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FINAL REPORT

Study for the Development of Facilities to Handle Domestic Corn at the Ports of General Santos City, Davao and Cagayan de Oro

Project No. 492-0432
Contract No. OTR-0000-1-00-720800
IQC Delivery Order No. 12

Prepared for : United States Agency for International Development Manila, Philippines

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28 February 1991

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February 28, 1991

US Agency for International Development
Ramon Magsaysay Center
1680 Roxas Blvd., Manila
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Attention: Mr. Leroy Purifoy
Chief, Office of Capital Projects

Reference: Contract No. OTR-0000-I-00-720800
IQC Delivery Order No. 12
Study for the Development of
Facilities to Handle Domestic Corn
at the Ports of General Santos City,
Davao and Cagayan de Oro
(Project No. 492-0432)

Subject : Final Report

Dear Sir:

Pursuant to the terms of our contract with USAID signed September 28, 1990 and in accordance with the Terms of Reference we are pleased to submit herein fifteen (15) copies of the Final Report.

This report sets forth the observations, findings, conclusions and recommendations that emerged from our study.

Our principal conclusion is simple and direct. If the Mindanao corn industry is to reach its expansion potential and efficiently meet the surging feed requirements of the nation's livestock and poultry producers, it must convert to bulk handling rather than continue the present antiquated practice of moving corn in bags.

Failure to make this conversion to bulk handling of corn will jeopardize and stifle the progress that can be achieved from other programs designed to aid the corn industry such as technical and financial assistance intended to increase the use of high yielding varieties of yellow corn.

The Consultants are aware of the mutually supporting nature of the varied, on-going programs to stimulate the corn production and distribution sectors. For this reason, we have investigated the recommended bulk handling facilities as components of an integrated corn project.

The Consultants have analyzed several sizes and types of bulk handling facilities for the three Mindanao ports. In formulating our recommendations we have been guided --in the first instance-- by the principle of minimizing initial construction outlays. However, in deciding upon our final recommendation we have combined this financial criterion with the need to assure that the proposed facilities were consistent with the present and future operational requirements of each of the three Mindanao ports. Our report details the selection process for each proposed facility.

We recommend that the following bulk handling facilities be constructed on the time table indicated:

1992 Port of General Santos City

A concrete slipform facility with approximately 20,000 metric ton storage capacity.

Estimated Cost: US $13,242,000, equivalent to $662/MT.

1993 Port of Cagayan de Oro

A concrete slipform facility with a 20,000 metric ton storage capacity.

Estimated Cost: US $13,242,000, equivalent to $662/MT.

1994 Port of Davao

A concrete slipform facility with a 10,000 metric ton storage capacity.

Estimated Cost: US $9,682,000, equivalent to $968/MT.

In addition to the above recommendations, the Consultants would like to re-emphasize that establishment of bulk corn loading facilities at General Santos, Cagayan de Oro, and Davao will simultaneously require compatible off-loading facilities at the destination ports. It is essential that the main receiving ports be identified and evaluated as to their existing bulk corn handling capabilities.

The Consultants wish to express their appreciation for the opportunity to serve USAID on this assignment. We are gratefull for help and support received from PPA and other Philippine governmental agencies; local city governments and civic organizations; contacted firms of the Philippine private sector; the Philippine Chamber of Commerce and Industry; the Confederation of Grains Association and the U.S. Agency for International Development.

Respectfully yours,

Richard C. Kerr

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Project Manager
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1.0 INTRODUCTION

1.1 Purpose of the Study

The principal purpose of the study is to determine the feasibility for future development of domestic corn handling facilities in the Ports of General Santos, Cagayan de Oro and Davao. Such facilities include storage silos/tanks and equipment for truck receiving, cleaning, grading, drying, aerating, bagging (if necessary), and loading into bulk vessels. This purpose is set forth in the Agreement dated 28 September 1990 together with the Terms of Reference, a set of which is included herein as Appendix A.

More specifically, the purpose as translated into step-by-step objectives outlined in the Terms of Reference include the following:

a) Based upon the estimated volume of corn shipped out of the port broken down in bulk and bagged cargo, determine the amount of corn traffic which could be handled cost effectively and efficiently by these ports annually up to the year 2000 and the constraints likely to be encountered in the efficient handling of such traffic.

b) Determine the physical bulk and bagged corn handling facilities and cargo handling equipment required at the ports and technical soundness and cost effectiveness of various alternatives in catering to the given traffic forecast up to the year 2000.

c) Identify the most cost-effective solution with particular attention to the need for additional handling facilities for the particular type of corn commodity (bulk or bagged) to be handled.

d) Propose phased investment priorities and operational improvements over the next 10 years, for optimizing the productivity of existing assets and catering to the traffic growth.

e) Prepare preliminary engineering designs and cost estimates for the facilities identified above and carry out a cost effective analysis to determine the least cost solution without jeopardizing the technical soundness and operational efficiency of the recommended cargo handling system.

This study has been pursued in accordance with the foregoing purpose and objectives, using the integrated project approach methodology.

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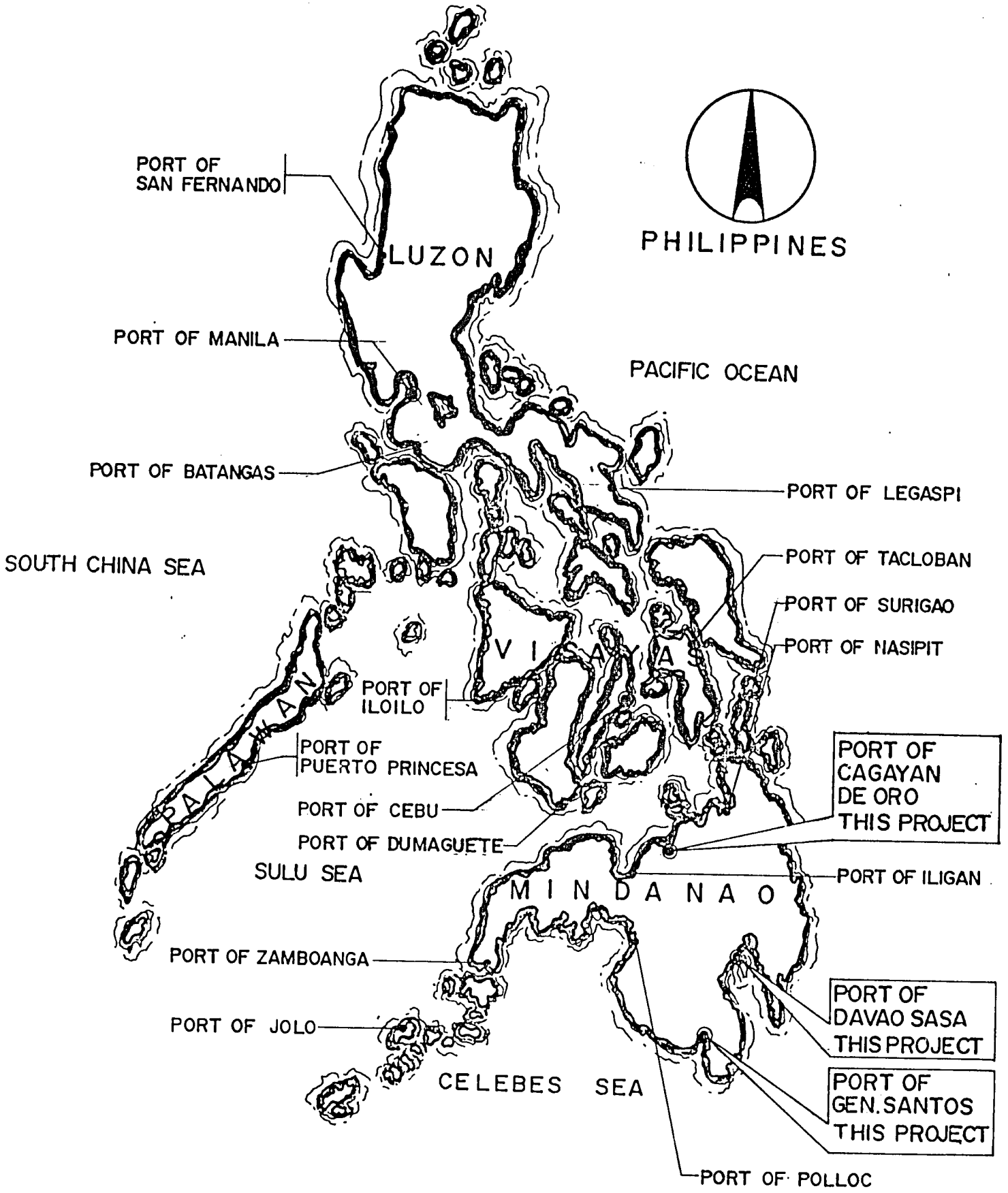

FIG. I-I MAP OF THE PHILIPPINES

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1.2 Study Methodology

1.2.1 General

The methodology employed in this corn handling study is based on and reflects extensive experience of developing nations and international financing institutions, such as USAID. The analytical approach used herein also derives from the worldwide experience of the Consultant.

Shipping large quantities of corn in bags is a practice wholly and totally out of date. No serious, sustained growth in corn farming and distribution efficiency is possible without recourse to bulk movements. The recommended bulk corn facilities set forth in this report is viewed as one of a series of projects and programs designed to improve the productivity of the corn farm sector in Southern and Northern Mindanao.

Rarely-- if ever--past evidence demonstrates--does narrow, isolated project analysis furnish a reliable guide to future developments. The benefits expected to flow from a single project usually require the implementation of a "package" of integrated components. This integrated approach often includes supporting infrastructure and/or other capital facilities, technical assistance, financing programs, cooperative marketing and producing efforts, legislative or policy changes plus the project or component which is central to the study.

In the case of the present corn handling study, the integrated project approach is logically consistent with USAID's overriding mission i.e., to improve the quality of rural life in the Philippines.

In order to achieve this aim, USAID has a variety of plans and programs to assist in corn sector improvements. And AID programs are coordinated with similar efforts sponsored by the Government of the

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Philippines, other foreign governments and such financial institutions as The World Bank and The Asian Development Bank. In turn, these programs formulated by the governments and the international lending agencies are intended to complement and stimulate supporting private sector activites in the Mindanao corn production and distribution sector.

This entire network of efforts and programs intended to assist the corn sector in the Philippines--including the proposed bulk handling facilities at the three Mindanao ports--constitutes the integrated project relevant to this study.

As noted above, the integrated project approach became an increasingly important analytical tool because the growing literature on post-project appraisals revealed a pattern of lower than anticipated benefits. With scrutiny and study it became clear that the emphasis on project analysis overlooked the importance of implementing the supporting and supplementary programs and policies so essential to benefit realisation.

While the present study is not charged with responsibility for identifying all of the necessary elements or components in an integrated project intended to assist the corn producing and distribution sector in the Mindanao area, the succeeding chapters discusses a suggestive rather than exhaustive list of these required projects.

It should be noted that if only the proposed corn loading port improvements are implemented and no progress is made on other aspects of the integrated corn project such as the receiving ports, the benefits of the port improvements will be much less than would have otherwise been the case. Hopefully, however, the port improvements will stimulate progress in other areas.

If meaningful progress is made in implementing the integrated project a primary benefit will be a rise in the income

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of the corn farming sector. And that is precisely in line with USAID stipulated intentions.

This Study will develop --among other calculations--an estimate of the income gain of the average Mindanao corn farmer that can be expected from successfull implementation of the integrated corn project. In an analogous perspective, the income of the average corn farmer will be compared with the average income of Manila taxi drivers who rent rather than own their working vehicles.

