


4.2 Design Conditions:

4.2.1 Natural Conditions:

The Majuro Atoll is located in the Central Pacific is dominated by a tropical marine climate. Average annual rainfall at Majuro is 3,400mm, with heavy precipitation between June and November, though there is no particularly sharp delineation between rainy and dry seasons. Protracted squall conditions are rare; the maximum recorded rainfall in a 24 hour period was 454mm in December, 1972, with the normal range between 140-200mm. Temperature changes over the course of the year are small, with an average monthly high of 30°C and a low of 25°C. The record high to date is 32.8°C and the record low 20.5°C. Majuro is under the influence of trade winds throughout the year, with 80% of the prevailing winds from the EN and ENE. The probability of wind velocity reaching 3-7.7m/second is about 80%. In November, 1982, under the influence of a tropical cyclone, SW winds with a velocity of 20m/sec were recorded; even in normal years, maximum wind velocity of some 18m/sec will develop.

Tidal readings in Majuro are continuously recorded by a tide gauge installed near the connecting bridge at the old Majuro dock. Tidal levels within the Majuro lagoon are shown below:



HHWL	2.13m
MHWL	1.95m
MWL	1.07m
MLWL	0.00m(CDL)
LLWL	-0.03m

Maximum current flow in the lagoon is estimated at about 0.25 knots but there are said to be certain area of water channel connected directly to the open sea where currents reach 2 knots. But the waters in front of the Plan site have a relatively simple lagoon contour, and so it has been determined that tidal currents are not particularly strong. On the other hand, since the site is directly exposed to the NE trade winds, we cannot ignore wave action resulting from these winds.

4.2.2 Infrastructure:

Majuro Atoll has a virtually oval shape, running 40km from east to west and 10km north to south. The distance between Laura on the western tip of the Atoll to Darrit on the east is about 50km, and the two points are linked by a paved asphalt highway. West of Darrit, there is a stretch of uninhabited islands, with no land transportation. The so-called DUD area on the eastern end of the atoll (comprising the three localities of Delap, Uliga, and Darrit) forms the political and economic hearth of the Marshall Islands, containing 75% of the total population of the Majuro Atoll. As a result, the DUD area has the most developed infrastructure in the country.

There is an ample supply of commercial power, with almost no power failures. A high-voltage power line of 12kv parallels the main highway. At the Plan area, a 285m³ cold storage unit formerly operated on the site, of which only a portion is still in use, but the power supply has been judged ample for the Plan facilities.

Majuro being an atoll, the supply of fresh water of high quality is severely limited. Potable water supply is drawn from the well in Laura, in the west, and also collected rainwater from the airport runway. Water mains cover virtually all residential areas, including the Plan site but, since there is an existing 50 ton rainwater tank on the site, we have decided, in principle, to rely primarily on rainwater that has been filtered and sterilized.

Underground sewage pipes have been laid along the main road, passing about 60m south of the Plan site, but this is too great a distance to permit a connection from the sewage system to the Plan facilities, and so the waste water will be permeated into the earth within the site. Soil water will be treated in a septic tank before permeation and will not be drained outside the site.

4.2.3 Governing Standards:

There are no codes in the Marshall Islands governing construction design. While U.S. standards are generally applied, they are not necessarily applied uniformly. Judging by the natural conditions, there do not appear to be any particularly arduous conditions but we have set the following standards for seismic intensity and wind pressure:

Design seismic intensity: $K_h = 0.20$

$K_v = 0.00$

Wind pressure $q = 60 \sqrt{h}$

q: velocity pressure

h: height (m) from ground level

No data exist on foundations conditions in the Plan vicinity, but, on the basis of the condition of the existing buildings in the Plan area, we have concluded that there is no danger of irregular subsiding.

4.2.4 Environmental Conditions:

The Plan area is at the fishery dock squeezed between the Majuro commercial port and the fishing base for the tuna longline fishery. The front of the dock faces the lagoon side of the Majuro Atoll. On the western perimeter of the Plan area is a building housing communication facilities for patrol vessels, while a copra processing plant and a thermal power station in the commercial port area lie further to the west. The eastern perimeter of the Plan site is used as a boat repair area and contain no buildings. The site is in an industrial zone, with almost no trees. At present, it contains a cold storage plant, sorting area, and ice plant, but only a portion of these are in actual use. For this reason, insofar as the Plan area is concerned, there are no special environmental conditions that need to be reflected in the facility design.

The organization responsible for environmental administration in the Marshall Islands is the Environmental Protection Authority. At present, there are regulations pertaining to solid waste, earthmoving, toilet facilities and sewage disposal. In the earthmoving regulations, it is provided that, for any construction project, soil erosion and silting must be prevented, with due care exercised to prevent soil erosion or silting, and to protect cultural sites. Accordingly, in connection with operations in the water area, we will have to devise a plan that will prevent erosion or silting while giving full consideration to seabed topography, condition and area of coral habitats, and the present state of benthic animals and plants. While construction work in water is totally excluded from the scope of Plan construction, since the facility will be handling fresh fish, it will be

necessary, whatever the conditions, to prevent drainage from the facilities from flowing directly into the lagoon.

With respect to the refrigerant used in the refrigeration facilities at the ice plant and cold storage included in the Plan facilities, it will be necessary to use an HCFC type refrigerant, which is now commercially available (this is a compound which includes hydrogen in addition to chlorine, making the ozone depletion factor quite small).

4.3 Basic Plan:

4.3.1 Site Plan:

As shown in the Site Plan, the area containing the Plan facilities is a flat piece of land, 40m x 25m in area, owned by MIMRA, located in almost the dead center of the Majuro fishery dock. It is registered as Lot "G" in the land registry office. At present, the facilities on the lot include a cold storage, a roof of steel frame construction, and, beneath this roof partially used offices, an ice plant, rainwater tank, and warehouse. In this Plan, the cold storage, rainwater tank and warehouse are to be used in their existing condition. Three times a week, a transport vessel arrives at the dock in front of the Plan site carrying fish from Arno Atoll, general cargo, and passengers. Unloading of cargo and disembarking of passengers take place at the dock. The unloading operations for the fish, which is packed in insulated fish boxes, and the empty fuel drums are also performed at the dock, using a truck crane. The unloaded fish boxes are hauled by truck untouched to the center of Majuro, with a portion temporarily stored in the existing cold storage unit. The process is the same when the vessel returns to Arno; the heavy cargo is loaded using the truck crane, while passengers wait on the dock until the loading operations are completed, at which time they are immediately boarded.

If the subject facilities are provided under this Plan, in addition to the present passenger and cargo movements, activity will develop from bait receipts and withdrawals from the cold storage for use on tuna longline vessels as well as traffic into and out of the office area. Since the positions of the existing cold storage, rainwater tank, and warehouse cannot be changed, we have determined that the most logical approach will be virtually to duplicate the existing building arrangement in our lay-out

plan. Accordingly, we shall locate items closely related to the operations of the above transport vessel as close to the dock as possible. Concretely speaking, the ice plant and the work area for fish sorting will be positioned on the dock side of the plot, while the administration building will be placed along the entrance side. From a safety standpoint, the fuel storage shed will have to be well separated from places where people congregate, and the plan is to utilize an open space for this structure between existing cold storage and the southern border of the site. The toilet building will, for sanitary reasons, be located adjacent to the Administration Building as a separate structure. Ample space will have to be secured in the area between the entrance and the dock to accommodate vehicular traffic. A roof will be installed over the cold storage, ice plant, work area, and corridor.

4.3.2 Floor Plan:

There will be a total of 6 rooms in the Administration Building: 3 offices, a meeting room, workshop, and a staff room. Since the cold storage, rainwater tank, and warehouse are to be used in their present locations, the area allocated to the Administration Building will necessarily be very confined. In order, therefore, to economize on space, this building will be given 2 stories. The first floor will contain the rooms most closely involved with facility operations: the work space, staff room, and one office. The second floor will include the other 2 offices and the meeting room. The 2 ice-makers, each with a capacity of 2 tons per 24 hour period, will be placed in front of the Administration Building on the water side at the western border of the site. The toilet building will be located to the west of the Administration Building.

The Administration Building will be given the simplest possible column intervals, using 3.5m by 5.5m modules. The structure will comprise 3 rooms on both floors. The second floor will be reached via an outer stairway and outer corridor. The first floor rooms will all be given direct access from the dock side. The width of the above modules will be 19.25m^2 , which is deemed adequate for virtually the entire area requirements for the various rooms, as considered in Section 3.3.3. The floor area of the Administration Building, calculated on the basis of the above lay-out, comes to 115.5m^2 , with the oil storage shed set at 14.4m^2 and the toilet at 5.4m^2 . The

roofing section will encompass the cold storage (169m²) and the ice plant, work space, and corridor (161m²).

