale
4) Packaging machine
5) Automatic canning machine

5-2-4 List of Supply for Each Facilities

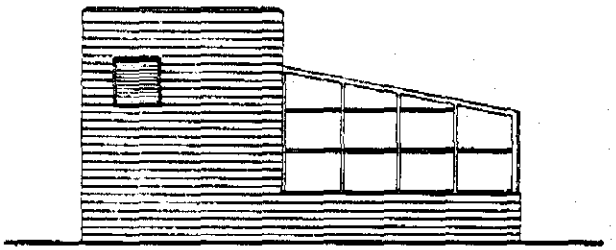
Table 5-4 List of Supply

Site No.	Establishment	Electric Supply		Water Supply		
		Electric Power 380V, 3φ, 50Hz	Electric Lighting 220V, 1φ, 50Hz	Cooling water	Irrigation water	Canal Water for Irrigation
1	Greenhouse	40kw	1.0kw		150ℓ/day	
1	Seed cleaning for inspection	2.0kw				
1	Seed inspection		9.0kw			
2	Greenhouses	17. kw		6.5m³/day	6.3 "	
3	Greenhouses					42m³/day
4	Seed cleaning equipment	43. kw	1.0kw			

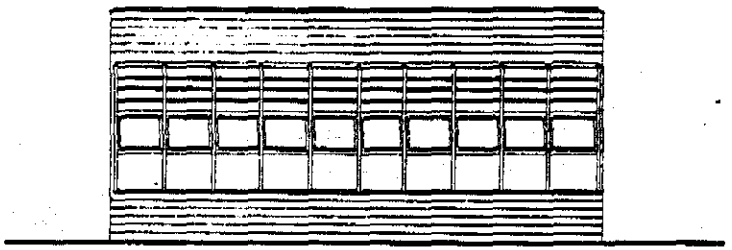
5-3 BASIC DRAWING



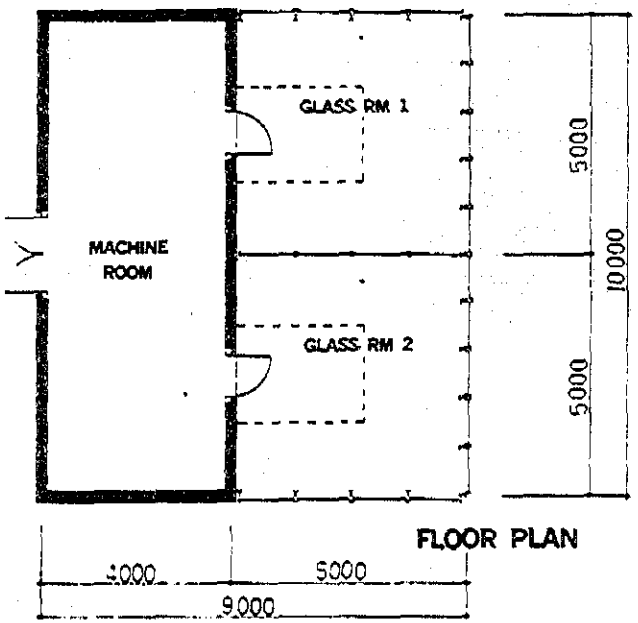
Site No.1 SITE PLAN SCALE 1:1000 1



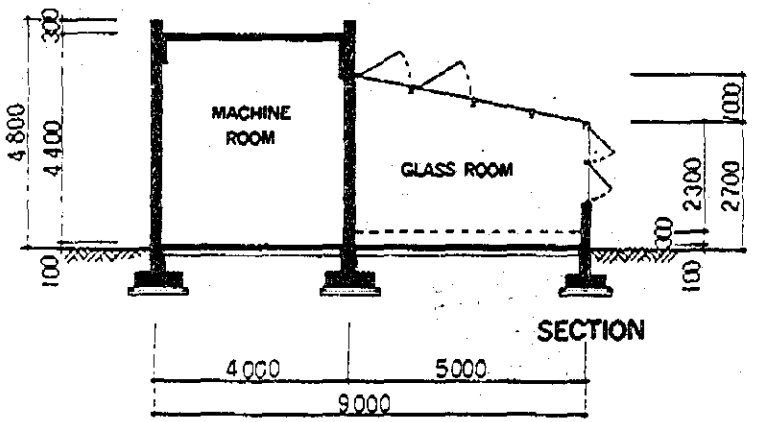
WEST ELEVATION



SOUTH ELEVATION



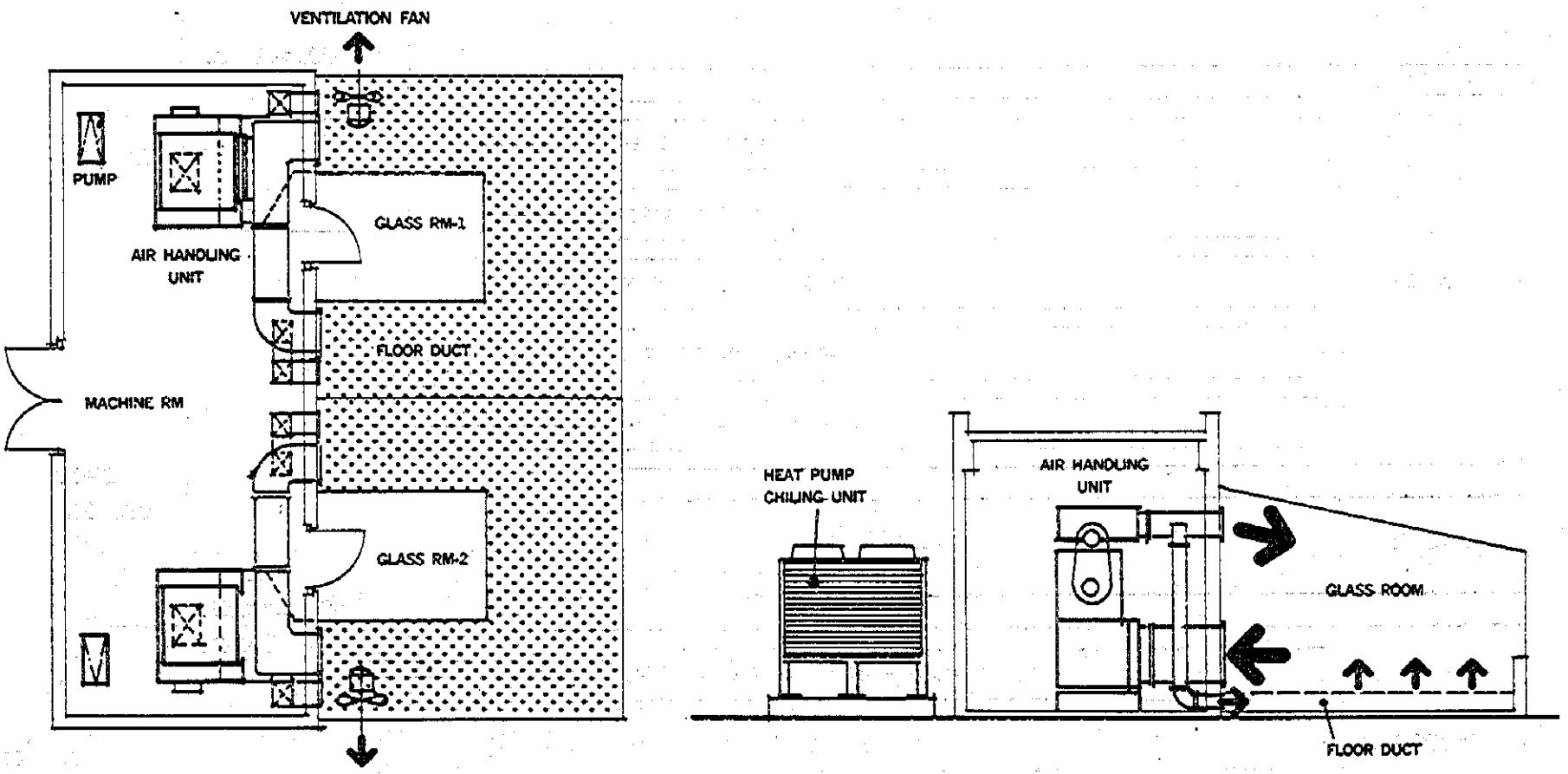
FLOOR PLAN