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1.2.2 Level of Detail

The methodology employed in this investigation is responsive to the required level of detail set forth in the Terms of Reference for this Study.

The TOR calls for preliminary engineering designs and cost estimates. With respect to the feasibility portion of the Study, the TOR refers to the determination of a cost effective solution to the corn handling facilities required at the three Mindanao ports.

A full scale feasibility study based on refined cost estimates and detailed benefit-cost calculations was not contemplated or required by the TOR. Indeed, the task of reviewing the corn handling requirements of three Mindanao ports within a three month period makes it imperative that the work be conducted at a preliminary, pre-feasibility level of detail.

1.2.3 Data Availability

National and regional data on corn industry operations in the nation and in Mindinao are readily available and have an acceptable order of accuracy. The data, however, do lack uniformity and rigorous consistency. It is not uncommon to find

varying estimates of what should be identical numbers, even though both estimates were provided by the same Government agency.

The data on corn movements through the ports of General Santos, Cagayan de Oro and Davao are fragmentary and of uncertain reliability. Data on corn movements provided by PPA and the National Statistical Office (NSO) often reveal major discrepancies.

Data on the corn handling operations of ships engaged in inter-island commerce at the three Mindanao ports are scarce. During the field investigation no data on ship operations were obtained for Davao or Cagayan de Oro. And the data for General Santos only covered the period January-September 1990. Staff observations during the brief site investigations plus the sketchy data for the port at General Santos were the principal information sources. Interviews with shipping officials were used to verify the available data and the judgments and estimates derived from these limited statistics.

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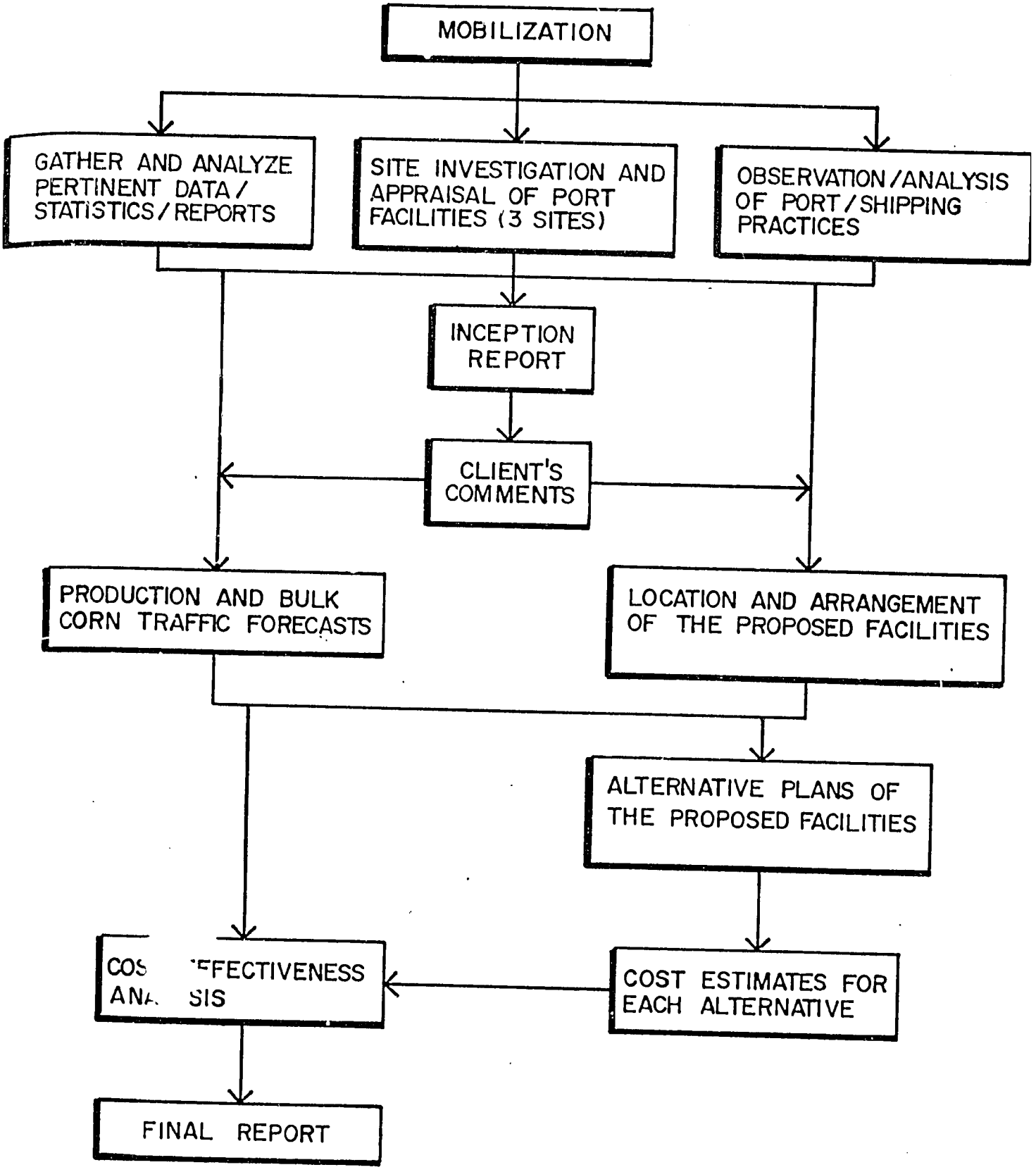
FIG. 1-2 STRUCTURE OF THE STUDY METHODOLOGY



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2.0 INTEGRATED CORN APPROACH

2.1 General

Every corn producing area in the Philippines has its unique and individual characteristics. It is also true that regional conditions, including problems, in the corn producing and distribution sectors tend to have many similarities. Indeed, the international experience of the Consultant indicates that the corn sector in the Philippines has many features in common with the corn industry in other developing nations.

Because of the similarities between different corn producing and distribution areas the discussion, below, is set forth in both general and specific terms. It is the judgment of the Consultant that the comments and observations which follow are directly relevant to the individual corn producing and distribution areas which are tributary to the ports of General Santos, Cagayan de Oro and Davao in Mindanao.

In addition to the Consultant field investigations, interviews, data review and accumulated experience, major sources of information about these Mindanao corn areas are: The Corn Marketing System, A Rapid Marketing Appraisal in the Northern Mindanao Region (1989) and The Corn Marketing System, A Rapid Marketing Appraisal in the Southern Mindanao Region (1988).

2.2 Farm Sector Requirements

Increasing the productivity of corn farming is the primary goal of the integrated corn program, of which the corn handling facilities at the three Mindanao ports are individual components. Because of the critical importance of improving corn producing operations, the discussion of the corn farming sector requirements warrants extended analysis.

2.2.1 International Comparison--Iowa and Mindanao

The available evidence suggests that opportunities for significant gains in corn farm efficiency and productivity exist in Mindanao with implementation of an integrated corn project.

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Some selected statistical comparisons between corn sector operations in the United States and in the Philippines support this expectation.

In Iowa, an American state noted for its advanced and productive corn farms, the minimum size farm for corn farming is considered to be about 300 acres, some 121 hectares. In Mindanao, corn farms range between 2 and 7 hectares (5 to 18 acres). For most statistical data on Mindanao corn farm operations, large farms are classified as those which exceed 3 hectares (about 7.5 acres).

Not a good comparison

A typical Iowa corn farm can produce between 130 to 140 bushels per acre, equivalent to about 9.00 metric tons per hectare. In Mindanao, among yellow hybrid corn farmers, the highest yield obtained in 1989 was 5.4 metric tons per hectare (84.86 bu/acre). By the definition used in A Rapid Marketing Appraisal in the Northern Mindanao Region, the term "highest" refers to the top 25% of those interviewed for data on corn productivity. The highest Mindanao yield was equal to somewhat more than 50% of average Iowa yield.

Despite the productivity differential, the data reveal an impressive performance by the most efficient Mindanao corn growers. The hybrid seed suppliers indicate that 6 metric tons per hectare (94.30 bu/acre) is a reasonable productivity target. Indeed, the single most efficient cultivator of hybrid yellow corn in Mindanao achieved a yield of 6.8 metric tons per hectare (107 bu/acre).

2.2.2 Bases for Higher Corn Productivity

The root causes for expecting increases in Mindanao corn output are several in number:

a) get higher yields from farmers presently using yellow hybrid. The average yield--defined as that obtained by half the hybrid yellow corn growers--is 3 metric tons per hectare. It appears reasonable to assume that in the decade of the

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1990's the average yield of the hybrid growers will rise from the present level of 3 metric tons per hectare to a point halfway between the 3 metric tons and the 6 metric tons considered an achievable ceiling, i.e. a yield of 4.5 metric tons per hectare. Productivity advances can be expected in both prime corn areas--South Cotabato and Bukidnon. While the average Bukidnon farmer tends to work a larger farm and have a more commercial point of view, he remains well below what the seed companies consider an attainable productivity target.

b) some present producers of white corn destined for use as feed can be expected to shift over to the hybrid yellow seeds. Present average yields on the open pollinated white varieties are below 2 metric tons per hectare. Since this shift from white to yellow will be accompanied by a gain in farmer cash income, it is a development that can be reasonably anticipated. On the other hand, some white corn growers may continue to prefer to avoid the fertilizer expense and seed cost of the hybrids. And the open pollinated whites are more drought tolerant than the yellow hybrids.

c) farmers growing open pollinated yellow also constitute candidates for the more productive hybrid yellow varieties.

d) the possible introduction of a hybrid white corn seed can be expected to lead to higher productivity by those growers serving the grits market. However, since demand for corn as food is a limited market, only modest gains are likely to accompany introduction of a white corn hybrid.

e) the development of corn farm cooperatives may lead to an effective increase in the land area cultivated as a single unit. Experience in Iowa suggests that 120

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hectares is about the farm size needed to justify the machinery and equipment essential to a modern, efficient corn producing operation. It is appreciated by the Consultants that changes in this area will not come easily. Traditional practices about land tenure and use are not lightly discarded. However, there is already some observable tendency in Bukidnon to shift to somewhat larger farming units. Corn farms as large as 20 hectares are not uncommon in that area.

2.2.3 Farm Sector Components of Integrated Corn Project

Some of the elements in an Integrated Corn Project designed to aid corn growing operations in Mindanao are suggested below in very general terms:

a) Programs designed to make it financially manageable for corn farmers to purchase hybrid seed and the required 4-6 bags of fertilizer while they wait the 100 day growing period before cash income is available. While the seed manufacturers may help in this aspect, the financial needs of the entire agricultural sector make it desirable that some Government support be available.

b) Programs of technical assistance and instruction in the farming practices needed to get higher yields from use of hybrid corn varieties. This help can come from the Government via agricultural extension services, seed suppliers, fertilizer suppliers, university experts etc.

c) Programs of technical assistance in managing corn farm cash flows on a financially sound basis. This is a logical program for USAID since much can be done at minimum costs. US agricultural experts can be sent to the field and selected local farmers can be brought to the United States for

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advanced, specialized training. Assistance in this area will help farmers obtain higher average revenues and lowest possible transport costs.

d) Post Harvest Programs intended to increase storage and drying facilities under farmer control, or with farmer participation, in the producing areas.

2.3 Inland Corn Transport to the Project Ports.

Throughout the developing world it is a given that the agricultural road network requires expansion, upgrading as well as extensive and accelerated maintenance. Most of the Mindanao agricultural roads are unpaved and have either a gravel or dirt surface. Many bridges are so damaged as to be of limited use.

Compounding the problems created by the poor condition of the agricultural road network is the fact that peak corn harvests tend to coincide with the rainy season. This means many roads are washed out when they are most needed. And the problem of antiquated wooden bridges is more acute during the rainy season.