The composition of the above facilities is summarized below:

Facility	Structure/Scale	Contents
Administration building	Steel frame construction, 2-story	
Office	55.75m ² (19.25m ² x 3 rooms)	<ul style="list-style-type: none"> • 1 room on 1st floor, 2 rooms on 2nd • on the 2nd floor • on the 1st floor, for repair work on outboard motors • on the 1st floor
Meeting room	19.25m ²	
Workshop	19.25m ²	
Staff room	19.25m ² 115.50m ²	
Roof	Steel frame construction, corrugated sheets (vinyl chloride coated steel plate), shingles	
Cold storage section	169m ²	<ul style="list-style-type: none"> • including corridor
Ice plant, work area	161m ² 330m ²	
Toilet	Concrete block construction with septic tank, single story, 5.4m ²	<ul style="list-style-type: none"> • for soil water disposal
Fuel storage	Concrete block construction, single story, 14.4m ²	

4.3.3 Sectional Plan:

Based on the natural conditions at the Plan site, which is characterized by high temperatures and humidity, high ceilings are desirable. However, since public buildings in the area are generally air-conditioned, the heights in the subject facilities have been set as follows, with due reference to comparable buildings in the area:

Type of Room	Ceiling Height	Remarks
Administration Building	2.7 m	offices, meeting room, workshop, staff room
Roof	open ceiling	cold storage section, work area

4.3.4 Structural Plan:

(1) Structural Methods:

The structural system for the columns and beams will be steel frame, while that for the walls and roof will be vinyl chloride coated steel plate. The Administration Building will have two stories, while the roof will have a span length of 13m to cover the cold storage facility. For this purpose, steel frame construction will be most practical, since uniform quality is assured by factory production, while construction accuracy is readily attained. However, since the building is to be constructed in a location continually exposed to the sea winds, utmost care must be taken to prevent corrosion, and so all of the steel frame components will be given hot-dip galvanize with paint finish on surface. For the same reason, the roofs and walls will be given extra-long components and will use corrugated and ribbed sheets of vinyl chloride coated steel plate, because of their superlative anti-corrosion properties.

(2) Foundation Methods:

The fishery dock, which contains the Plan site, was built in 1973, while the existing cold storage was constructed in 1978. Judging from the present condition of the existing facilities, there was no apparent evidence of unstable foundations, such as irregular subsiding. The steel frames used in the Plan facility are relatively light weight, and so it has been determined that the existing foundations are in no danger of subsiding and thus are fully capable of supporting the buildings. Accordingly, the base foundations for the facilities will be direct foundation.

4.3.5 Electrical and Mechanical Equipment:

(1) Electrical Work:

Electricity will be stepped down from the transformer on the pole at the southern boundary of the Plan site to 120/208V, 60Hz and received on an intake board, from which it will be branched to the power equipment and light sockets. Maximum power load capacity is estimated as follows:

Lights, socket load	5kva
Power equipment load	45kva
Total	50kva

The target power equipment comprise the ice plant, compressors for the chill and cold storage units, and air conditioners for the offices. Load voltage has been set at 3-phase 208v 60Hz. We will specify fluorescent lighting, the most common type in the area. Two types of sockets will be used: a general type for room use and a specialized socket for use in the workshop. The general sockets will be single-phase and the workshop sockets 3-phase. Since power conditions in Majuro are excellent, with few blackouts, an emergency generator will not be required.

Based on public buildings in the locality, individual room air conditioner will be installed in the offices, meeting room, and staff room. As to telephone equipment, only interior wiring will be done; equipment is to be installed by MIMRA, as required, upon completion of the facilities.

Also, since the vinyl chloride coated steel plate roof will cover a wide area, lightning rods will be provided.

(2) Water Supply, Drainage, and Sanitation:

Water requirements will be met from rainwater collected on the facility roof in the existing 50m³ concrete tank and pressure-pumped to the using location. The rainwater will be used in the ice plant, work area, and toilets. In the case of the ice equipment, it will be filtered and sterilized before use.

In designing the drainage facilities, special attention will have to be paid to preservation of the marine environment inside the lagoon. In principle, therefore, apart from the downward flow of the rainwater, based on the natural gradient of the facility, all drainage will be treated and permeated. Soil water from the toilets as well as miscellaneous drainage will be piped to a septic tank for joint treatment and then permeated. In the oil storage shed, in order to guard against spillover due to overturning of the drums, the entrance area will be raised slightly, with a slope toward the interior. This will facilitate in-and-out movements of the drums while also preventing any direct effluence of leaked oil to the outside. Drainage pipes will be PVC and laid underground.

4.3.6 Building Material Plan:

We have carefully evaluated the various types of finishes. The floor finish in the offices and meeting room in the Administration Building will be vinyl tile on concrete. In other areas we shall use mortar trowel finish on concrete. However, in the toilet building, in the interest of sanitation, we will install ceramic tile on the floors and wainscoting. Since the outer walls will be vinyl chloride coated steel plate, no finish will be required. The interior walls of the Administration Building will be finished with paint on gypsum board on metal furrings. The only ceilings will be those in the Administration Building, and the finish will be painted gypsum boards.

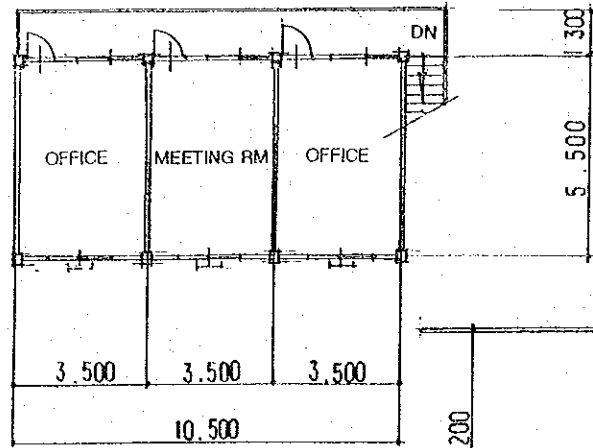
Fittings and doors will be aluminum for purposes of rust prevention.

4.4 Equipment Plan:

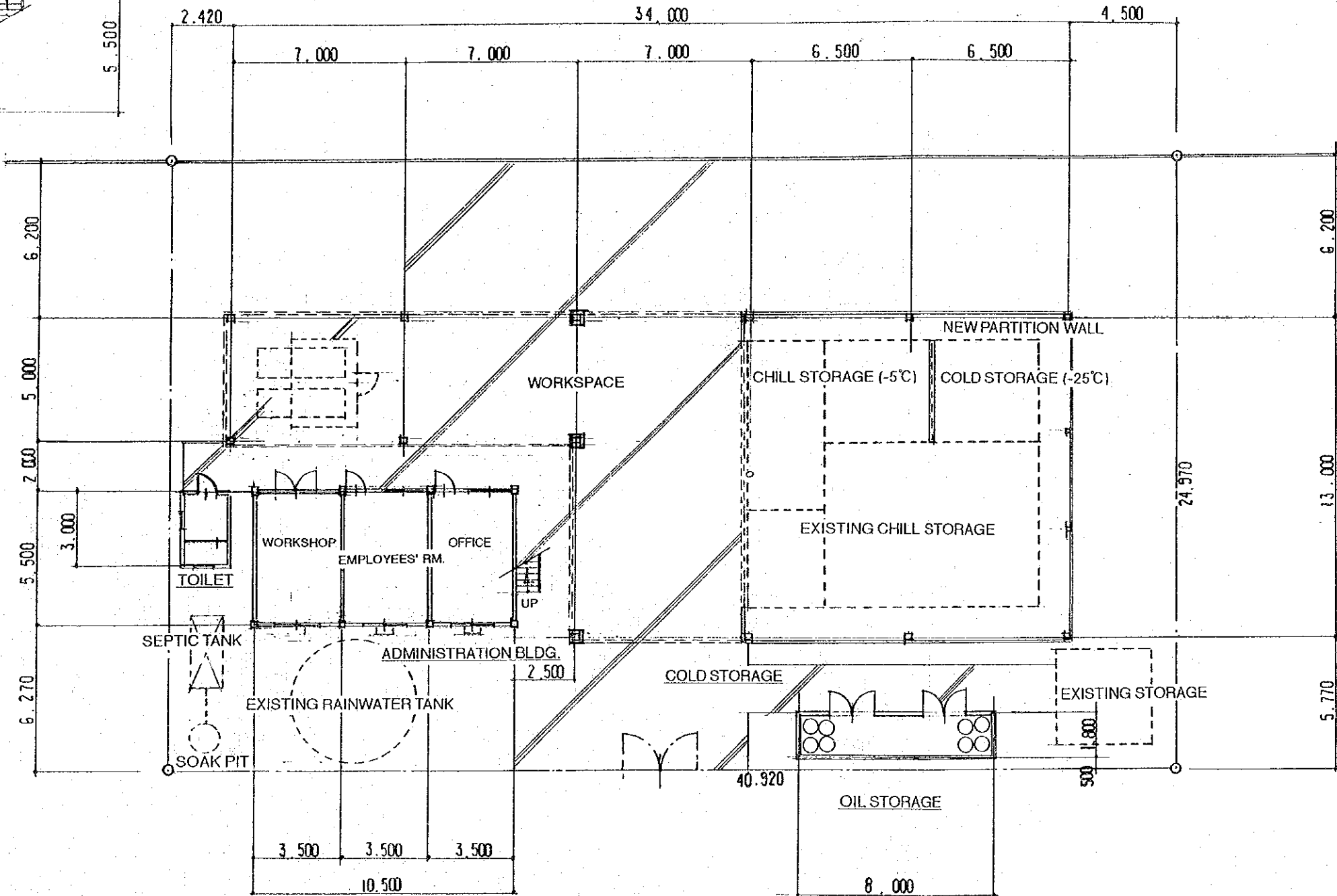
A description of the main equipment items is given below. A detailed list is shown in Appendix V-3. Based on the nature of this equipment, we have determined that there will be no need for either local or third country procurement.