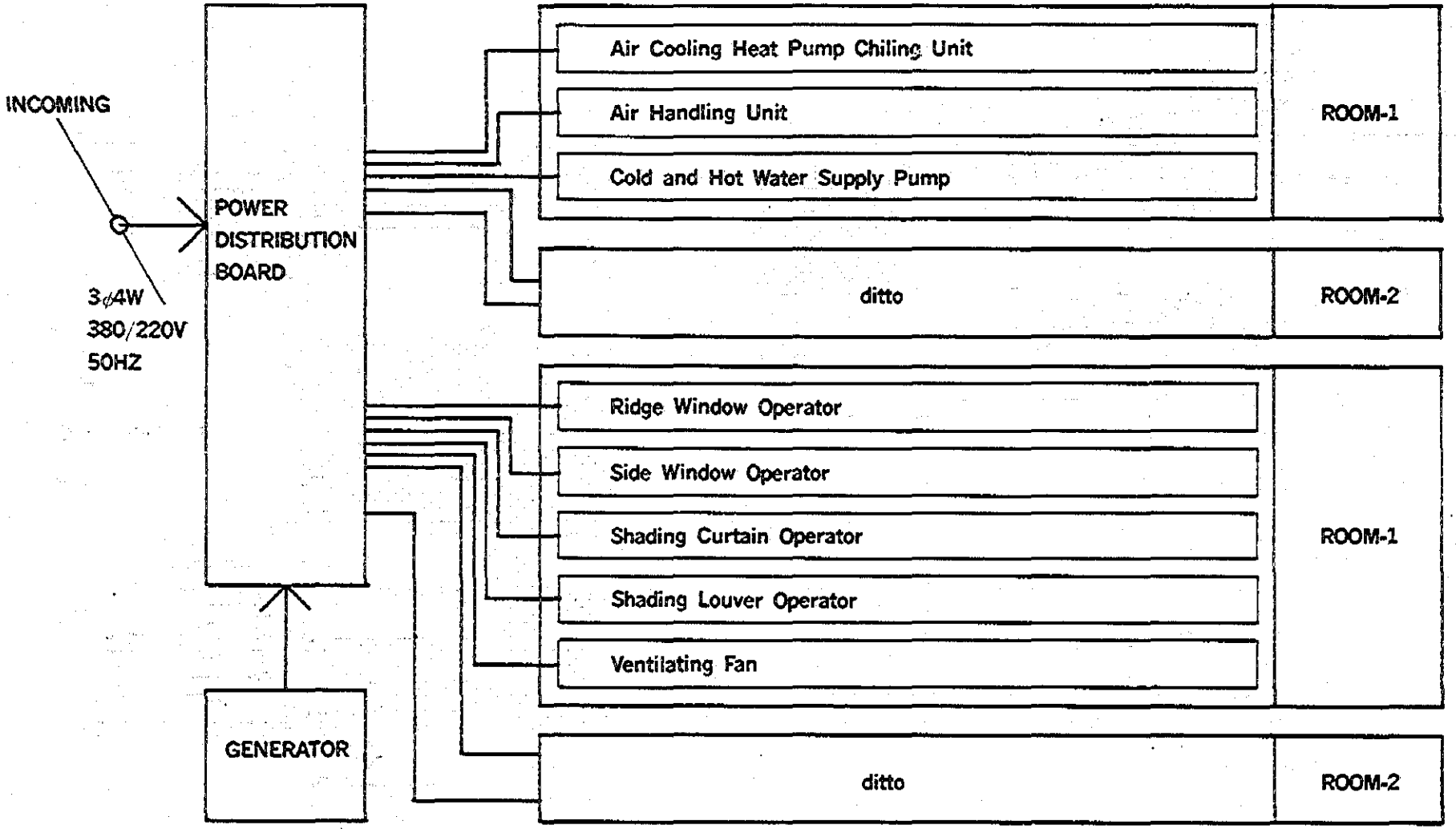
SECTION

Site No.1 AIR-CONDITIONED GLASS-HOUSE SCALE 1:150

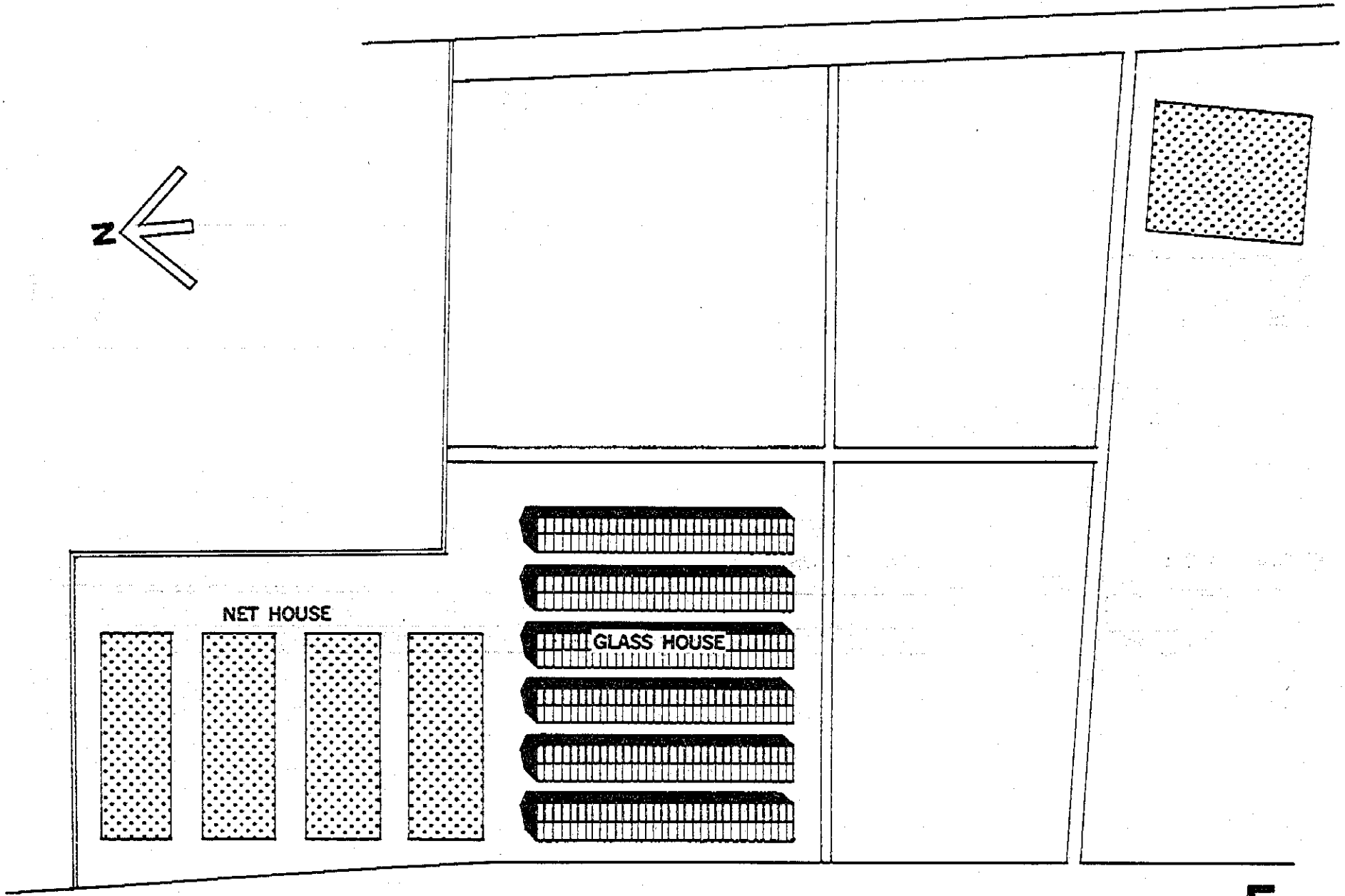
2



Site No.1 AIR CONDITIONING SYSTEM SCALE 1:100 3



Site No.1 POWER SUPPLY DIAGRAM 4

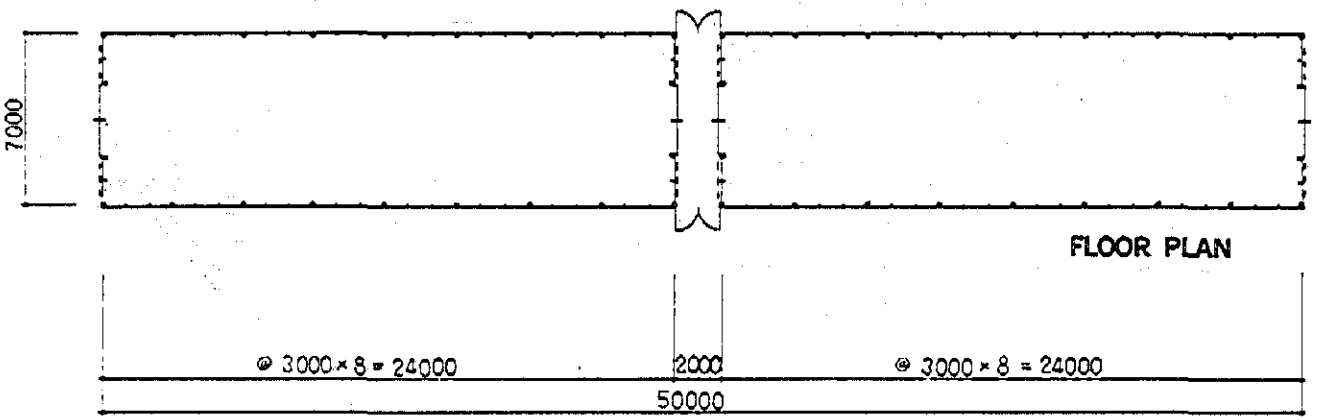