In addition to the deteriorated road situation, there was a lack of appropriate truck transportation available to move corn from the fields to inland markets or to the three Mindanao ports that are the subject of this study. Carabao or cow-drawn carts, sleds and horses and motorized tricycles had to be used to move corn from many interior barangays.

Successful implementation of the integrated corn project will lead to a substantial increase in corn output. The Mindanao agricultural roads and road transport vehicles will have to be capable of moving corn in bulk rather than bagged form. This means that more all-weather roads will have to be built. Existing motor vehicles will have to be adapted--retro-fitted--to the requirements for bulk transport. In addition, substantial increase in the existing supply of available motor vehicles will be essential.

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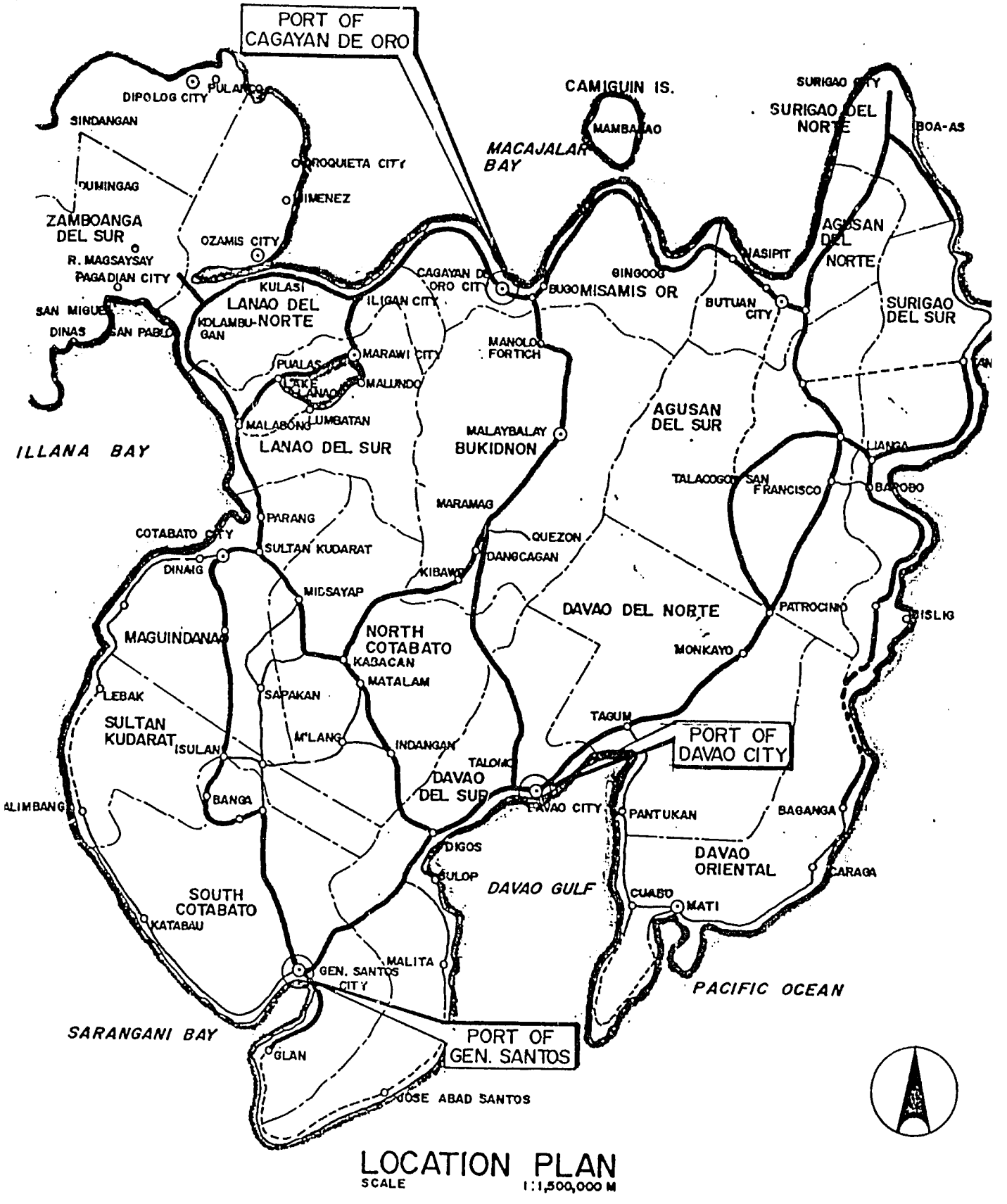

FIG. 2-1 INLAND TRANSPORT SYSTEM OF PROJECT PORTS

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2.3.1 Road Transport Components of Integrated Corn Project

a) Plans for road rehabilitation and new road construction are essential. Transport from farm gates to intermediate points and then to Mindanao loading ports must be made less costly. The World Bank has substantial experience in this field, as does USAID. The Bank has a computer model which can rapidly evaluate road upgrading versus new construction.

b) It is axiomatic that transporters respond to increased opportunity for commodity movements. In an economy where capital and foreign exchange are in scarce supply the response of the transporters will not lead to an excessive or even totally adequate supply of motor vehicles. Evaluating the impact of growing corn production on the need for bulk carrying motor vehicles is a private sector project and function. This need for added vehicles can be met by new vehicle acquisition as well as by retro-fitting existing vehicles used for transporting corn in bags

2.3.2 Mindanao Port Improvements

The purpose of the present study is to formulate a series of recommendations for improving the efficiency of the corn handling operations at Cagayan de Oro, General Santos and Davao. Prior Consultant experience plus visits to the three Mindanao ports indicated that the present system of moving corn in bagged form was costly and time consuming. It was costly in terms of loading the vessel, in terms of ship time and of required arrastre-stevedore labor requirements as well as in terms of spoilage and pilferage.

The study sets forth information about the nature and cost of the proposed bulk handling facilities at the Mindanao ports. This information defines the role of the port improvement components as part of the integrated corn program.

Details on the recommended corn handling facilities for the three Mindanao ports are set forth in Chapter 4 of this report.

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2.4 Inter-Island Water Transport

The April 1989 Final Report, Inter-Island Shipping Industry, prepared for the Presidential Task Force, demonstrated that present inter-island water transport was severely flawed.

Three areas where critical improvements were needed were identified--Safety, Cost and Adequacy of Shipping Services, and Cost and Efficiency in Port Services.

In each of these areas the Presidential Task Force identified numerous programs, policies and projects that would be required if the inter-island shipping industry was to be able to serve the nation with safe, secure, reliable, and efficient service. The sum total of these various regulations constitute the inter-island shipping component of the integrated corn project. There is a clearly defined role for both the public and private sectors in the inter-island shipping portion of the integrated corn project.

The Conference of Interisland Shipowners and Operators has argued--see Manila Bulletin of 2 January 1991--that pervasive graft, corruption and red tape at the nation's port facilities are causing severe problems for the shipping industry, including unwarranted increases in transport costs.

2.4.1 Receiving Port Requirements

It was determined that the present study did not have the responsibility to prepare recommendations about the required facilities at the major off-loading ports for bulk corn shipped through the three Mindanao ports.

It is essential, however, to note that new bulk unloading facilities at the receiving ports will be required if Mindanao corn shipmemnts arrive in bulk rather than bagged form. The receiving ports will have to be able to receive, store and ship bulk corn.

The array of required improvements constitutes the receiving ports component of the integrated corn project. This will be mainly public sector improvements although the private sector will be involved, especially if expansion or rehabbing of the truck transport fleet is required.

2.4.2 Final User Requirements

If the feed mills will be receiving their corn in bulk rather than bagged form, it is evident that their storage facilities and handling operations will have to be modified.

This phase of an integrated corn project is a private sector responsibility. It can be assumed that these facility adaptations will be promptly undertaken in response to the growth in bulk corn movements.

2.5 Overall Observations on Integrated Corn Project

The above discussion was intended to demonstrate that the improvement in rural standards of living--which is one of USAID's major, continuing policy objectives--will come about only if a variety of programs and projects are implemented. Among this network of components are the recommended bulk handling facilities for corn at the Mindanao ports of General Santos, Cagayan de Oro and Davao.

As noted earlier, the contribution of each component of an integrated corn project to the realisation of anticipated benefits cannot be determined with any degree of accuracy. It is possible, however, to identify the components of critical, overwhelming importance.

With respect to the integrated corn project, the key elements are the farm sector components, the loading port requirements as noted in this study, and the inter-island water transport improvements. These are key elements in terms of their contribution to the corn production and distribution operations emanating from Mindanao as well as because of the complexities involved in their implementation.

Inland transport and receiving port requirements are also of major importance. However, there are fewer uncertainties associated with their implementation than is anticipated for the key elements noted above. And the final user requirements--while essential--pose no implementation problems.

3.0 BULK CORN TRAFFIC FORECASTS

3.1 Philippine Agriculture: Corn - Trends and Outlook

3.1.1 Introduction

Corn, also known as maize, is second only to rice as a food crop. Corn is a staple food for about 21 percent of the country's population. Further, corn is an all important ingredient in feed formulation for the country's livestock, poultry and prawn industries. It also serves as a production input for industrial products such as oil, cornstarch and paints.

About one third of Filipino farmers earn their livelihood from corn farming.

3.1.2 Domestic Production

Corn is produced in all regions of the country although production is heavily concentrated in certain regions because yields are affected by differences in climate, soil fertility and terrain. The bulk of the country's corn is produced in the Cagayan Valley, Southern Tagalog and in Northern, Southern, and Central Mindanao. Together these areas account for about 77% of the country's total corn output. The principal corn producing regions are Region 11, Southern Mindanao which account for about 27.5% and Region 12, Central Mindanao which contribute around 24% to national corn production.

National production figures for corn for the period 1980 - 1990 are presented in Table 1.

Table 3-1

PRODUCTION, AREA AND YIELD OF CORN
IN THE PHILIPPINES, 1980-1990

YEAR	PRODUCTION	AREA	YIELD (MT/HA)
1980	3,050,200	3,198,960	0.95
1981	3,295,765	3,294,750	1.00
1982	3,404,085	3,382,930	1.01
1983	3,134,095	3,131,950	1.00
1984	3,250,305	3,226,950	1.01
1985	3,862,805	3,510,910	1.10
1986	4,090,730	3,594,970	1.14
1987	4,278,119	3,682,650	1.16
1988	4,427,951	3,745,070	1.18
1989	4,522,195	3,668,240	1.23
1990	4,871,598	3,820,860	1.28

Source: Department of Agriculture
Bureau of Agricultural Statistics

Total production tons had an average annual compound rate of growth of 5.5% over the span 1980-1990. The annual growth rate for area harvested was 1.7%. The yield per hectare increased from 0.95 MT per hectare in 1980 to about 1.28 MT per hectare in 1990.

Tables 2, 3 and 4 indicate the regional distribution of corn production, of area harvested and of yield for the period 1980-1990.

Table 3-2
CORN PRODUCTION, 1980 - 1990
(in Metric Tons)

REGION	1980	1981	1982	1983	1984	1985
PHILS.	3050200	3295765	3404085	3134095	3250305	3862805
CAR	17262	19319	19586	18503	19073	18816
ILOCOS	31990	31070	42370	49440	53230	60790
CAG. VALLEY	185948	269536	251279	222317	292217	351314
C. LUZON	5815	4720	6160	6045	5880	7610
S. TAGALOG	263140	261425	247270	254200	197325	239605
BICOL	115870	93525	106610	114530	112000	131960
W. VISAYAS	35460	39040	52635	49315	31725	40650
C. VISAYAS	227030	238625	254890	272740	213090	241155
E. VISAYAS	172255	218195	223005	184810	216080	234145
W. MINDANAO	171950	183435	206120	202525	165665	216605
N. MINDANAO	242485	225595	213455	212415	177960	237590
S. MINDANAO	1008620	1037645	1153920	999640	1058200	1216195
C. MINDANAO	572575	670635	626785	547615	707860	866370

Table 3-2 (cont'd.)