Type of Equipment	Scale	Quantity	Description
Ice plant	2 tons/24hr.	2 units	plate ice; 4-ton storage unit
Materials for repairing cold storage unit	for repairs to present facility (30sq. m)	1 set	cooler units (2), partition, openings, materials for ceiling repair, piping
Outboard motors	25ps gasoline engine 40ps	15 units 15 units	
Fishing gear & materials			
Hand line	lead lines, fish hooks, other	1 set	
Troll line	lure heads, hooks, other	1 set	
Underwater gear	underwater masks, harpoons, other	1 set	
Tools for outboard repairs	grinder, compressor, drill, hydraulic press, general purpose and specialized tools	1 set	
Plastic containers for fish transportation	160 ltr insulated fish boxes 80 ltr plastic fish boxes 50 ltr fish barrels 300 kg platform scale Chill display cases for retail store use	15 units 40units 40units 1unit 4units	
Removable boarding ladder	Stainless steel construction	1 unit	retractable fixing metal, fender

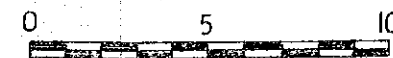
4.5 Basic Design Drawing:

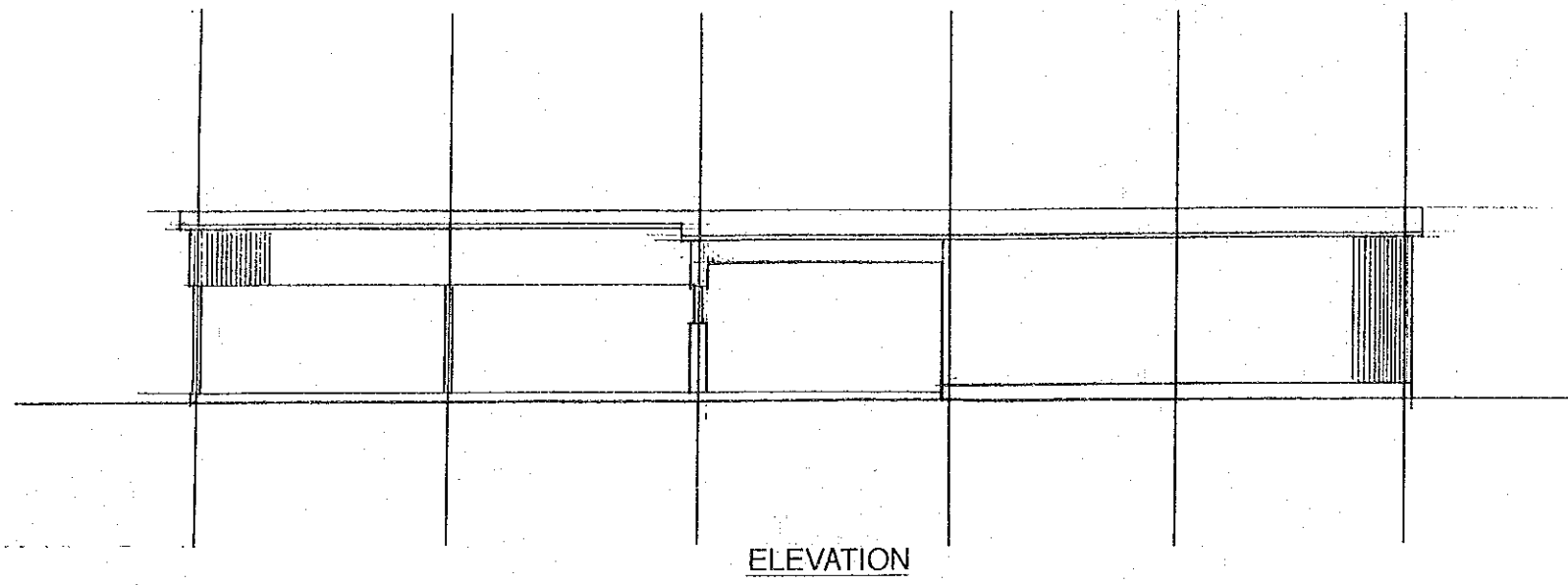


1st FLOOR PLAN

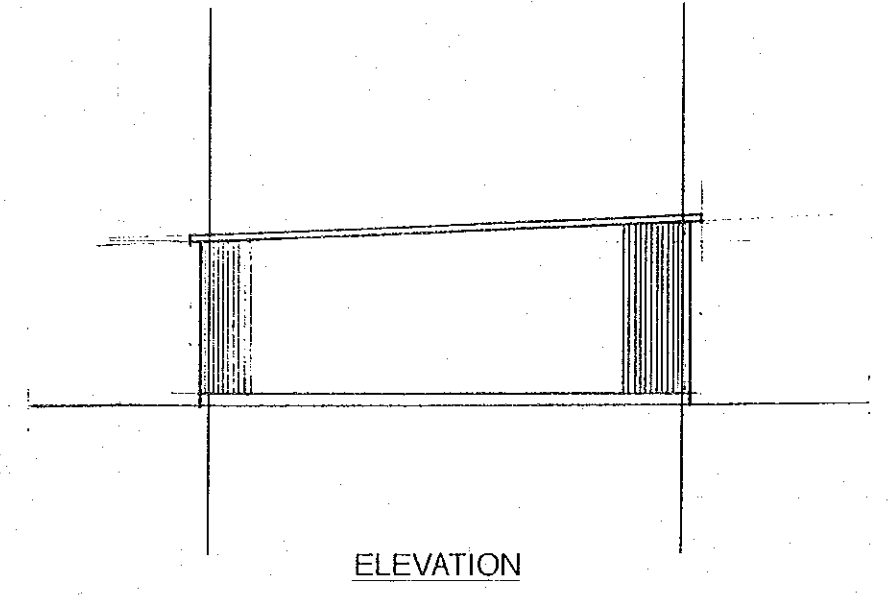


FLOOR PLAN



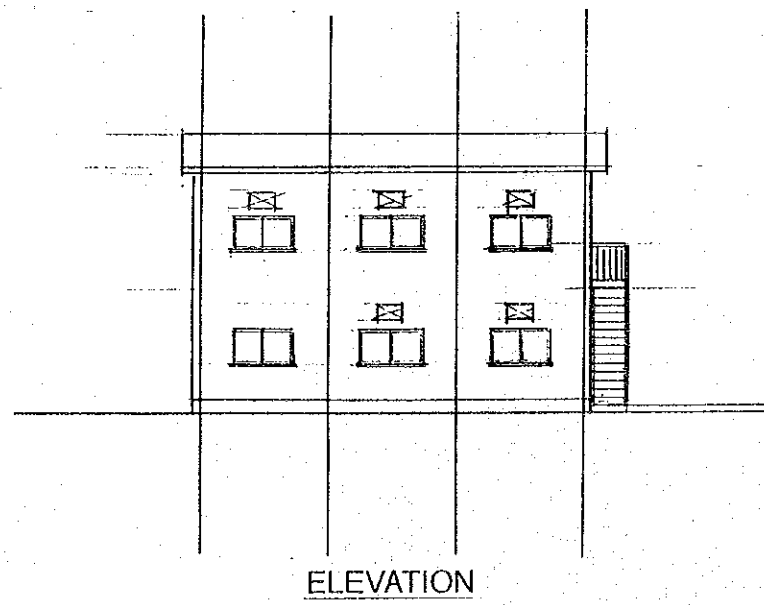


ELEVATION

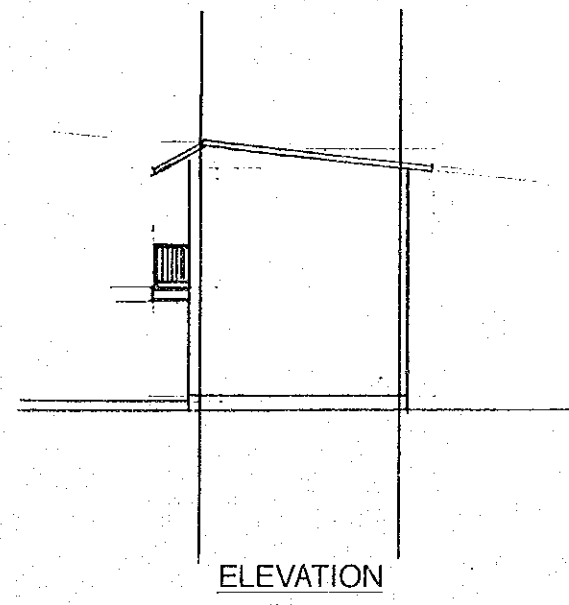


ELEVATION

COLD STORAGE