Site No.2 SITE PLAN SCALE 1:1000

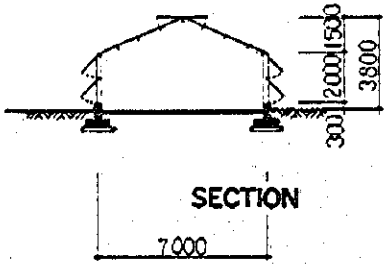
5

WEST ELEVATION

SOUTH ELEVATION

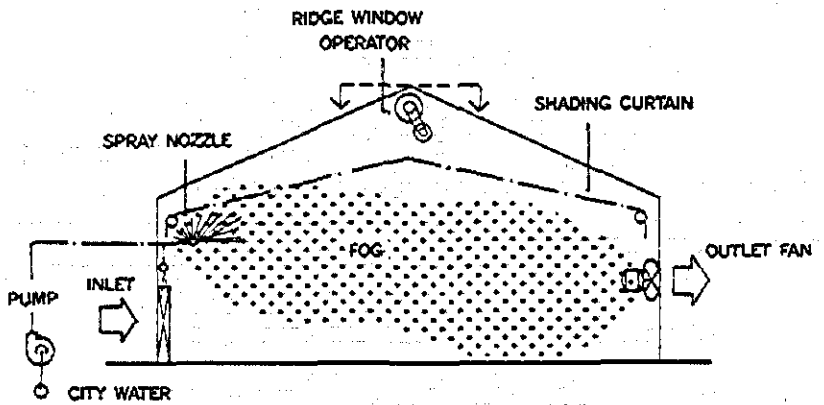


FLOOR PLAN

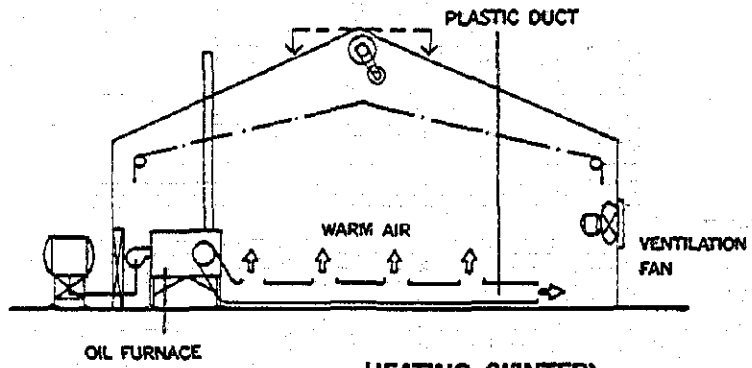


SECTION

Site No.2 GLASS-HOUSE SCALE 1:300 6



COOLING (SUMMER)