REGION	1986	1987	1988	1989	1990
PHILIPPINES	4090730	4278119	4427951	4522195	4871598
CAR	20560	22088	28177	24524	25055
ILOCOS	55170	63830	67792	66884	87933
CAGAYAN VALLEY	358150	398517	438167	448692	546548
CENTRAL LUZON	8530	9307	11752	12888	17290
SOUTHERN TAGALOG	250030	248084	235185	222179	218612
BICOL	138575	121415	138093	127021	149773
WESTERN VISAYAS	51330	61342	59537	45222	36079
CENTRAL VISAYAS	264945	269177	286041	280147	305087
EASTERN VISAYAS	212900	216800	225040	227210	216208
WESTERN MINDANAO	216005	223539	241438	246726	259716
NORTHERN MINDANAO	274455	305735	355347	428360	523171
SOUTHERN MINDANAO	1277725	1318665	1283523	1294320	1338887
CENTRAL MINDANAO	962355	1020130	1063444	1108042	1147239

Source: Department of Agriculture
Bureau of Agricultural Statistics

Southern Mindanao (Region 11), Central Mindanao (Region 12) and Northern Mindanao (Region 10), account for more than 60% of national corn production while Cagayan Valley contributes about 10 percent.

Table 3-3

REGIONAL DISTRIBUTION OF CORN AREA, 1980-1990
(in Hectares)

REGION	1980	1981	1982	1983	1984	1985
PHILS.	3198960	3294750	3382930	3131950	3226950	3510910
CAR	19340	21650	18070	19180	18400	18560
ILOCOS	46350	42630	51110	53430	58470	63920
CAG. VALLEY	272490	317060	292530	294500	295200	316970
C. LUZON	8530	7100	8130	8400	8820	9780
S. TAGALOG	224730	239950	271410	271430	231800	245500
BICOL	179310	159360	165790	159000	156850	173550
W. VISAYAS	71360	64920	76780	63730	69660	83100
C. VISAYAS	473340	481970	490280	469470	482070	517360
E. VISAYAS	186980	203920	206820	194370	197510	213240
W. MINDANAO	251780	268150	277290	270620	251350	288400
N. MINDANAO	285430	234700	229800	197420	203420	235840
S. MINDANAO	738100	760050	803500	739730	747760	791680
C. MINDANAO	441220	493020	491420	390670	505640	553010

Table 3-3 (cont'd.)

REGION	1986	1987	1988	1989	1990
PHILIPPINES	3594970	3682650	3745070	3689240	3820860
CAR	20590	21110	21600	21770	22300
ILOCOS	65850	72460	75610	71960	79000
CAGAYAN VALLEY	324800	333200	346400	347690	346270
CENTRAL LUZON	10670	10210	12010	13020	12730
SOUTHERN TAGALOG	250480	255140	248530	237530	235980
BICOL	180070	187290	194490	186950	192940
WESTERN VISAYAS	103930	114150	115250	88360	64900
CENTRAL VISAYAS	533490	530190	541500	532620	563840
EASTERN VISAYAS	219290	229800	225040	227210	230620
WESTERN MINDANAO	295730	293730	299110	269160	299790
NORTHERN MINDANAO	244840	272340	288310	313520	328500
SOUTHERN MINDANAO	764810	770460	778360	773260	816080
CENTRAL MINDANAO	580420	592570	598860	606190	627910

Source: Department of Agriculture
Bureau of Agricultural Statistics

Table 3 shows that in terms of area harvested, Southern Mindanao's corn area is about 21% of the total, followed by Central Mindanao, accounting for about 16%. The other regions which have significant areas planted to corn are Northern Mindanao (9%), Cagayan Valley (9%) and Central Visayas with almost 15% of the total area planted to corn.

Table 3-4

REGIONAL DISTRIBUTION OF CORN YIELD, 1980-1990
(in Metric Tons per Hectare)

REGION	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
CAR	0.89	0.89	1.08	0.96	1.04	1.01	1.00	1.05	1.30	1.13	1.12
ILOCOS	0.69	0.73	0.83	0.93	0.91	0.95	0.84	0.88	0.90	0.93	1.11
CAGAYAN VALLEY	0.68	0.85	0.86	0.75	0.99	1.11	1.10	1.20	1.26	1.29	1.58
CENTRAL LUZON	0.66	0.66	0.76	0.72	0.67	0.78	0.80	0.91	0.98	0.99	1.36
SOUTHERN TAGALOG	1.17	1.09	0.91	0.94	0.85	0.98	1.00	0.97	0.95	0.94	0.93
BICOL	0.65	0.59	0.64	0.72	0.71	0.76	0.77	0.65	0.71	0.68	0.78
WESTERN VISAYAS	0.50	0.60	0.69	0.77	0.46	0.49	0.49	0.54	0.52	0.51	0.56
CENTRAL VISAYAS	0.48	0.50	0.52	0.58	0.44	0.47	0.50	0.51	0.53	0.53	0.54
EASTERN VISAYAS	0.92	1.07	1.08	0.95	1.09	1.10	0.97	0.94	1.00	1.00	0.94
WESTERN MINDANAO	0.68	0.68	0.74	0.75	0.66	0.75	0.73	0.76	0.81	0.92	0.87
NORTHERN MINDANAO	0.85	0.96	0.93	1.08	0.87	1.01	1.12	1.12	1.23	1.37	1.59
SOUTHERN MINDANAO	1.37	1.37	1.44	1.35	1.42	1.54	1.67	1.71	1.65	1.67	1.64
CENTRAL MINDANAO	1.30	1.36	1.28	1.40	1.40	1.57	1.66	1.72	1.78	1.83	1.83

Source: Department of Agriculture
Bureau of Agricultural Statistics

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In terms of yield of corn per hectare, Region 12 (Central Mindanao) registered the highest corn yield for the past three years with 1.83 MT in 1990. The other regions with higher yields per hectare are Southern Mindanao (1.64 MT), Northern Mindanao (1.59 MT) and Cagayan Valley with 1.58 MT.

The domestic supply of corn is highly seasonal, with major harvests occuring in July, August and September. minor harvests from January to June and a "mini" peak in the October to December period.

Based on the Corn Situation Outlook of the Department of Agriculture, the Philippines maintains a position of virtual self-sufficiency in corn. An occasional deficit of some five per cent of consumption is met by temporary imports for animal feed.

3.1.3 Consumption

The highest consumption of corn per person is in the Central Visayas (Region 7) where it is the staple food, consumed in larger quantities than rice. On the other hand, human consumption of corn in Luzon is very low since it is mainly used as animal feed or production input for cornstarch, paints and other industrial products.

The main regional deficit area is Region 7 and is supplied from the surplus of Mindanao. The other surplus area is Region 2 and corn from this region is transported to Metro Manila and Bulacan, to be processed as animal feed.

In recent years, there has been an increase in demand for corn as feed as a result of the growth of the livestock sector. The Department of Agriculture estimates that about 25 percent of the crop is used for food and some two-thirds for animal feed.

3.1.4 Importance of Corn Industry

Corn is a commodity of considerable economic and political significance in the country's agricultural sector. With the growing domestic demand for corn, the government is undertaking measures to enhance production, procurement and distribution in the different regions. Corn is included in the Comprehensive Agrarian Reform Program (CARP). The aim is to increase productivity of corn lands and raise the income of corn farmers.

In the Medium Term Development Plan for 1987-1992, corn production is projected to grow by 6.4 percent per annum and priority was to be given to the promotion of hybrid corn.

The Department of Agriculture has implemented a plan to increase corn production for the period 1990-1991 by 5 to 6 percent and its objectives include self-sufficiency of corn supply, stability in prices and the integration of the corn and hog/poultry industries.

Efforts to this effect include provision of credit support to farmers in the short and medium term, introduction of hybrid seeds, increase in fertilizer use, removal of transport bottlenecks, improvement in post harvest facilities, provision of extension services and expansion of marketing arrangements/services.

3.2 Mindanao Agriculture: Corn - Trends and Outlook

3.2.1 Introduction

The major corn producing areas in Mindanao are Northern Mindanao (Region 10), Southern Mindanao (Region 11) and Central Mindanao (Region 12). As noted above, these regions account for 60% of national corn output. The aggregate production for these three regions exhibited an average growth of 5.9% over the period 1980-1990, higher than the average growth of national production for corn of 5.5%.

Southern Mindanao or Region 12, the top corn producing region in the country in terms of production, yield and area harvested accounts for about 28% of national corn production.

Area harvested for the three regions in Mindanao increased from 1.82 million hectares to 3.0 million hectares in 1990 i.e. an average compound growth rate of 1.9 percent per annum for the period 1980-1990.

The government in recent years has encouraged yellow corn production through its Maisan 77 and 99 programs, based on the application of new hybrid seeds and high technology. It has also promoted the shift of traditional white corn areas to yellow corn. These corn production programs were extensively promoted in the Mindanao corn producing provinces for the past three years. The said programs increased the percentage of yellow corn relative to white corn.

3.2.2 Corn Production by Province

Since the study focuses on the three corn producing areas in Mindanao, it is useful to look into the provinces which produce corn in each of these three regions.

Table 3-5
CORN PRODUCTION BY PROVINCE IN REGION 10, 1980 - 1989
(in Metric Tons)

PROVINCE	1980	1981	1982	1983	1984
Agusan Del Norte	14720	17740	15445	14950	14945
% Share	6.07%	7.86%	7.24%	7.04%	8.40%
Agusan Del Sur	29670	25255	28980	22180	21635
% Share	12.24%	11.19%	13.58%	10.44%	12.16%
Bukidnon	157605	152320	142685	147735	118900
% Share	65.00%	67.52%	66.85%	69.55%	66.81%
Camiguin	450	335	295	160	330
% Share	0.19%	0.15%	0.14%	0.08%	0.19%
Misamis Occiden'l	6990	5100	3740	4030	4680
% Share	2.88%	2.26%	1.75%	1.90%	2.63%
Misamis Oriental	32155	24425	21725	22835	16935
% Share	13.26%	10.83%	10.18%	10.75%	9.52%
Surigao Del Norte	895	420	585	525	535
% Share	0.37%	0.19%	0.27%	0.25%	0.30%
NORTHERN MINDANAO TOTAL	242,485	225,595	213,455	212,415	177,960

Table 3-5 (cont'd.)

PROVINCE	1985	1986	1987	1988	1989
Agusan Del Norte	17760	19650	21660	25331	24816
% Share	7.57%	7.16%	7.08%	7.13%	5.79%
Agusan Del Sur	24415	24235	28420	29089	28479
% Share	10.41%	8.83%	9.30%	8.19%	6.65%
Bukidnon	157640	196035	208325	246765	312697
% Share	67.20%	71.43%	68.14%	69.44%	73.00%
Camiguin	690	805	875	1094	668
% Share	0.29%	0.29%	0.29%	0.31%	0.16%
Misamis Occiden'l	11190	11295	17825	15049	16907
% Share	4.77%	4.12%	5.83%	4.24%	3.95%
Misamis Oriental	22075	21755	27610	37292	44038
% Share	9.41%	7.93%	9.03%	10.49%	10.28%
Surigao Del Norte	820	680	1020	727	755
% Share	0.35%	0.25%	0.33%	0.20%	0.18%
NORTHERN MINDANAO TOTAL	234,590	274,455	305,735	355,347	428,360

Source: Department of Agriculture
Cagayan de Oro City

For Region 10, the major corn producing province is Bukidnon, which contribute about 70% of total corn production in Region 10, and it registered an average annual growth of 8.9% for the period 1980-1990, attributable mainly to the use of hybrid seeds.