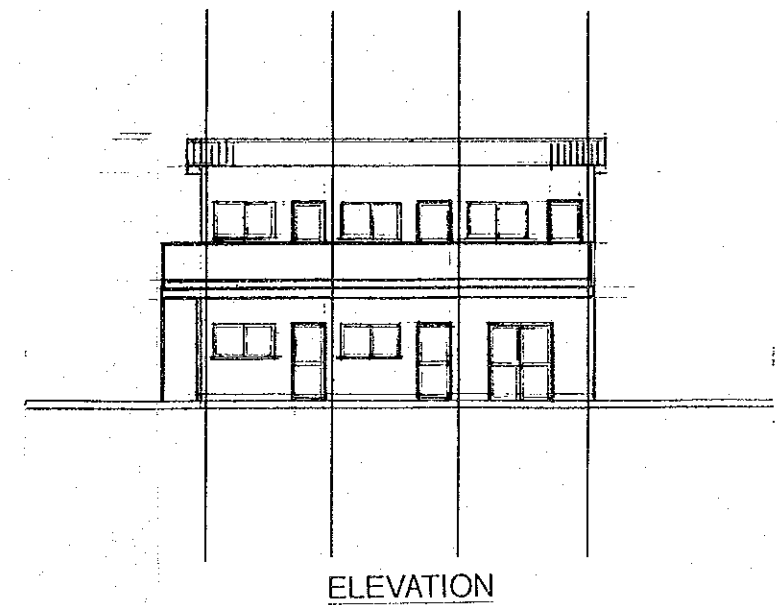


ELEVATION

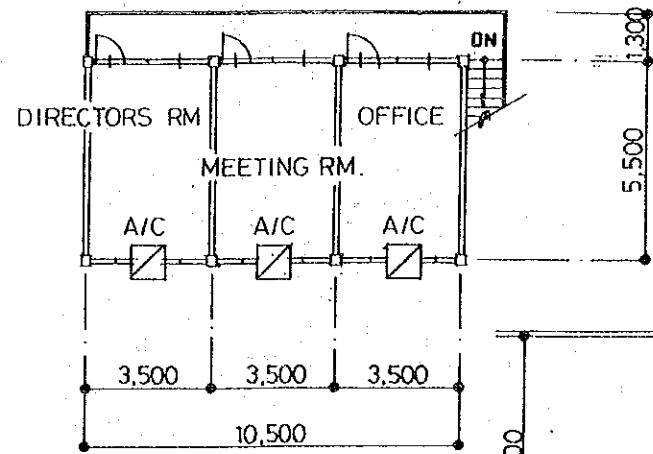


ELEVATION

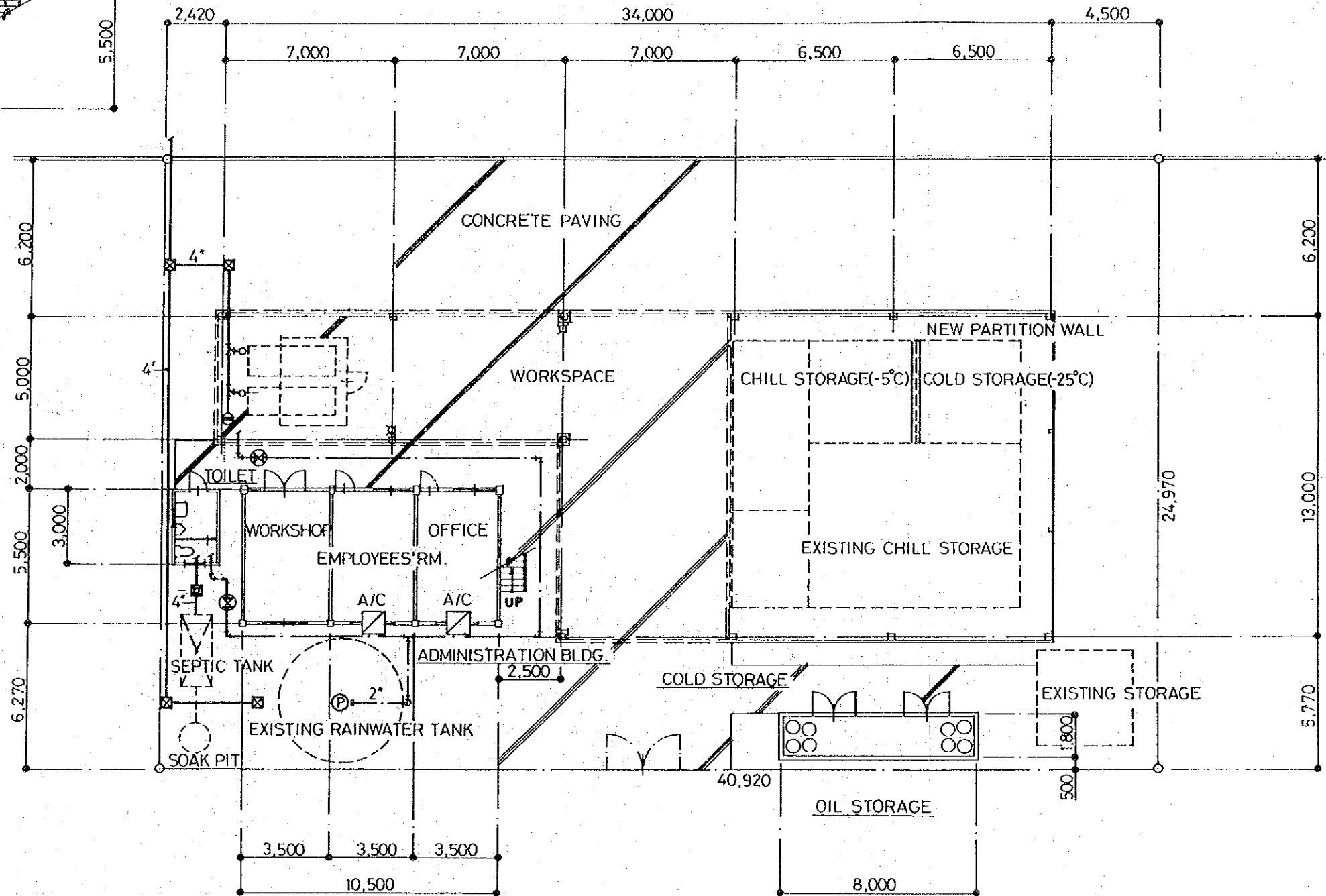
ELEVATION



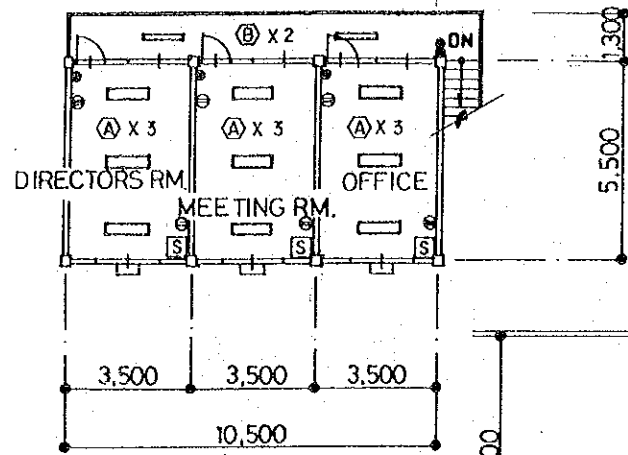
ELEVATION



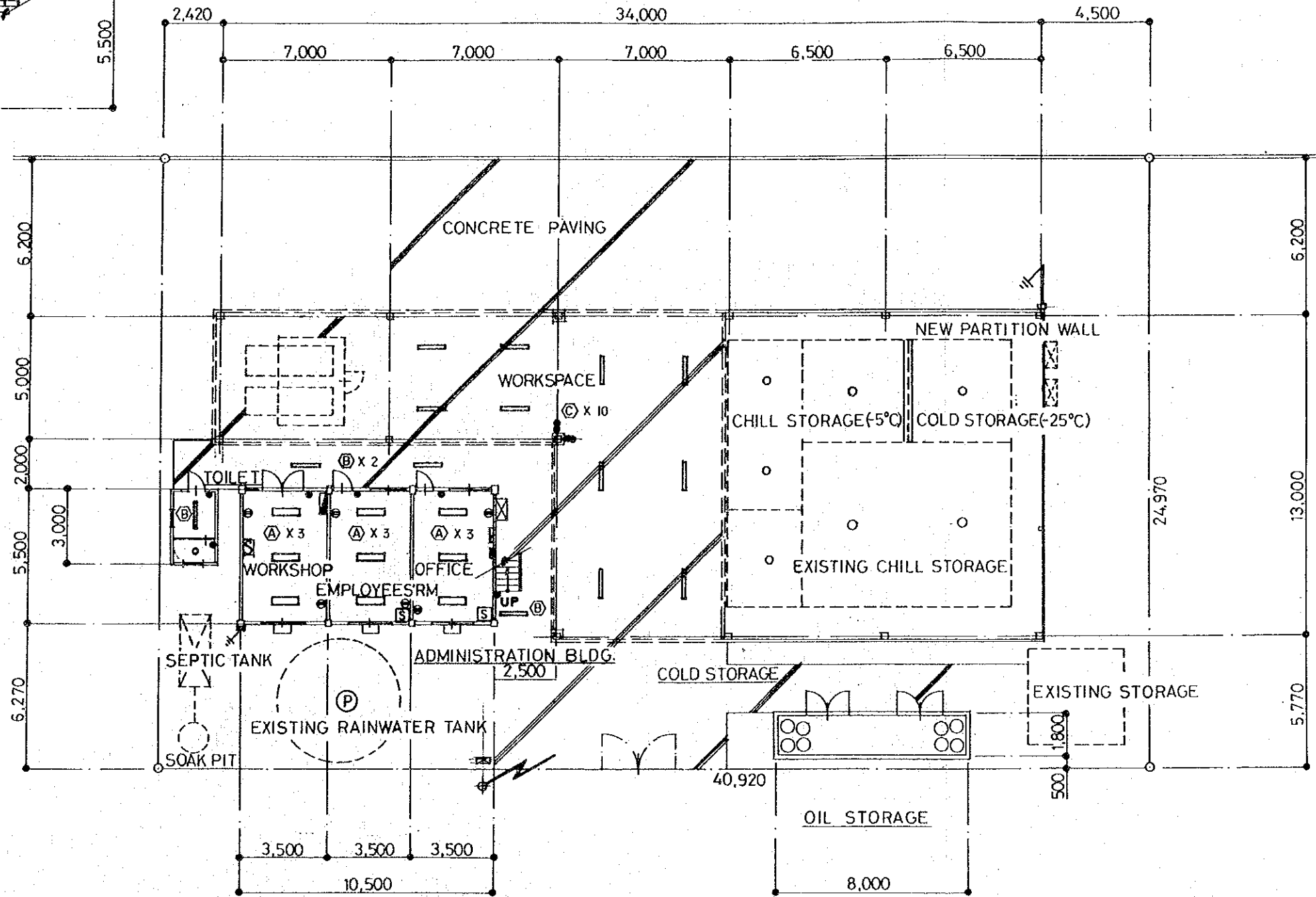
1st FLOOR PLAN



ELECTRIC PLAN



1st FLOOR PLAN



MECHANICAL PLAN

4.6 Construction Plan:

4.6.1 Construction Guidelines:

The Plan facilities will cover a total area of 115.5m^2 , comprising a 2-story steel frame building and a 330m^2 steel frame roof. Since the structural steel components and the vinyl chloride coated steel plates for roof materials are difficult to obtain in the Marshall Islands, it will be necessary to ship them by sea from Japan. Although we believe that the construction period in the Marshall Islands for steel frame construction is relatively short, the overall project schedule, as will be discussed in Section 4.6.5, will be subject to finish within 12 months under Japan's grant-aid system. There is only one scheduled vessel bimonthly from Japan to the Marshall Islands, and so careful planning is required in connection with the project schedule. We will follow the following guidelines in order to finish the construction schedule on time:

- (1) In the subject Plan, we will be renovating a part of the existing cold storage on the Plan site. In addition to providing chill storage and cold storage areas, we will utilize the rainwater tank and warehouse in their present form. However, the original plans and drawings for these structures are missing, making it necessary, in developing the construction plan, to determine the position of the foundations of the existing facilities and whether or not there are underground pipes or other obstacles. Accordingly, as far in advance as feasible of the start of construction work, discussions should be held at the Plan site to develop in advance proper countermeasures to make sure there are no impediments to construction progress, particularly in the portions that are to be used from the existing facilities.
- (2) Since steel frames have been specified, it is expected that a considerable proportion of the building materials will be sourced from Japan. However, given the small size of the facility, it will be difficult to dispatch technicians of variety of trades to the site for efficient use of the materials shipped from Japan, and so it will be necessary to utilize local technicians. But, since the number of experienced technicians is quite limited, a careful preliminary survey will be needed to secure the required technical support.

4.6.2 Special Construction Conditions:

Buildings already exist on the Plan site. A portion of these will be used in the Plan, while others will have to be dismantled. With respect to the scope and method of removing existing structures, full discussion and validation will be required with MIMRA, which is both the superintendent of the existing facilities and the designated operating organ for the Plan. Because of limited scale and methods of construction, no technological constraints will be foreseen. However, during the construction phase, a special effort will be required to minimize any impact on the lagoon environment. In particular, if heavy rains were to fall during the construction period, care would have to be taken to prevent any muddy water from flowing into the lagoon. Caution must also be exercised in connection with the supply of gasoline and oil for operation of the construction equipment to insure that no oil substances flow into the ocean.

4.6.3 Construction Supervision Plan:

Following the exchange of notes on Plan implementation between the Governments of Japan and the Marshall Islands, a consultant contract will be signed between a consultant of Japanese national and MIMRA. The consultant will prepare detail design, specifications, bill of quantity and tender documents for Plan implementation along with the necessary drawings for contracts. Subject to MIMRA's approval, the consultant will also screen bidders, put out tenders, review tender documents and make the recommendation for the successful contractor. Following the conclusion of the construction contract, shop drawings will be approved in Japan along with the inspection of the equipment during production. The consultant will supervise the facility construction program, guaranteeing the progress and accuracy of the construction. Since the facility scale is small, no specialized construction techniques will be required. Thus, it will not be necessary to dispatch a resident supervisor. The consultant will be required to conduct preliminary consultations in the Marshall Islands, make an interim and final inspection, and validate the equipment to be delivered.

4.6.4 Procurement Classification for Equipment and Materials:

(1) Procurement of Construction Materials:

Among the construction materials to be used for the Plan, sand, gravel, cement, steel bars, concrete blocks and certain other items can be sourced in the Marshall Islands and so will, in principle, be procured locally. However, local procurement will be difficult for the structural steel materials, roofing and wall materials, boards, aluminum sashes, doors and other fittings, electrical materials, and water supply, drainage, and sanitation materials. We plan, therefore, to source these items from Japan. Following is a breakdown of the main construction materials by procurement source:

Main Construction Materials	Source
Sand	Marshall Islands
Gravel	Marshall Islands
Cement	Marshall Islands
R-bars	Marshall Islands
Concrete blocks	Marshall Islands
Steel frames	Japan
Roofing materials (corrugated sheets)	Japan
Wall materials (vinyl-coated steel plates)	Japan
Wooden materials and plywood	Japan
Fittings & fixtures	Japan
Paint	Japan
Main Equipment Items:	
Electrical wire	Japan
Lighting fixtures	Japan
Intake board	Japan
Pumps	Japan
Water and drainage pipes	Japan
Sanitary equipment	Japan

(2) Equipment Procurement:

The main items of Plan equipment will be the ice plant, materials to renovate the cold storage, outboard engines, insulated fish boxes, fishing gear, and a boarding ladder. Since all of these items are industrial or manufactured products, they will, in principle, be sourced from Japan.

4.6.5 Implementation Schedule:

In connection with the implementation schedule, we have summarized below the division of construction responsibility between the Governments of Japan and of the Marshall Islands:

(1) Scope of responsibility to be assumed by the Government of Japan:

Assuming this project is carried out on the basis of a grant-aid program from Japan, the Government of Japan will assume responsibility for the following items:

- 1) Facility construction
- 2) Procurement of the ice plant, outboard motors, and other equipment
- 3) Consulting services with respect to detail design, assistance on tenders, and construction supervision.

(2) Scope of responsibility to be assumed by the Government of the Marshall Islands:

Assuming this project is carried out on the basis of a grant-aid program from Japan, the Marshall Islands will assume responsibility for the following items:

- 1) Securing the planned construction site and validating the scope, method, and timing of the removal of existing facilities.
- 2) Obtaining all required permits for the construction work as well as permits for all other phases of project implementation.
- 3) All required procedures and expenses with regard to bringing power lines into the Plan area.
- 4) Prompt customs clearance of all equipment and materials imported into the Marshall Islands in connection with the subject project as well as arranging exemptions from all required duties and taxes thereon.
- 5) Exemption of Japanese nationals residing in the Marshall Islands for the purpose of rendering project services from all taxes and surcharges.
- 6) All other items that are not specifically included among the responsibilities of the Government of Japan, as necessary for project implementation.

Assuming implementation of the construction work in accordance with the above division of responsibilities, the project implementation schedule has been divided into the following categories: detail design, including tender operations, facility construction work, and equipment supply. In accordance with the Japan's grant-aid system, the entire implementation schedule must be completed within a period of 12 months. The major construction procedures in connection with facility construction may be broadly classified as follows:

(1) Construction work--

Construction of the roof structure, Administrative Building, toilet building, and oil storage structure.

(2) Power, water supply, drainage, and sanitary facilities--

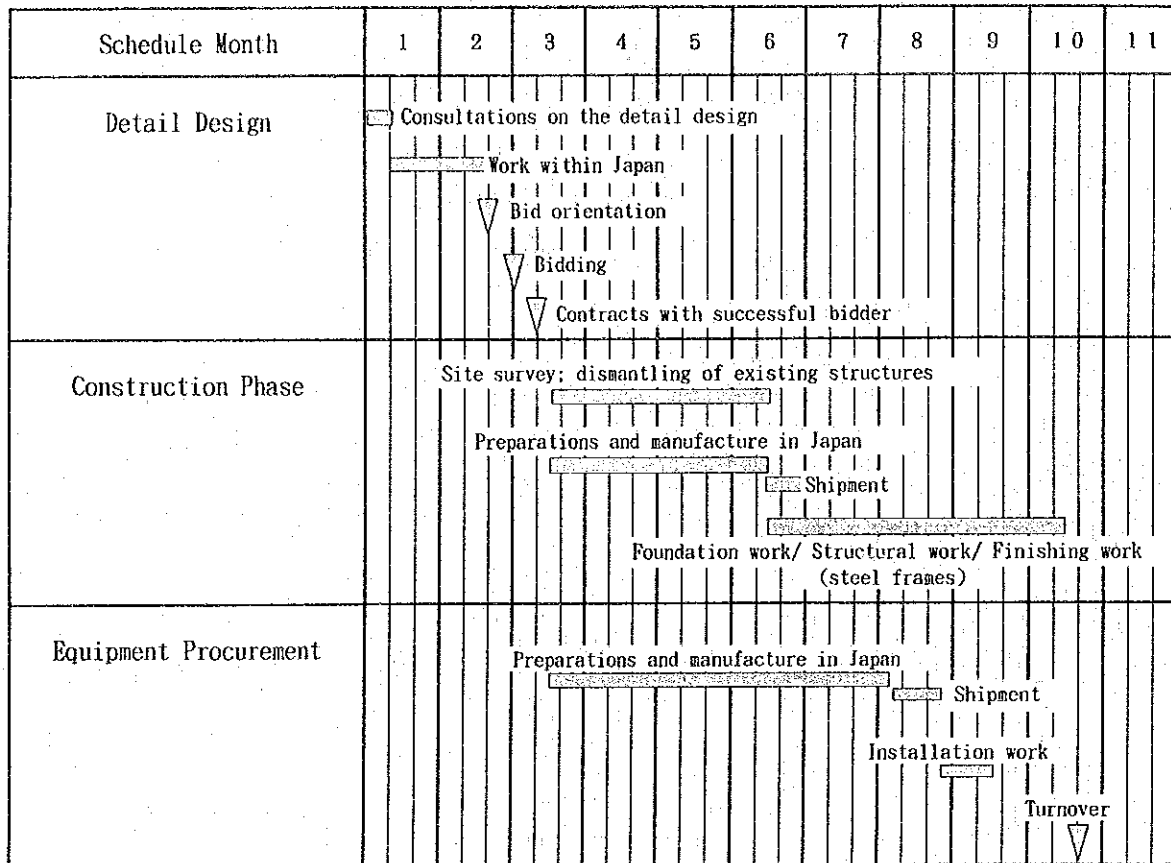
Intake line work, wiring, piping work, and installation of fixtures.