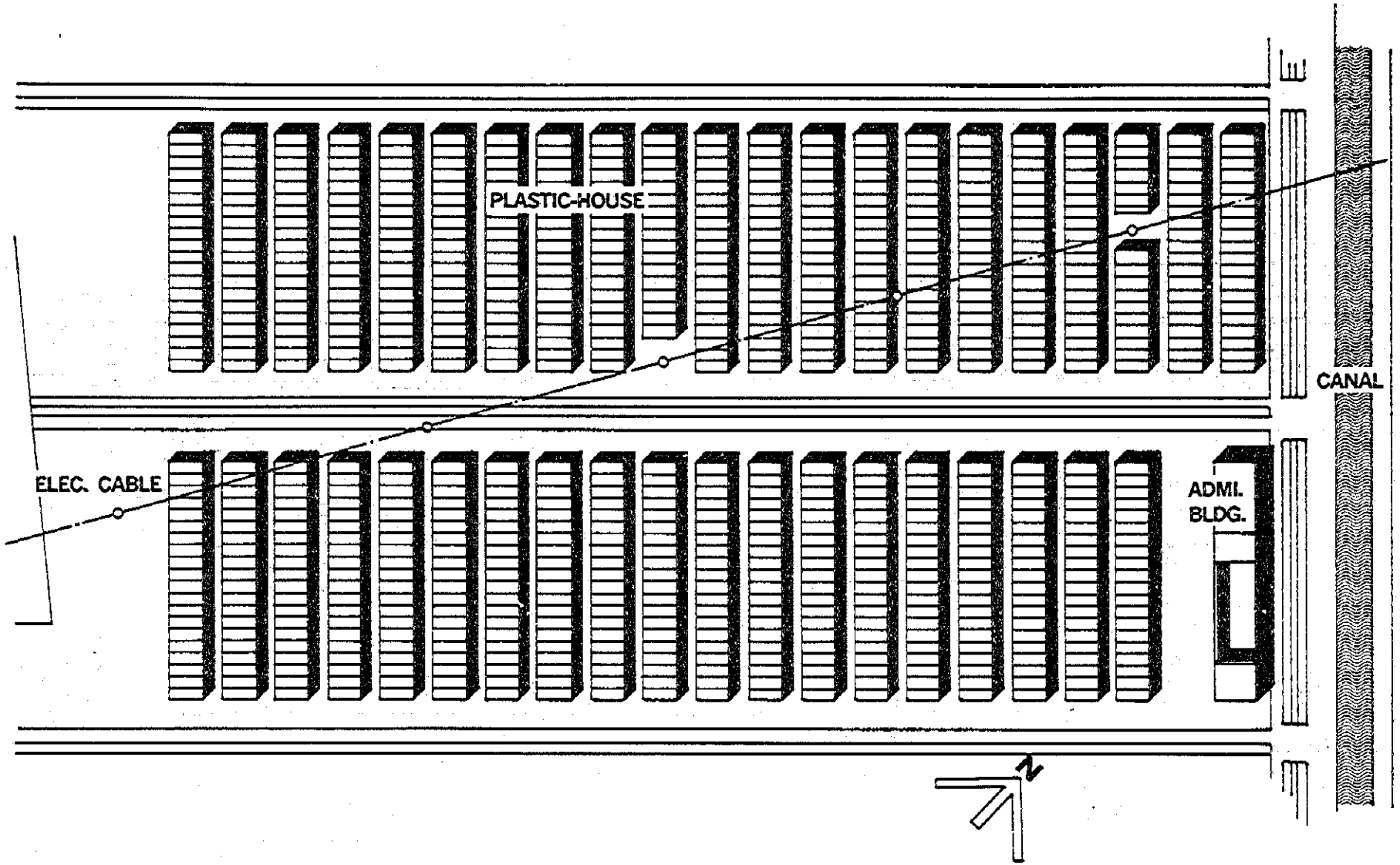


HEATING (WINTER)