For Region 11 or Southern Mindanao, as shown in Table 6, South Cotabato is the highest corn producing province accounting for about 90% of total corn production in the region and its production exhibits an average annual growth of 3.6% for the period 1980 - 1989.

Table 3-6
CORN PRODUCTION IN REGION II
1980 - 1990

YEAR	DAVAO DEL SUR	SOUTH COTABATO	DAVAO ORIENTAL	DAVAO DEL NORTE	DAVAO CITY	SURIGAO DEL SUR
1980	20,775	751,975	59,980	160,720	7,265	7,905
1981	23,425	783,925	60,200	152,715	4,805	12,575
1982	24,425	839,795	60,170	210,210	6,815	12,505
1983	25,565	778,795	61,285	110,395	8,955	14,635
1984	25,130	817,400	60,920	132,750	7,655	14,345
1985	26,695	918,745	68,450	178,080	7,910	16,315
1986	29,155	997,965	78,170	146,110	7,245	19,080
1987	31,400	1,039,780	70,590	150,760	6,810	19,325
1988	34,685	1,006,402	61,977	155,975	7,459	19,468
1989	36,179	1,020,462	60,260	144,804	9,693	18,477

Source: Department of Agriculture
Davao City

3.3 Preparation of Corn Forecasts

In order to provide a forecast that can serve as the basis for planning the recommended bulk handling facilities at the ports of General Santos, Cagayan de Oro and Davao, four steps are necessary:

1. determine the expected rate of increase in corn production over the period through 2000.

2. if appropriate, apply this rate of increase to the available data on corn movements through each of the Mindanao ports.

3. eliminate the volume of corn throughout that is not susceptible to bulk movement. This is principally grits, which will continue to move in bags.

4. determine flow of bulk corn during the peak month. This is a required input in designing appropriate bulk handling facilities.

5. establish a priority schedule among the three Mindanao ports with regard to the implementation of the proposed bulk corn handling facilities.

3.3.1 Rate of Growth of Corn Output

Review of historical corn production trends, analysis of Department of Agriculture estimates for corn production increases through 1995 and discussions with a major international grain merchandiser led to the determination that an average annual rate of increase of 6% in corn production can be expected for the period from 1990 through 2000. This 6% figure is based on an expected increase in hectarage as well as rising productivity to expanded and more efficient utilization of yellow corn hybrid seeds.

Table 1, above, suggests the potential for growth in corn output. In 1990 corn output per hectare was 1.28 metric. Existing hybrid yellow seeds have a demonstrated productivity potential of 6 metric tons per hectare. And this is not a laboratory or controlled test result but is considered to be an attainable potential.

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The grain merchandising company that was interviewed--an intensive, long time participant in Mindanao corn operations--considered the 6% estimate to be most conservative. However the Consultants decided that it was more prudent to base their engineering calculations on that number rather than a higher figure.

3.3.2 Corn Movements Through the Three Mindanao Ports

It appears reasonable--even conservative-- to expect flows of corn through the Mindanao ports of General Santos, Cagayan de Oro and Davao to proceed in line with the 6% growth rate forecast for national production over the period through 2000. Corn farmers in the Bukidnon area are particularly enterprising and take an increasingly commercial approach to their agricultural activities.

Developing an estimate of current corn movements through each of the three ports was no simple task. As noted in Chapter 1 only fragmentary, contradictory and inconclusive data are available on past corn movements through these ports.

Table 7, below, shows estimated corn movements through each of the ports in 1989 and 1990 plus forecasts for the period 1991 through 2000.

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Table 3-7

CORN SHIPPED THROUGH SELECTED MINDANAO PORTS

Year	Cagayan de Oro 1/	General Santos 2/	Davao 3/
1989	268,426 MT	263,756 MT	94,338
1990	220,000 MT (est)	35,000 MT (est)	100,000 (est)
1991	233,200	279,581	106,000
1992	247,192	296,356	112,360
1993	262,023	314,137	119,101
1994	277,744	332,985	126,247
1995	294,409	352,965	133,822
1996	312,074	374,142	141,851
1997	330,798	396,591	150,363
1998	350,646	420,386	159,384
1999	371,685	445,610	168,947
2000	393,986	472,346	179,084

1/ Cagayan de Oro forecast based on 6% per year, starting 1990.

2/ General Santos forecast based on 6% per year, using 1989 shipments as reference point.

3/ Davao forecast based on 6% per year, starting 1990

3.3.3 Corn Movements Susceptible to Bulk Transport

Not all corn now moving through the ports of General Santos, Cagayan de Oro and Davao is a logical candidate for bulk transport. The only significant item that will continue to move in bags is corn grits, destined as food for people in the Visayas.

Based on the field investigations, it has been estimated that about 25% of the corn moving through Cagayan de Oro is grits. The comparable figure for General Santos is 5% and for Davao the estimate is 10%. When these percentages are applied to the forecasts shown above in Table 7, the volume of corn shipments which are candidates for or susceptible to bulk handling is as shown, below, in Table 8.

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Table 3-8

FORECAST OF CORN SHIPMENTS SUSCEPTIBLE TO BULK TRANSPORT

Year	Cagayan de Oro	General Santos	Davao
1991	174,900 MT	265,601 MT	95,400 MT
1992	185,394	281,538	101,124
1993	196,517	298,430	107,190
1994	208,308	316,335	113,622
1995	220,806	335,316	120,439
1996	234,055	355,434	127,665
1997	248,098	376,761	135,326
1998	262,984	399,366	143,445
1999	278,763	423,329	152,052
2000	295,489	448,728	161,175

3.3.4 Peak Movements

The design of bulk handling facilities is geared to meeting peak month requirements. Because of the limited and incomplete data on current corn movements through the three Mindanao ports, it has not been possible to develop concrete and acceptably accurate data on peak month movements.

Fragmentary and inconclusive data on the Mindanao ports suggests that peak months may now account for more than 16% of the annual total. If there were no peaks, each month would account for 8.3% of the annual total. It is the judgment of the Consultants that implementation of the proposed bulk facilities at the three Mindanao ports along with the other elements of the international corn project will help farmers to avoid a price weakening oversupply at harvest times as well as an absence of supply during the period of highest prices.

The combination of increased aerated storage and drying facilities plus improvements in farm management will even out the annual flow of corn and assist the farmer in improving his cash return. Based on interviews and discussions--as well as the international experience of the

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Consultant--it has been determined that by the end of the century the peak month percentage can be brought down to about 10%.

Based on this 10% estimate the peak volume in the year 2000 for each of the three Mindanao ports is shown below in Table 9:

Table 3-9

PEAK MOVEMENTS OF BULK CORN IN YEAR 2000

Port	Peak Month Volume in 2000 (MT)
General Santos	45,000
Cagayan de Oro	30,000
Davao	16,000

3.3.5 Priority Among Ports

Due to design and scheduling of resources, the three bulk handling facilities would probably not be built simultaneously. It is best to think of a staging approach to implementation.

Based on levels of traffic, it appears that the proposed facilities for General Santos should be the initial effort. Assuming an affirmative decision on project implementation will be forthcoming in 1991, General Santos should be scheduled for construction in 1992 with Cagayan de Oro scheduled for construction in 1993. The lowest priority--based on present and anticipated levels of traffic--is Davao, where construction might be scheduled in 1994.

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4.0 ALTERNATIVE DEVELOPMENT PLANS

4.1 Introduction

The basic development philosophy used for the selected Mindanao loading ports would be predicated on providing each port with an appropriate modern bulk corn shipping facility capable of meeting the local demands of an ever increasing domestic corn trade as it relates to the overall Philippine economy.

The proposed terminals would be designed and equipped to adequately serve the needs of the entire corn industry from producer to end user.

The physical site location for each facility would be determined primarily on the direct results of initial field investigations with regard to site approximation to PPA approved "dedicated" berths. We would also be concerned with existing land usage; size of site; topography; truck accessibility; soil conditions; environmental impact concerns and "on a comparison basis of operating aspects" which might interfere with on-going port operations prior to, during and after construction activities.

In addition, the Consultants would identify the advantages and disadvantages of various site locations at each selected port. The Consultants would make specific recommendations as to type and size of each facility, based not only on short and long term cost efficiencies but also on the physical compatibility requirements of the site location and, most important, the anticipated growth of future grain traffic.

Privatization of these facilities and their overall operation is considered a must if conversion to a modern bulk corn marketing and distribution system is to be achieved. Transformation to such a system would take place gradually. The Consultants believe that investment in port loading facilities would both stimulate and contribute to this change.

4.2 Site Investigations

4.2.1 Port of General Santos

a) Port Location. The Port of General Santos (also referred to as Makar Wharf) is located at the head of Sarangani Bay. The Bay forms a natural oblong cove that protects the port from the strong winds and waves coming from the Celebes Sea at

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the southwest and Philippine Sea at the southeast. Its geographic coordinates are Latitude 6°06′ North and Longitude 125°09′ East. The port is just a few kilometers west of the city commercial center.

b) Topography and Hydrography. The general topography of the surrounding area is extensively plains with hills and mountain ranges irregularly distributed. It slopes gently towards the shorelines of Sarangani Bay. The bay is a 500-square kilometer basin of deep water and is almost enclosed by a 30 kilometer coastline. The mouth into the bay is 11 kilometer wide with water depths exceeding 1000 fathoms.

c) Climatology. The climate classification of the area is Type II, where there is no pronounced wet or dry season because the rainfall is evenly distributed throughout the year. The average rainfall is 819 mm a year. It is located in a typhoon-free zone, although the tropical cyclones passing through the northwestern part of the country bring substantial rainfall during the months of July and August. The hottest months are from March to June and the coolest months are December and January.

d) Oceanography. Prevailing wind direction is north to northwest with an average velocity of four knots during the early and later months of the year. By midyear, the direction changes towards the south and southwest. Currents are induced primarily by the position of the moon. When the moon is near the equator, it produces two ebb-currents a day, but as the moon declination increases, it produces a diminishing velocity of one ebb and an increasing velocity in the other. Tidal range between the ebb and the tides is approximately 1.48 meters.