(3) Equipment supply--

Delivery, installation, adjustment, and test operation of the ice plant, cold storage renovations, workshop equipment, boarding ladder, and other equipment.

About 7 months are anticipated for the construction phase, including preparatory work in Japan and construction operations in the Marshall Islands. Procurement time for the equipment will be set at 4 months, since this is the procurement time anticipated for the ice plant, the item with the longest procurement lead time. The other equipment can be procured in 2-3 months, but about 1 month will probably be required locally for installation and adjustment of the ice plant and a portion of the workshop equipment and for adjustment and test operation of the chill storage and cold storage facilities. On the basis of the above conditions, we have prepared an optimum construction schedule, from the standpoint of both time and cost. The resulting Project Implementation Schedule is given in the next page.

Project Implementation Schedule



SECTION FIVE: PROJECT EVALUATION AND CONCLUSIONS

5.1 Project Evaluation:

The fishery development project for Arno Atoll, which is to be the primary source of fish supply handled by the support station under this Plan, started operations in 1988. Based on the establishment of production facilities under a grant-aid from the Government of Japan and technical assistance and equipment donated by the Overseas Fisheries Cooperation Foundation of Japan, the scope of this project has grown to the point that, in 1993, an estimated 42 tons of fish were shipped from Arno to Majuro. Since March, 1993, this activity has been operated by 5 full-time employees under the guidance of MIMRA. However, despite the accomplishments to date on the supply side, attention has been called to an ongoing problem that has developed in terms of a continuing increase in unsold fish. From May to November, 1993, fish purchases from Arno totaled 38,897kg, but sales came to 30,994kg, leaving an unsold balance of 7,953kg. The level of unsold stocks has clearly increased from the same period of the preceding year, when supplies totaled 32,370kg, sales 29,775kg, and unsold inventories 2,595kg. If the present condition is left unchecked, it will probably not be long before serious problems develop with the economic viability of the Arno operation. While it will not be possible to reduce distribution inventories to zero, in order to prevent the Arno operation from generating unsold stocks, it will be necessary to speedily develop solutions either in the form of a further increase in marketing effort or a cut-back in production. The support base which is to be provided under this Plan is aimed at rationalizing distribution and expanding sales outlets for the catches at Majuro. Furthermore, by involving the support base directly in actual sales activity, it is expected that the fishermen can then be given accurate information on supply and demand trends in fishery products at Majuro, thereby enabling them to adopt a production structure keyed to demand levels.

The benefits that can be generated through the realization of the Plan facilities may be summarized as follows:

(1) Effective use of resources based on a reduction in unsold catches:

Under present conditions, unsold fish is stored in the existing cold storage, but, since the temperature in the chill storage unit is high, this fish loses virtually all of its edible quality, and in the end, the product

has to be sold as animal feed. The average price of fresh fish from Arno at time of shipment over the period March to November, 1993 was \$2.70 per kg. The value of the unsold stocks, when converted from the current international market price for fish meal for livestock, runs about 14 cents /kg, barely 5% of the original fresh price. The unsold ratio in 1992 was 6.75%, but, if this ratio could be lowered to 5% through operations at the new support facilities, the following economic benefits could be expected:

Unsold stock ratio (Mar.- Nov., 1993):

$$7,953\text{kg} / 38,897\text{kg} = 20.45\%$$

Annual volume of unsold fish and their final sales value:

$$42,000\text{kg} \times 20.45\% = 8,589\text{kg}$$

$$8,589\text{kg} \times 14 \text{ cents} = \$1,202$$

Increased revenue and remaining product value based on achieving an unsold ratio of 5%:

$$42,000\text{kg} \times 5\% = 2,100\text{kg}$$

$$8,589\text{kg} - 2,100\text{kg} \times \$2.70/\text{kg} = \$17,520$$

$$2,100\text{kg} \times 14 \text{ cents} = 294$$

$$\text{Total} = \$17,814$$

Thus, the economic benefit, based on an improvement in the level of unsold stocks to 5%, can be calculated at:

$$\$17,814 - \$1,202 = \$16,612.$$

If the unsold ratio can be reduced to 5% on the basis of an increase in sales volume, this would mean added revenues of \$16,612 for the support base. Alternately, if the 5% ratio is attained through production cutbacks, this would mean that present income levels could be maintained within the context of lower fishing effort and smaller resource utilization. The operation on Arno Atoll that was initiated as a model for fishery development on the outer islands of the Marshall Islands produced more than \$80,000 of cash income for fishermen in 1993. However, the benefits resulting from Plan implementation will not be confined just to the economic gains discussed above; there will also be considerable significance in terms of maintaining the soundness of the coastal fishery operations on Arno Atoll.

(2) Easing of resource pressures based on a diversification of production areas:

The fisheries development program targeted at Majuro Atoll is presently being carried out in Arno Atoll, which has the advantage of proximity to consuming markets. While data do not permit a firm estimated on the volume of catches brought to Majuro from Arno Atoll prior to the start of this operation in 1988, certainly, in comparison with the current level of shipments, exceeding 40 tons a year, the former volume must have been very small. These catches are taken mainly from the Arno lagoon, and we may presume that this places considerable catch pressure on the resources therein, particularly bottom fish. Despite the lack of quantitative data in this respect, it has been pointed out that the average size of certain bottom fish species has clearly decreased, giving rise to serious concern over over-fishing in this lagoon. The Arno lagoon covers some 340km² but, on the assumption that total catches from the lagoon are now running about 100 tons per year, comprised of the 40 tons shipped to Majuro plus an estimated 60 tons consumed by fishermen's households, the catch per square kilometer comes to 294kg. This indicates a catch pressure at Arno almost three times the 103kg per km² for all coastal fishery production, including self-consumed fish, in the Marshall Islands (1,200 tons of coastal fishery production / 11,670km² of lagoon area = 103kg). The fishery resources in the lagoon are particularly vulnerable to intensive fishing pressure and run the risk of depletion in the absence of prudent fishery management. However, the fishery resources outside the lagoon are still left underdeveloped, it can be possible to maintain the existing catch level without further increase in catch effort in the lagoon area.

In the future, it is expected that a separate organization will be created to take independent charge of fish marketing in Majuro. With activation of the new support facilities, it will be possible to distribute fish from other outer islands as well through the distribution channels cultivated in Majuro. We feel then that there will be considerable significance in developing a capability to meet consumer demand through a broader-based supply without having to concentrate resource pressure on particular areas. Admittedly, it is difficult, within the parameters of this basic design study to calculate the quantitative benefits that could result from sustainable resource utilization, but one can attach major significance to the value of maintaining an environment conducive to the reproduction of fish resources, thereby insuring a self-sufficient supply of important animal proteins for the Marshall Islands people in the years ahead.

(3) Maintaining public assets by the continued use of the existing facilities at the Plan site:

Based on this Plan, by replacing the roof over the existing cold storage facility, it will be possible to maintain the insulating structure of this unit in working order. The floor area of the existing cold storage is 120m², with the interior space divided into four compartments, of which only about 30m² are presently being used. Under this Plan, the chill section now in use will be divided into two rooms: one for chilled and the other for cold storage, with the equipment in both sections to be newly installed. At the same time, a new roof will be installed to replace the old roof, which has suffered protracted corrosion and other damage. In addition, certain other portions of the cold storage will be selectively repaired so as to enable them to be utilized sometime in the future. Some 16 years have passed since the original cold storage facility was built in 1977 but it has been established that the insulation panels at this plant are still usable. Preserving and reusing a valuable state-owned asset will not only bring direct benefits to the people of the Marshall Islands in terms of investment economies but can also be expected to set a powerful example of the benefits to the national economy that can derive from the renewal of still valuable, though currently unused, public property.

5.2 Conclusions:

In a country made up of atolls scattered over an ocean expanse of some 700,000km², the development of the outer islands--excluding the urban areas of Majuro and Ebeye on Kwajalein Atoll, the site of the U.S. missile tracking base--has already been adopted by the Marshall Islands Government as a continuing high-priority project. With meager land-based resources, high hopes have been placed on boot-strap development, by the Marshall Islands people themselves, of the rich marine resources found in the country's waters, which constitute in effect the country's significant natural resources. In line with this national goal, the outer island fisheries development project was launched on Arno Atoll in 1988 and since then has been extended to other atolls, including Likiep, Namu, and Ailinglaplap. The pioneering Arno venture is estimated to have produced 45 tons of fish in 1993, which was transported to the market at Majuro. The Arno project, thus, has served as a precedent for outer islands fishery

development in the country. The subject Plan has been deemed to be quite appropriate in terms of insuring the continued viability of these outer islands fisheries, we have validated the appropriateness of the subject Plan, which is designed to equip a support base capable of functioning as an effective marketing base in Majuro for catches from the outer islands, with a view to rationalizing distribution and expanding the sales network for outer islands catches.