Site No.2 COOLING & HEATING SYSTEM

SCALE 1:100

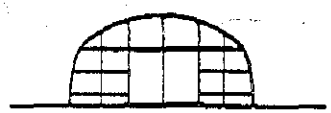
7



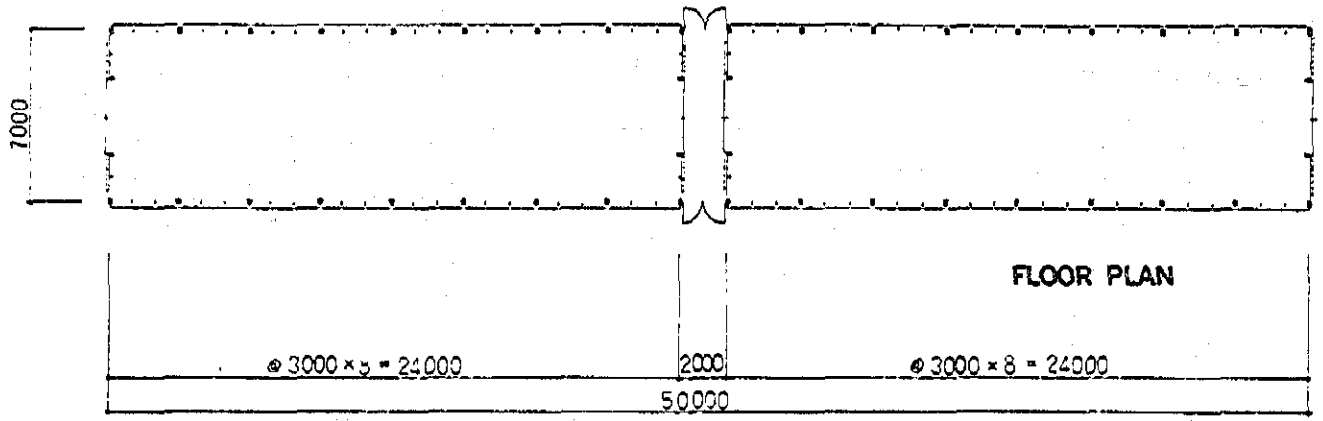
Site No.3 SITE PLAN SCALE 1:1000

8

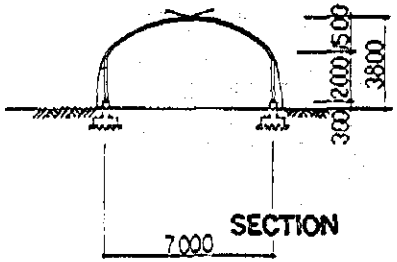
WEST ELEVATION



SOUTH ELEVATION



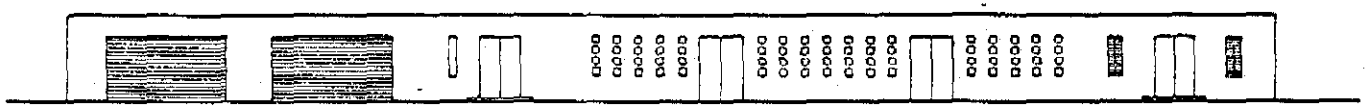
FLOOR PLAN



SECTION

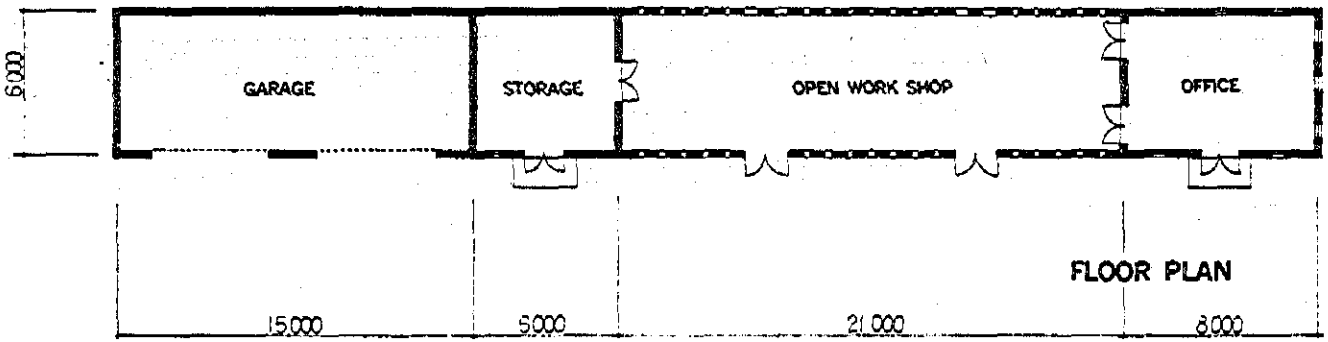
Site No.3 PLASTIC-HOUSE SCALE 1:300

9

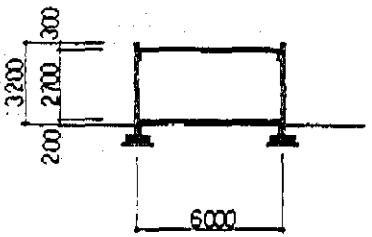


WEST ELEVATION

SOUTH ELEVATION



FLOOR PLAN



SECTION

Site No.3 ADMINISTRATION BLDG.