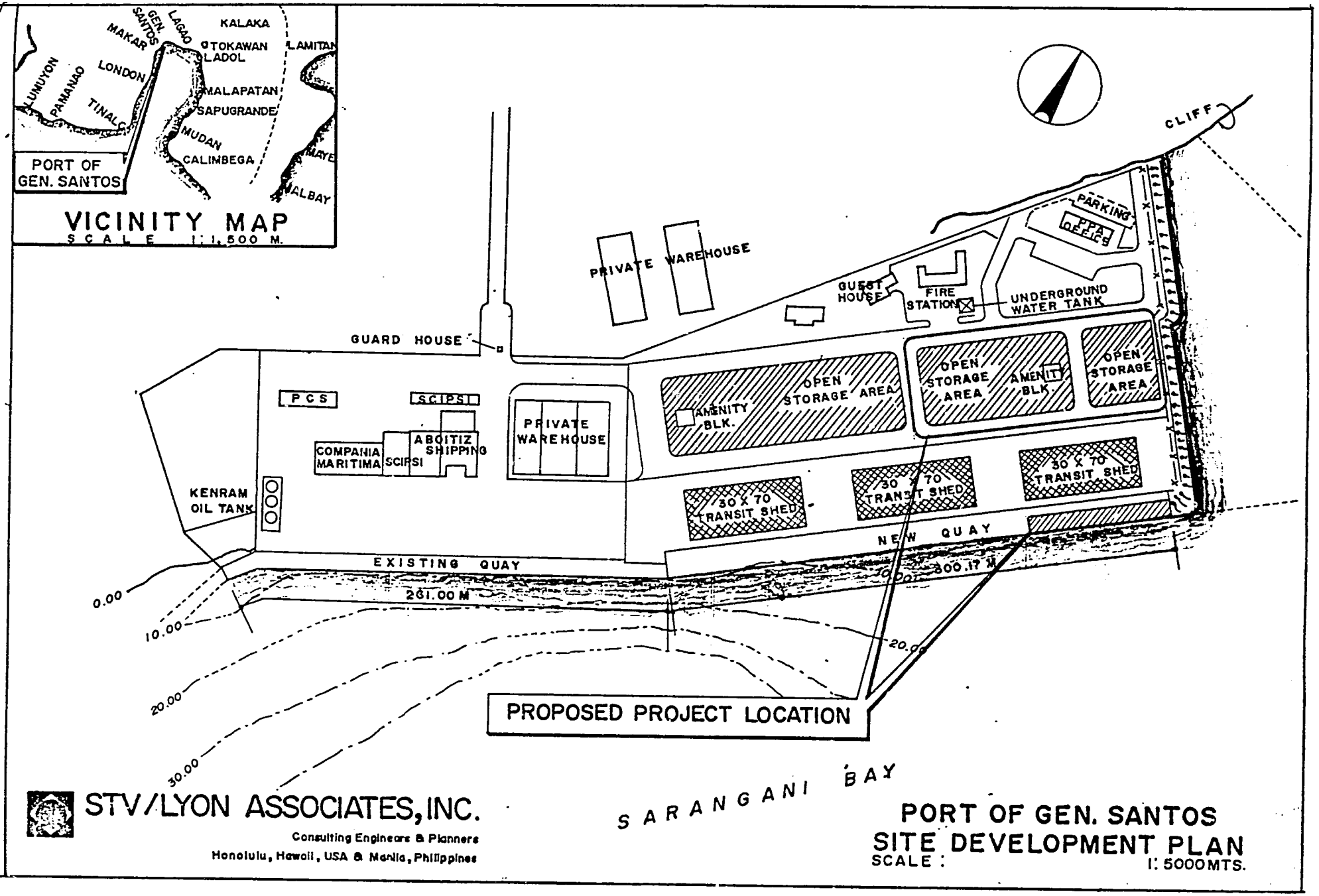
e) Geotechnical Conditions. The top soil in the area is of the loamy type consisting of a friable mixture of clay silt and sand. The Koronadal Valley and Allah

Valley though separated by a mountain range are both underlain by sedimentary and metamorphic rocks. The seabed near the port consists of coraline sand and quartz particles. Sediments of soft gray mud can be found near the mouths of the rivers that empty into Sarangani Bay. The study did not call for geotechnical investigations to be undertaken. However, all available relevant information, particularly on the piling system of the new wharf, was reviewed. The storage structures are expected to have a structural loading of some 1.7 to 2.0 metric tons per square foot. Pile lengths of 20 meters have been recommended.

f) Existing Port Facilities. The government port operated by the Philippine Ports Authority is commonly known as Makar Wharf or Port of General Santos City. It is situated in a 14.7-hectare area partly reclaimed from the sea. The wharf is 562 meters long, of which 341 meters was constructed in 1975 to supplement the original wharf. There are also a number of private ports in Sarangani Bay under the supervision of the Philippine Ports Authority.

g) Proposed Site of the Bulk Corn Facilities. Considering the foregoing, the site at the northeast end of the existing 562-meter wharf was chosen for development. About one hectare of the port area would have to be reserved for the storage silos and ancillary facilities. Likewise, 100 meters of the wharf would have to be dedicated for the bulk loading berth

FIGURE 4-1


VICINITY MAP
SCALE 1: 1,500 M.
PORT OF GEN. SANTOS
GEN. SANTOS
LAGAO
KALAKA
MAKAR
TOKAWAN
LADOL
LAMITAN
LONDON
ALUMUYON
PAMANAO
MALAPATAN
SAPUGRANDE
TINALC
MUDAN
CALIMBEGA
MAYE
ALBAY
PRIVATE WAREHOUSE
GUEST HOUSE
FIRE STATION
UNDERGROUND WATER TANK
PARKING
PPA OFFICE
CLIFF
GUARD HOUSE
PCS
SCIPSI
COMPANIA MARITIMA
SCIPSI
ABOITIZ SHIPPING
PRIVATE WAREHOUSE
AMENITY BLK.
OPEN STORAGE AREA
OPEN STORAGE AREA
AMENITY BLK.
OPEN STORAGE AREA
KENRAM OIL TANK
30 X 70 TRANSIT SHED
30 X 70 TRANSIT SHED
30 X 70 TRANSIT SHED
NEW QUAY
EXISTING QUAY
261.00 M
300.17 M
0.00
10.00
20.00
30.00
20.00
PROPOSED PROJECT LOCATION
SARANGANI BAY
STV/LYON ASSOCIATES, INC.
Consulting Engineers & Planners
Honolulu, Hawaii, USA & Manila, Philippines
PORT OF GEN. SANTOS
SITE DEVELOPMENT PLAN
SCALE : 1: 5000 MTS.

4.2.2 Port of Davao

a) Port Location. The Port of Davao at Sasa is located in Pakiputan Strait between Davao City and Samal Island, inside the Gulf of Davao in Southeastern Mindanao. In the admiralty chart, it is marked at Latitude 7°05 North and Longitude 125°35 East. It is accessible from the Pan Philippine Highway approximately ten kilometers north of downtown Davao City.

b) Topography and Hydrography. The area around the Port of Davao is characterized by extensive mountain ranges with uneven distribution of plateaus and valleys. The Gulf of Davao opens into the Philippine Sea in the South Pacific Ocean. Water depths in the gulf vary from 180 meters near the center and 1,000 meters at the mouth. In the Pakiputan Strait, it is 35 meters. The depth of water along the wharf is nine meters.

c) Climatology. Rainfall is fairly well distributed throughout the year with a mean value of 1,753 mm per year. Hence, there is no defined dry and wet season. Temperature averages 26°C and varies only slightly from the dry to the wet season. Humidity, as in many parts of the Philippines, is high, ranging from 82% to 95%.

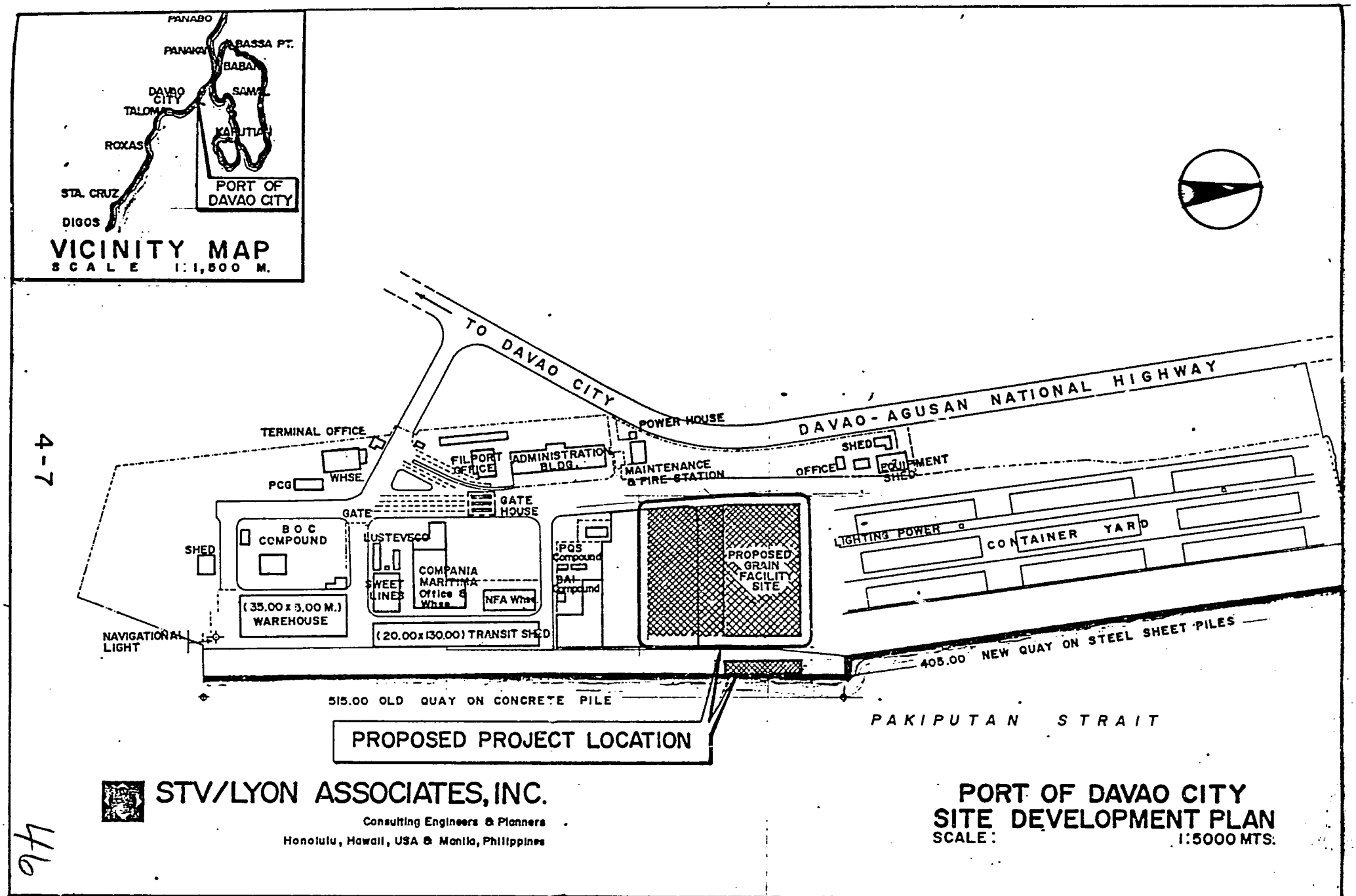
d) Oceanography. Davao is less affected by tropical cyclones. The only period of vulnerability is during the rainy period from November to January. Since Davao Gulf is protected on all sides by land masses except at its mouth at the south, water surface is normally calm except during the southwest monsoon period from June to September. During this time, wave height averages 1.50 meters. Tides are of the semi-diurnal type that follows the moonchanging phases, which range approximately 1.80 meters.

e) Geotechnical Conditions. The uplands of Davao are generally mountainous and underlain by igneous and methamorphic rocks. The lowlands are underlain by sedimentary rocks such as limestone, shale and conglomerate of soil and gravel deposits. The prevailing strata of soil in the lowlands usually required pile foundation works. Core drilling and soil investigations carried out in 1975 for the Sasa Wharf Extension revealed that coraline sands exist down to an average depth of 11 meters below the seabed. For the silo structures at Sasa Wharf, pile lengths of 20 meters are deemed adequate for cost estimating purposes. New borings on the proposed silo site during the detailed design phase would establish precise lengths of the piles required.

f) Existing Facilities. The Port of Davao at Sasa (the other is at Sta. Ana) has two berthing facilities: an old 515-meter quay with four berths of 10.6 meters draft, and a new 405-meter quay with 4 berths of 10.6 meter draft. It also has a 2.6-hectare open storage area and a 7,200-square meter roofed storage. Power is supplied by the Davao Light and Power Co., using a 3-phase 4 wire 69 KVA primary line. Water is tapped from a 6-inch main pipe owned by the Davao City Water District. Drainage and sewer systems are adequate. No flooding occurs in the port area. Communication facilities such as telephone, telex and fax are available.

g) Proposed Site of the Bulk Facilities. The total port area is 16.76 hectare with two quays; the old (515 x 18 m.) and the new (405 x 35 m.) The site proposed for the bulk corn facilities is located at the north end of the old quay abuting the new quay. About 100 meters of dedicated berthing space and one hectare of operational area would be required for this project.