The Plan site is a fishery dock in the heart of Majuro, squeezed between the commercial port and the fishing base. The site contains facilities of the former Majuro Fishing Cooperative Association and has been confirmed as belonging to MIMRA. While there are some construction constraints imposed by the intended use of a portion of the existing facilities, no problems are anticipated in the Plan construction program. For the time being, MIMRA is to operate the Plan facilities and equipment. This organization has overall responsibility for the administration of living and inanimate resources in the 200 mile zone of the Marshall Islands and has assigned several full-time employees to assist fishery development in the outer island. Sometime in the future, however, the operations at the new facilities are expected to be separated into 3 distinct functions: fish production in the outer islands and transport of catches to Majuro; sales of these catches at Majuro; and administrative support for overall economic development in the outer islands. When activity at the Plan facility reaches this stage, MIMRA will then be able to concentrate on its original mission of providing administrative support and guidance.

Total operating costs of the Plan facilities have been calculated at \$26,372 per year and revenues at \$26,845, indicating a marginal surplus. Accordingly, a continuing effort will be called for to operate the facilities expeditiously and administer them on a sound professional basis. Based on Plan implementation, conditions should be created for the stable continuance of the fishery development program on Arno Atoll, which is seen as a model for outer islands development based on the utilization of domestic resources. Success of the Arno program can be expected to promote fishery development on other outer islands. We have determined, therefore,

that there is considerable significance in implementing the subject Plan under a grant-aid from the Government of Japan.

ANNEX

- I Basic Design Study Team Members
- II Survey Itinerary
- III Discussants
- IV Minutes of Discussions
- V Others
 - V - 1 Breakdown of Operation Costs
 - V - 2 Breakdown of Project Revenues
 - V - 3 List of the Equipment

I Basic Design Study Team Members

Name	Assignment and Organization
Ishiyama Yoshio	Team Leader Associate Specialist on Fisheries, Second Basic Design Study Division, Grant Aid Study and Design Department, Japan International Cooperation Agency
Kawahara Satoshi	Fisheries Development Section Chief, International Affairs Division, Oceanic Fishery Department, Fisheries Agency
Terao Toyomitsu	Facilities Planner Fisheries Engineering Co., Ltd.
Nakajima Naohiko	Equipment Planner Fisheries Engineering Co., Ltd.

II Survey Itinerary

Day	Date	Ishiyama, Kuwahara	Terao, Nakajima
1	Nov. 28 (Sun)		Lv. Tokyo (20:55) CO-960
2	29 (Mon)		Ar. Guam (02:35), Lv. Guam(08:15) CO-956, Ar. Majuro (18:15)
3	30 (Tue)		Courtesy call to and discussion with Director of MIMRA
4	Dec. 1 (Wed)		Survey on Arno Atoll Fishery Bases
5	2 (Thu)		Discussion with MIMRA, Study on fish retail
6	3 (Fri)		Survey on the planned site
7	4 (Sat)		Survey on the site vicinity and study on fish retail
8	5 (Sun)	Lv. Tokyo (10:00) CO -962, Ar. Guam(17:05)	Data and information analysis
9	6 (Mon)	Lv. Guam(08:15)CO-956 Ar. Majuro (18:45)	Survey on construction costs and trade
10	7 (Tue)	Courtesy call to Undersecretary of Foreign Affairs, Joint meeting with directors and officials concerned	
11	8 (Wed)	Survey on Arno Atoll Fishery Bases	Discussion with MIMRA, Survey on power and water supply to the site
12	9 (Thu)	Meeting on the draft of Minutes of Discussions	
13	10 (Fri)	Signature of the Minutes of Discussions	
14	11 (Sat)	Lv. Majuro (11:00) CO-957, Ar. Guam (17:05)	
15	12 (Sun)	Ishiyama: Lv. Guam (15:55) JL- 942, Ar. Tokyo (18:30)	

III Discussants

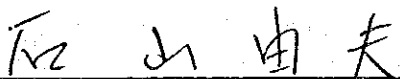
Name	Title and Organization
Danny Wase	Director Marshall Islands Marine Resources Authority (MIMR)
Danny F. Jack	Deputy Director MIMRA
Capital Bani	Chief Fisheries Officer, MIMRA
Xavier Myazoe	Licensing Officer, MIMRA
Glen Joseph	Licensing Officer, MIMRA
Resta Kattil	Chief of Administration and Finance, MIMRA
Teruo Kaminaga	Placement Officer, Fisheries Training Center, MIMRA
Michael C. White	Advisor, MIMRA
Thomas Kijiner, Jr.	Undersecretary of Foreign Affairs, Ministry of Foreign Affairs
Justin deBrum	General Manager Marshall Islands Development Authority (MIDA)
Moses Samuel	Secretary of Transportation Ministry of Transportation and Communication
Toshiro Sato	Coordinator Japan Overseas Cooperation Volunteer, Japan International Cooperation Agency (JICA)
Hiroyuki Yoshida	Fisheries Specialist JICA

MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY
ON
THE COASTAL FISHERIES DEVELOPMENT PROJECT
IN
THE REPUBLIC OF THE MARSHALL ISLANDS

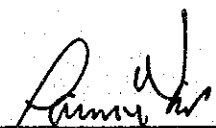
In response to a request from the Government of the Republic of the Marshall Islands, the Government of Japan decided to conduct a basic design study on the Small-scale Fishery Support Station Project (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Republic of the Marshall Islands a study team, which is headed by Mr. Yoshio Ishiyama, Associate Specialist on Fisheries, Basic Design Study Division, Grant Aid Study and Design Department, JICA, and is scheduled to stay in the country from November 29 to December 11, 1993. The team held discussions with the officials concerned of the Government of the Republic of the Marshall Islands and conducted a field survey at the study area. In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The team will proceed to further works and prepare the basic design study report.

Majuro, December 10, 1993



Yoshio Ishiyama
Leader,
Basic Design Study Team,
JICA



Danny S. Wase,
Director,
Marshall Islands Marine
Resources Authority,
Republic of the Marshall Islands

ATTACHMENT

1. Objectives

The objective of the Project is to improve fish distribution system by providing necessary facilities and equipment.

2. Project Site

The project site is Log G of the New Port Subdivision at Delap as shown in Annex I.

3. Executing Agency

Responsible agency: Ministry of Resources and Development
Implementing agency: Marshall Islands Marine Resources Authority

4. Items requested by the Government of the Marshall Islands

After discussion with the basic design study team, the items listed in Annex II were finally requested by the Marshallese side. However, the final components of the Project will be decided after further studies.

5. Japan's Grant Aid system

- (1) The Government of the Republic of the Marshall Islands has understood the system of Japanese Grant Aid explained by the team.
- (2) The Government of the Republic of the Marshall Islands will take the necessary measures, described in Annex III, for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study

- (1) The Consultant will proceed to further studies in Japan.
- (2) JICA will complete the final report and send it to the Government of the Republic of the Marshall Islands by April in 1994.

7. Particular items discussed and requested to the Government of the Republic of the Marshall Islands by the Team

To ensure the operation budget and staffing required for the Project.

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8. Counterpart fund

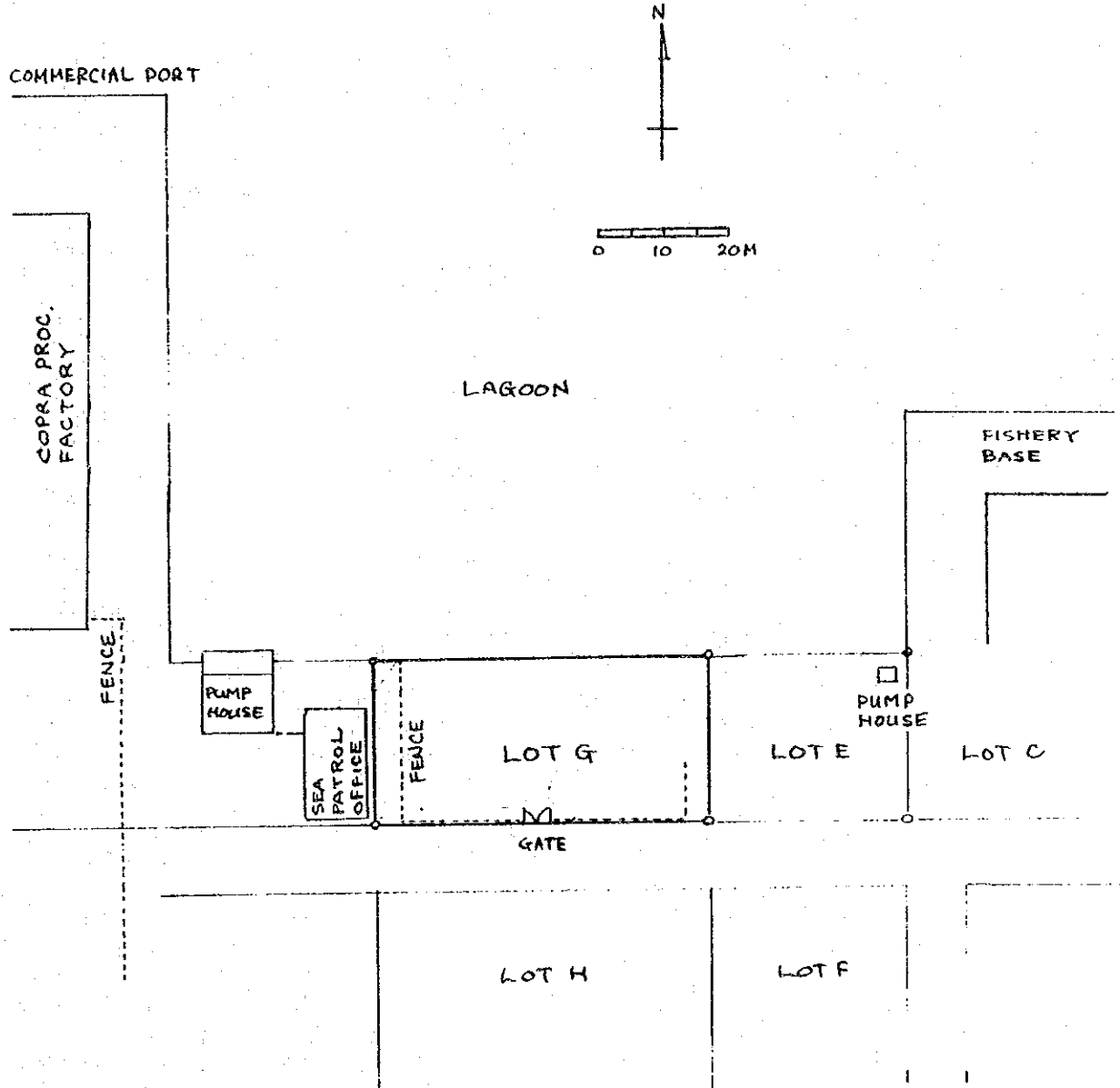
If and when the products, purchased by the grant from the Government of Japan, are sold or leased to fishermen, the Government of the Republic of the Marshall Islands shall take necessary measures to ensure the followings:

- (1) to deposit the funds generated from the sale (or the lease) of fishing gear into a separate account.
- (2) to utilize the funds for the purpose of promoting fishery in the Republic of the Marshall Islands.
- (3) to consult with the Government of Japan before utilizing any of the funds.
- (4) to provide, on the request of the Government of Japan, a report on the use of the funds and the balance in the account.

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Annex I

Location of the project site



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Annex II

Items Requested by the Government of the Republic of the Marshall Islands. (in order of priority)

- (1) Ice making plant
- (2) Cold storage room(s)
- (3) Office and store
- (4) Workshop
- (5) Fish display case for retail shops
- (6) Outboard motors
- (7) Fishing gear
- (8) Fish carrying boxes
- (9) Vehicle

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Annex III

Necessary measures to be taken by the Government of the Republic of the Marshall Islands in case Japan's Grant Aid is executed.

1. To secure the tenure of site for the Project.
2. To clear and level the Project site, when needed, prior to commencement of the Project.
3. To secure yard for stocking materials and for constructing temporary facilities at the project site.
4. To improve the access road to the project site, if necessary.
5. To provide necessary permissions, licenses and other authorizations for smooth implementation of the Project.
6. To provide facilities for distribution of electricity, water supply, drainage, telephone line and other incidental facilities.
7. To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.
8. To ensure prompt unloading and customs clearance at ports of disembarkation in the Republic of the Marshall Islands and internal transportation therein of the products purchased under the Grant.
9. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of the Marshall Islands with respect to the supply of the products and services under the Verified Contracts.
10. To accord Japanese nationals whose services may be required in connection with the supply of products and the services under the verified contracts such facilities as may be necessary for their entry into the Republic of the Marshall Islands and stay therein for the performance of their works.
11. To maintain and use properly and effectively that facilities constructed and equipment purchased under the Grant.
12. To bear all the expenses other than those to be borne by the Grant, necessary for construction of facilities as well as for the transportation and the installation of the equipment.
13. To coordinate and solve any matters which may arise with third party in connection with the tenure of the Project site during implementation of the Project.

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V Others

V-1 Breakdown of Operation Costs

(1) Electricity

Chill storage	3.0kw x 365days x 24hr x 0.4(*) x \$0.13/kwh	= 1,370
Cold storage	4.5kw x 365days x 24hr x 0.3(*) x \$0.13/kwh	= 1,540
Ice making plant	12.5kw x 260days x 8hr x \$0.13/kwh	= 3,380
Workshop equipment	2.5kw x 260days x 8hr x 0.3(*) x \$0.13/kwh	= 200
Pump for water tank	0.75kw x 260days x 8hr x 0.1(*) x \$0.13/kwh	= 20
Illumination	2.0kw x 260days x 8hr x 0.5(*) x \$0.13/kwh	= 270
Air-conditioners	15.0kw x 260days x 8hr x 0.5(*) x \$0.13/kwh	= 2,030

(*) Load factors (average working ratio)

Sub total: \$8,810/yr

(2) Personnel Expense

Personnel expense is planned by referring to the present salaries of employees of the AFFA Project. Two staffs will be employed; a general base manager and a sales manager.

Genral Base Manager	\$600/month
Sales Manager	\$450/month

Sub total: \$12,600/yr

(3) Maintenance Cost

Annual budget for the maintenance for the planned facilities and equipment has been estimated at 0.5% of construction cost for the structure of building, 2% of the ex-go-down price for the ice making units, chill and cold storage units and the workshop equipment.

Structure of building	\$391,120 x 0.5%	= 1,956
Ice making units	\$108,940	
Cold storage units	\$ 19,220	
Chill storage units	\$ 8,760	
Workshop equipment	<u>\$ 13,400</u>	
	\$150,320 x 2.0%	= 3,006

Sub total: \$4,962/yr

Total (1)+(2)+(3) = \$26,372/yr

V-2 Breakdown of Project Revenues

(1) Ice Sales

Annual ice production by the planned facilities: $640\text{kg} \times 260\text{days} = 166.4 \text{ tons}$

The ice demand at Ine is estimated at 34 tons per year, which is sent from Arno. Capacity of the ice making unit at Arno is $360\text{kg}/14\text{hr}$, powered by a 45kva generator.

$$160\text{lb.} \times 0.7 \times 0.4536 = 51\text{kg}$$

$$51\text{kg} \times 5\text{box} \times 3\text{times/week} \times 45\text{weeks} = 34,425\text{kg/yr (34tons)}$$

Ice production cost at Arno, based on use of the small generator, are considerably higher than they will be at Majuro, which is served by commercial power. Thus, the ice requirement at Ine, which is currently supplied from Arno, will henceforth be filled from Majuro. Ice price at Ine runs 22 cents/kg (10 cents per lb.).

Applying this price,
 $34,000\text{kg} \times \$0.22 = \$ 7,480/\text{yr}$

(2) Cold Storage Services

Target product	Bait for tuna longline operations
Storage volume	Number of vessels making continued use: 5 vessels Bait per vessel loading: 200 cases x 5kg = 1,000kg Monthly consumption of bait per vessel: 1,000kg x 2 voyages = 2,000kg 2,000kg x 5 vessels = 10 tons
Net floor area	15 sq.m = 160 sq.ft.
Service revenue	Storage rate: \$6.00/sq.ft/month 160 sq.ft x \$6.00 = \$960 \$960 x 12 months = \$11,520

(3) Facility Usage Fees

Facility usage fee	5 cents/lb. of fish handled
Annual volume passing through the facility	92,592 lb.

$$92,592 \text{ lb.} \times \$0.05 = \$4,630/\text{yr}$$

(4) Interest Income from the Operating Fund

Sales of outboard engines, spare parts and fishing gear is assumed to be made evenly over a 4-year period. Average interest income over a 10-year period is set as follows:

$$\$126,100 \times 1/4 \times 34 \text{ years} \times 3\% \times 1/10 = \$3,215$$

$$\text{Total (1)+(2)+(3)+(4)} = \$26,845$$

V - 3 List of the Equipment

1. Outboard Engines		
1.1 25PS Outboard engine and spare parts	Transom height approx. 20"	15 units
1.2 40PS Outboard engine and spare parts	Transom height approx. 20"	15 units
2. Tools for Outboard Engine Repairs		
2.1 Hydraulic press machine	15 tons	1 unit
2.2 Bench type drill	13 mm	1 unit
2.3 Air compressor	8 - 10kgf/cm ²	1 unit
2.4 Work bench	Approx. 1,500 x 900 x 740mm	2 sets
2.5 Electric tools	Drill, grinder, and others	1 lot
2.6 Hand tools	Wrench, screwdriver, pliers, and others	1 lot
2.7 Battery charger	6 - 12V	1 unit
3. Fishing Gear		
3.1 Hand line	Wooden reel, lead line, hook, sinker, and swivel	1 lot
3.2 Trolling lure head	Lure head "Octopus" type	60 pcs
3.3 Trolling gear	Trolling board, 3 kind of lure heads, and others	60 sets
3.4 Rope	Polypropylene 12mm dia. 200m/coil	15 coils
	16mm dia. 200m/coil	15 coils
	Vinylon 12mm dia. 200m/coil	15 coils
	16mm dia. 200m/coil	15 coils
3.5 Underwater gear	Underwater mask, foot fins, work gloves, harpoon, and flashlight	30 sets
3.6 Fish carrying box	Insulated fish box 160 ltr.	15 pcs
	Plastic fish box 80 ltr.	40 pcs
	Fish barrels 50 ltr.	40 pcs
3.7 Insulated display case	200 ltr. with support	4 sets
3.8 Platform scale	300kg. minimum reading 100g	1 unit
4. Office Furniture		
4.1 Desk	Approx. 1,200 x 700 x 700mm	6 sets
4.2 Chair		6 sets
5. Ice Making Plant	2 tons/24hr. plate ice	2 units
	4-ton storage bin	1 set
6. Materials for Repairing Cold Storage Unit		
	Cooler units, partition, openings, and insulation materials	1 lot
7. Boarding Ladder	Approx. 600W x 2,500L mm Removable type	1 unit

JICA