SCALE 1:300

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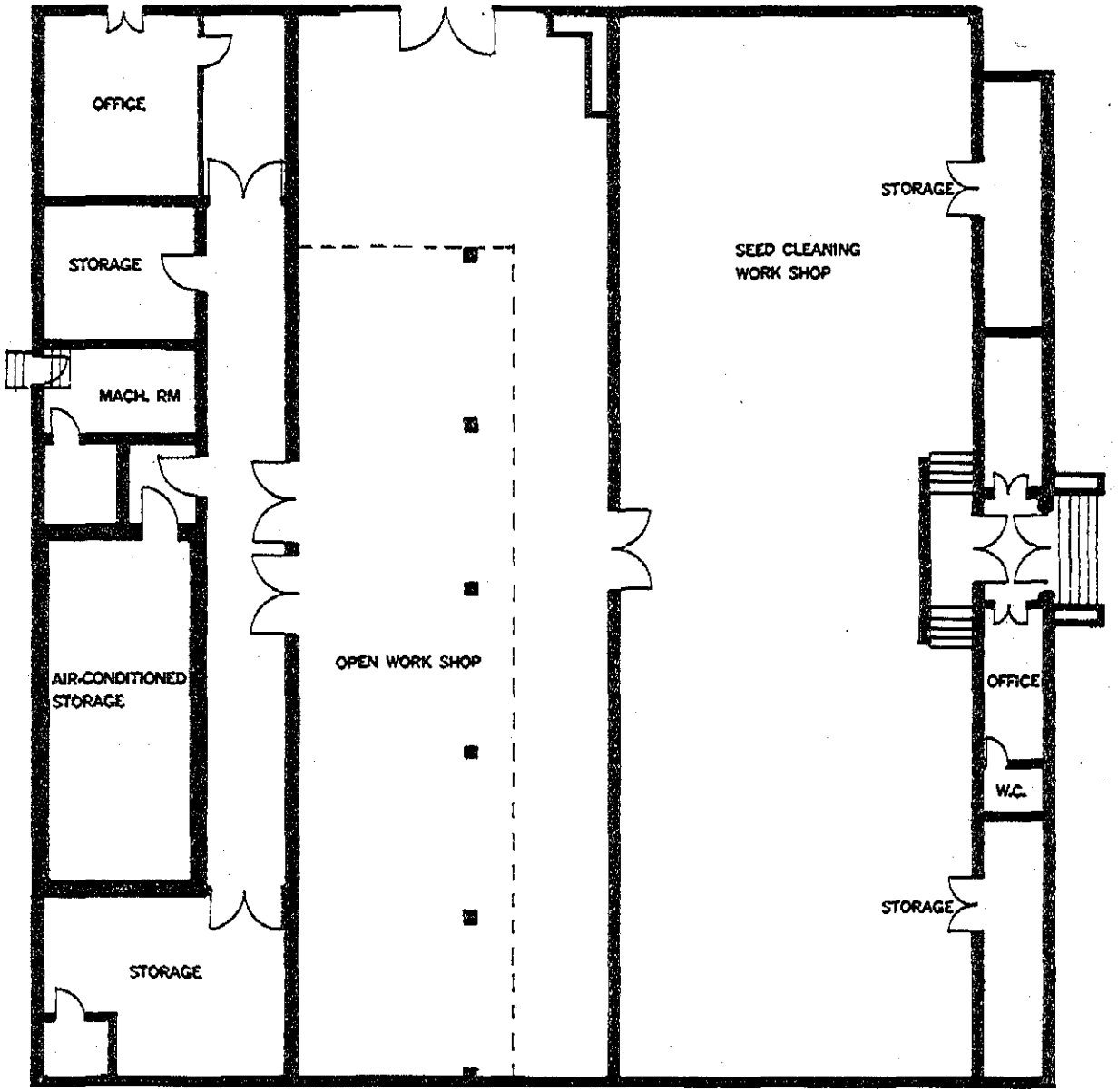

Site No.4 FLOOR PLAN SCALE 1:200

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