FIGURE 4-2



STV/LYON ASSOCIATES, INC.

Consulting Engineers & Planners

Honolulu, Hawaii, USA & Manila, Philippines

PORT OF DAVAO CITY
SITE DEVELOPMENT PLAN
SCALE: 1:5000 MTS.

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4.2.3 Port of Cagayan

a) Port Location. The Port of Cagayan de Oro is located at Macajalar Bay in Central Northern Mindanao at Latitude 8°30′ North and Longitude 124°40′ East. The port is just north of the downtown city area. It is accessible from the main west-east coastal road of Northern Mindanao (Iligan City- Cagayan de Oro-Butuan City Road), through two gates: the general cargo gate at the west and the container cargo gate at the east.

b) Topography and Hydrography. Macajalar Bay is protected by a range of mountains with elevations of 2560 meters in the north and 2900 meters in the south. The seabed of the port is steeply shelving and reaches a depth of 1000 meters at the outer mouth of the bay. The controlling water depths alongside the middle of the 165-meter quay is 9.50 meters.

c) Climatology. The climate in the area is generally pleasant. The dry season occurs from November to April while the wet season consumes the rest of the year. The wet months coincide with the southwest moonsoon season which occurs during the months of May through October.

d) Oceanography. Macajalar Bay experiences strong waves during the monsoon season, but the port itself is protected by Mabalacan Point. The waves dissipate before reaching the anchorage and berthing areas. The current velocity ranges from 0.10 to 0.50 knots. Tidal range in approximately 1.50 meters.

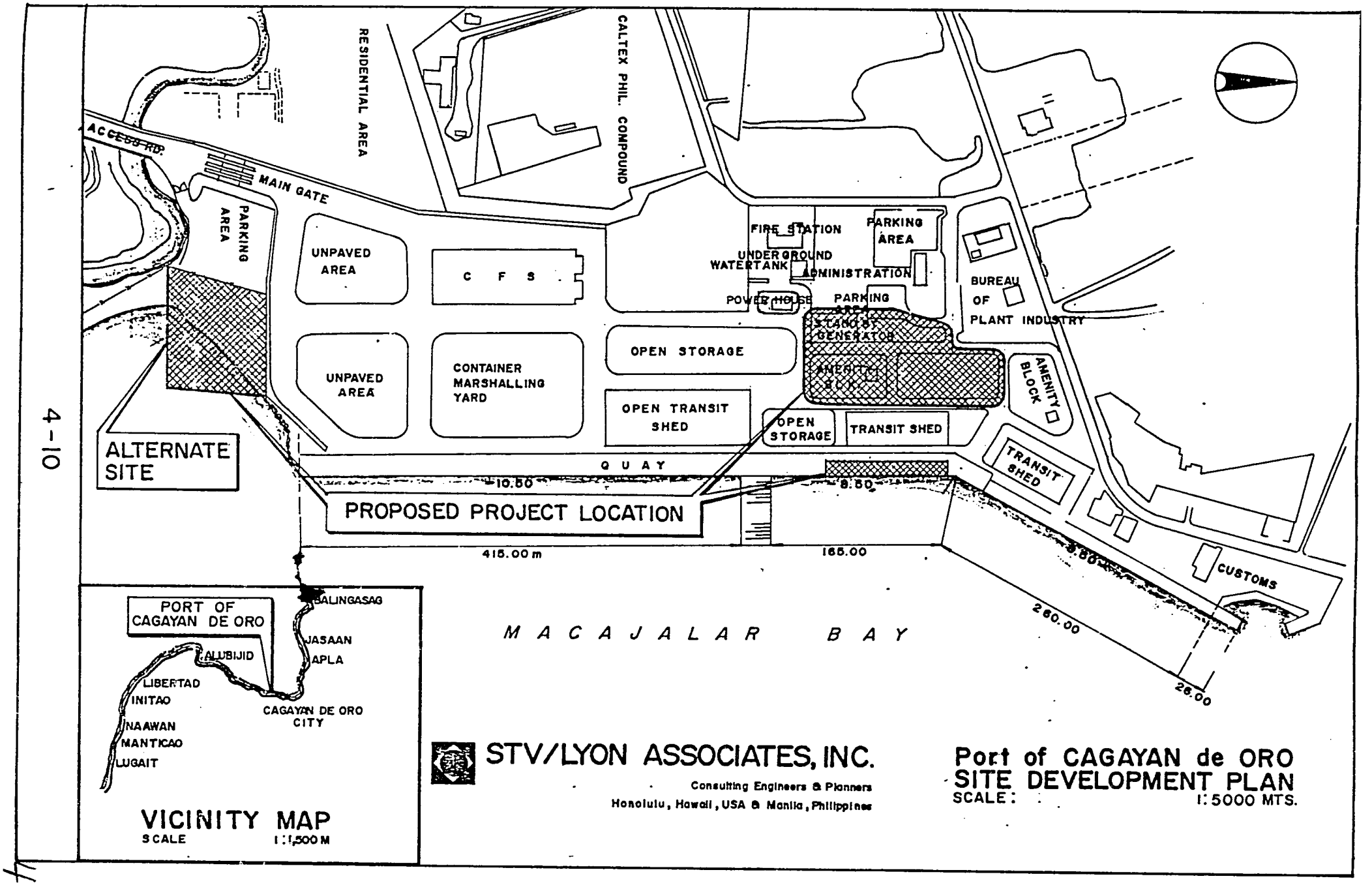
e) Geotechnical Conditions. The oldest known rock units consist of metamorphic rocks with crystalline schists. Recent formations consist of conglomerate and shale with overlying alluvial deposits. Several borings and tests were carried out starting with the 1972 UNDP Study and 1979 IBRD Study. The newest subsurface

investigations fo. the latest wharf extension were undertaken in 1986. Since silo structures are characterized by high concentrated loads, the use of a piled foundation system for all silo storage structures is recommended based on the available soil data, piles of 35-meter lengths are expected to be used.

f) Existing Facilities. The port has an adequately designed water and drainage system. Potable water supply is furnished by the Cagayan de Oro Water District. It is also served by a 3-phase 34.5 KV primary power line. The existing power distribution within the port is an underground duct/conduit system encased with concrete. Telephone, telex and fax facilities are readily available.

g) Proposed Site of the Bulk Facilities. Two sites have been considered. One near the intersection of the new and old wharf at the north end of the container rail and the other at the far south end of the wharf (berthing dolphins would have to be constructed). However, bcause of higher investment costs for the latter site, the first site is recommended. About 100 meters of berthing space and one hectare of storage area would to be required for initial construction.

FIGURE 4-3


RESIDENTIAL AREA
CALTEX PHIL. COMPOUND
ACCESS RD.
MAIN GATE
PARKING AREA
UNPAVED AREA
C F S
UNPAVED AREA
CONTAINER MARSHALLING YARD
OPEN STORAGE
OPEN TRANSIT SHED
FIRE STATION
UNDERGROUND WATERTANK
ADMINISTRATION
PARKING AREA
POWER HOUSE
PARKING AREA
ISLAND GENERATOR
AMENITY BLOCK
OPEN STORAGE
TRANSIT SHED
BUREAU OF PLANT INDUSTRY
AMENITY BLOCK
TRANSIT SHED
CUSTOMS
ALTERNATE SITE
QUAY
10.50
8.50
PROPOSED PROJECT LOCATION
415.00 m
165.00
260.00
26.00
MACAJALAR BAY
PORT OF CAGAYAN DE ORO
BALINGASAG
JASAAN
APLA
ALUBIJID
LIBERTAD
INITAO
NAAWAN
MANTICAO
LUGAIT
CAGAYAN DE ORO CITY
VICINITY MAP
SCALE 1:1,500 M
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Port of CAGAYAN de ORO
SITE DEVELOPMENT PLAN
SCALE: 1:5000 MTS.

4.2.4 Applicable Engineering Standard for the Bulk Handling Facilities

The planning and development of the bulk handling facilities, on the whole, should comply with internationally accepted standards and codes as adopted for Philippine conditions. Pertinent engineering codes and standards used locally are listed below:

a) American Concrete Institute Building Code (ACI-318-N-83)

b) American Institute of Steel Construction (AISC 8th Edition)

c) American Society for Testing Materials (ASTM)

d) National Structural Code of the Philippines (ASEP - 1987)

e) Philippine Electrical Code (IIEE - 1985)

f) The U.S. Standard ACI 313R-77, "Recommended Practice for Design and Construction of Concrete Bins, Silos and Bunkers for Storing Granular Material" (revised in 1983) [1]

g) U.S. National Grain and Feed Association Publication "A Practical Guide to Elevator Design"

h) The German Silo Code DIN 10-55 [2]

i) The Soviet Silo Code CH-302-65 [3]

j) French Silo Regulations [4], [5]

i) "Dynamic Pressure of Granular Material in Deep Bins", - Alexander M. Turitzin PE-ASCE 1963 (proceedings of ASCE).

Based on the foregoing codes and standards the following important factors were used in the

preliminary design schemes in order to arrive at the preliminary cost estimates:

a) Uniform Live Loads:

- On pier/jetty	2,500 kg/sq. m.
- On floor	500 kg/sq. m.
- On roof	100 kg/sq. m.

b) Concentrated Loads

- Truck load	MS-18 (HS-20-44)
- Crane load	1,000 tons

c) Impact Load

- Truck	30 %
- Crane	30 %

d) Lateral Wind Loads (175 kph)

- On Moored vessels	50 kg/sq. m.
- On tall structure (>30.5 m)	245 kg/sq. m.
- On medium structures (9.15-30.5 m)	200 kg/sq. m.
- On short structures (<9.15 m)	150 kg/sq. m.

e) Lateral Earthquake Loads

- For pier/jetty	0.144 W
- For braced buildings	0.140 W
- For boxed buildings	0.190 W

(Note: W is the total dead weight)

f) Mooring Force

- Bollard	100 tons
- Bitt	50 tons

g) Vessel to Dock Force

- Berthing speed	0.15 m/sec.
- Approach angle	10 degrees

h) Reinforcing Steel (Tensile Strength)

- Grade 60 (marine structure)	166 MPa
- Grade 40 (land structures)	138 MPa

i) Portland Cement Concrete (Compressive Strength)

- Prestressed members	34.5 MPa
- Marine structures	24.0 MPa
- Land structures	21.0 MPa
- Plain concrete	17.0 MPa

4.3 Port Operations

4.3.1 General

The Ports of General Santos, Cagayan de Oro and Davao are owned and operated by the Philippine Ports Authority by virtue of Presidential Decree No. 857 as amended. Each of these ports are administered by a Port Manager whose authority also covers limited control of private ports within his port district. Operationally, each of these ports supervises and/or manages dockside and shipside activities, storage and delivery of cargo, collection of fees and other charges, security and enforcement, berthing/docking of ships, port improvement and maintenance, among others.

4.3.2 Current Methods of Loading Corn

Several methods of handling corn grains are presently used at the selected ports. These procedures include bagged breakbulk; containerized bags; bleeder bag; and pure bulk.

In the breakbulk method of handling corn, trucks deliver corn to the port in 50 kilo bags which are loaded directly into the vessel holds via pallets, nets or manual labor. Recently there has been a shift to the use of containers which hold some 280 bags of corn. The bagging and

stuffing operation is usually accomplished off-port at the shippers' warehouse. The pre-stuffed containers are then trucked to the port for direct loading aboard ship.

Whenever acceptable "bottoms" are available for bulk shipments, corn is brought to the port in 4 to 5 ton boxes via flat bed trucks. Each is capable of transporting two to four boxes which are lifted by crane and positioned over the ship's hold. A gate lever is then actuated opening the bottom "flap" discharging the bulk corn into the bulk carrier. Sometimes there is a call for bulk shipment of already bagged corn. In this case, bags are "slit" open and bled into the hold of the vessel.

4.3.3 Size and Type of Ships

No particular size or type of ship could be characterized as typical for handling bagged corn. In fact most vessels could receive and transport bagged corn either as breakbulk or containerized. However, transportation of "pure" bulk corn must be in an acceptable carrier. A typical day or week in a port which loads corn could find practically the same ship characteristics described in the tabulation on the following pages.

Table 4-1

CONTAINER VESSEL CHARACTERISTICS

TYPE/NAME OF VESSEL	DWT	GRT	NRT	BEAM	LENGTH	DRAFT
Supercon I	7,018	4,733	2,750	17 M	115 M	7 M
Wilcon IV	3,500	2,312	1,754	14 M	81 M	6 M
Sulcon XIV	5,000	3,828	2,822	17 M	100 M	6 M

Table 4-2

PASSENGER-CARGO VESSEL CHARACTERISTICS

TYPE/NAME OF VESSEL	DWT	GRT	NRT	BEAM	LENGTH	DRAFT
Manila City	4,003	2,961	1,648	16 M	106 M	6 M
Asia Korea	3,021	1,842	1,226	10 M	76 M	6 M
Phil. Princess	8,643	2,993	4,717	17 M	120 M	7 M

Table 4-3

GENERAL CARGO VESSEL CHARACTERISTICS

TYPE/NAME OF VESSEL	DWT	GRT	NRT	BEAM	LENGTH	DRAFT
Great Faith	1,883	991	640	11 M	69 M	5 M
7-Log Master	4,545	2,067	1,832	12 M	84 M	6 M
Continental I	808	449	224	8 M	47 M	5 M
Great Hope	1,460	871	529	10 M	60 M	4 M

Table 4-4

BULK VESSEL CHARACTERISTICS

TYPE/NAME OF VESSEL	DWT	GRT	NRT	BEAM	DRAFT
Wolverin	1,165	992	578	12	5 M
David Sr	1,750	1,099	639	11	5 M
Edwin	1,010	551	417	9	5 M

It should be noted that the container ships are generally larger vessels, followed by the passenger-cargo and general cargo vessels. "Pure" bulk ships or barges are in short supply even for transporting copra. This explains one reason why corn is containerized. Shipping corn in bags does offer some flexibility regarding type of water transportation. However, it is expected that bulk carriers up to 7,000 DWT would be used to commensurate with the bulk storage facilities. This size vessel would require about 110 to 120 meters of dedicated berthing space.

4.3.4 Port Productivity

Each port maintains statistics on productivity rate, i.e. tons per gang hour or per hour of cargo throughout. An analysis of port statistics during the corn production months (usually during the last quarter and first quarter of the following year) shows that most of the corn is shipped in bags either as breakbulk or containerized cargo. Average size of shipments are, however, reversed - bigger sizes for bulk per shipment and smaller sizes for containerized shipments.

In terms of port productivity rate, containerized bags exhibited an unusually high rate of over 40 tons per hour, compared with 34 tons per hour for breakbulk handling and less than 20 tons per hour for bulk handling. These figures are misleading because of the following reasons:

a. Containers are pre-stuffed off-port and are loaded directly to the vessel from incoming trucks

b. Breakbulk loading uses pallets or nets. Pallets usually come with the truck loading and are direct transferred into the ships hold.

c. Bulk loading by bleeding or slitting each bag is the slowest method. An improved system uses bulk boxes of 4 to 5 tons capacity which can be dumped directly into the ships hold.

Table 4-5

PORT PRODUCTIVITY OF HANDLING CORN

NAME OF VESSEL	SYSTEM OF HANDLING	TONS OF CORN HANDLED	PRODUCTIVITY IN TONS/HR
Wilcon X	Containerized Bags	244.22	21.69
Supercon III	"	302.42	14.61
Sulcon IX	"	292.59	21.15
Wilcon IV	"	255.34	30.54
Mega I	"	498.45	20.32
Wilcon IX	"	731.93	20.07
Phil. Princess	"	798.1	11.03
Sulcon XIV	"	1,635.19	56.79
Supercon I	"	1,447.40	63.22
Mega Carrier	"	1,120.93	74.91
AVERAGE FOR CONTAINERIZED HANDLING		732.66	33.43
Great Hope	Breakbulk Bags	197.00	25.91
Mongoose	"	1,500.00	24.73
7-Log Master	"	1,760.00	25.96
JQ BAV V	"	1,050.00	24.30
St. Joseph	"	1,581.00	32.55
Racoon	"	3,846.00	29.10
Barge Ryan	"	1,100.00	31.50
V. dela Paz	"	1,384.92	24.73
Barge Ryan	"	1,264.99	32.55
Ever Transport	"	591.30	18.17
AVERAGE FOR BREAKBULK HANDLING		1,427.52	26.85

Wolverine	Bulk/Bleeder	2,400.00	16.79
Terrier	"	480.54	8.00
Foxbat	"	1,850.00	32.50
Weasel	"	2,850.00	17.85
Edwin	"	2,650.88	15.50
Barge Solid	"	1,104.00	13.95
Wolverine	"	2,400.00	16.79
Terrier	"	1,001.72	11.83
Wolverine	"	2,440.83	21.04
Terrier	"	2,071.84	19.64
AVERAGE FOR BULK/BLEEDER HANDLING		1,924.98	15.43

Source: Selected PPA Statistics for Mindanao Ports: 1989-1990

4.3.5 Proposed Bulk Operations

In contrast to the current methods of handling bulk corn, the proposed bulk loading facilities would receive the commodity directly via bulk trucks which in turn would be unloaded with a hydraulic dumper. From the truck receiving pit, the corn would be elevated for distribution to appropriate storage bins or tanks. The loading of bulk ships is accomplished at a rate of 350 to 400 tons per hour by using overhead conveyors and swinging/telescoping spouts. The detailed operation of these proposed facilities is described in the following Sections:

4.4 Engineering/Operational Analysis

4.4.1 Introduction

The original engineering concept established for this study was based on the idea of developing two separate designs to determine cost effectiveness guidelines.

Preliminary cost estimates have been prepared for various versions of both the CONCRETE SLIPFORM and the BOLTED STEEL TANK designs. This procedure was adopted in order to standardize two basic designs that would physically fit appropriate locations at any of the three selected ports.

The following assumptions, conditions, and engineering criteria among others are considered critical to the successful development of this project:

a) Philippine Ports Authority (PPA) approval of selected facility sites.

b) PPA approval of appropriate berths dedicated for bulk corn loading facilities.

c) Final PPA approval of type of construction proposed at each selected port (concrete slipform silos vs bolted steel tanks):

d) Existing arrastre and stevedoring charges to be either eliminated or reduced to fit actual need of bulk loading operations.

e) Development of essential corn grading standards by the Agriculture Department.

f) Sampling, inspection, weighing, cleaning, aeration, and drying systems to be provided at each proposed facility for both receipt and shipment of bulk corn.

g) A system of co-mingling "like" quality corn to be initiated once Corn Grading Standards have been established.

h) Two types of vertical storage construction were evaluated engineering and operational-wise with due consideration of initial cost effectiveness.

i) All storage silos and tanks to be provided with self-unloading hopper bottoms. Each main silo and tank to be sized at approximately 900 to 1000 tons.

j) Facility design requirements to be based on "peak" month forecasts.

k) Minimum facility sizing of storage to be set at 10,000 ton.

l) Maximum truck dump receiving rate to be established at 12 trucks/hr on one dumper. Design flow rate of the truck receiving leg and conveyors to be set at 400 t/hr.

m) Special shipping bins to be provided as part of the concrete silo design only. The design flow rate from these bins to be 400 t/hr.

n) Final study results indicate that bagging facilities are not feasible for a bulk corn operation.

o) Estimated costing of proposed facilities to include aeration, drying, dust control, cleaning and temperature monitoring systems.

p) All storage facilities and component conveying structures to be pile supported.

q) All conveyors to be of en masse flow design for maximum dust control and automation.

r) The following specific grain elevator standards and codes would be utilized for facility design reference:

The U.S. Standard ACI 313R-77 "Recommended Practice for Design and

Construction of Concrete Bins, Silos and Bunkers for Storing Granular Material" as revised in 1983.

- The German Silo Code Din 1055
- The Soviet Silo Code CH-302-05
- The French Silo Regulations
- U.S. National Grain and Feed Association Publication "A Practical Guide to Elevator Design"
- "Dynamic Pressure of Granular Material in Deep Bins" - Alexander M. Turitzin, P.E. ASCE 1963 (Proceedings of ASCE)

4.4.2 Bulk Corn Shipping Facility Operation Analysis

The proposed Standard Design for a 20,000 ton Concrete Slipform Facility would consist of silos supported on concrete piling. Each storage structure would consist of two (2) separate "slips" consisting of 9 main storage silos each (7.90 m to 8.50 m inside diameter by 30.50 m to 35.0 m high depending on the final design) plus four included interstice (star) bins. False bottom shipping bins would be provided as a standard design in three of the main silos. These bins would be provided to facilitate the shiploading system. All bins would be center filled and center discharged. Each silo, including the interstice bins, would be self-unloading via hoppered bottoms.

The main bins would be sized to hold approximately 1,000 tons each while the "star" bins would each contain about 225 to 235 tons.

Corn would be received via a hydraulic truck dump fitted with a 60 ft platform scale/load cell weighing system. The dumper would have a design capability (cycle time) of handling approximately 12 trucks per hour depending on the smoothness of the "take away operation."

The standard procedure utilized in <u>receiving</u> bulk corn by both of the facility designs is described below:

a) The bulk corn truck arrives at the "sampling" area where a representative sample of the corn load is taken using a pneumatic sampling probe. The sample is quickly tested for moisture, foreign material, damage, etc. The results of this testing would be used for both purchasing and "binning".

b) Once the grade of corn has been determined, the truck proceeds to the truck dump where it is weighed "heavy" without the driver. The truck is then "secured" on the platform via hydraulic wheel chocks and is raised to a maximum angle of about 35° discharging the bulk corn into a "grated" hopper pit. After the truck is completely empty, it is lowered and weighed "light". The automatic weighing system would then produce a final printed tape of the net weight and grade received. A visual weighing read out system would also be provided for convenience of all concerned parties.

c) After the corn has been discharged into the receiving pit, it would be elevated via a 400 ton/hr bucket elevator (jack leg) and discharged either directly to house leg no. 1 or to a cross conveyor serving house leg no. 2. The corn would then be discharged either directly to the corn scalper or by-passed to the bin floor distribution conveyors which deliver the corn to a pre-selected bin. The concrete silo design provides for direct spouting of corn to the shipping bins thus utilizing truck weights directly for vessel loading. This operation is known as a "direct transfer" procedure which would help expedite ship loading during "peak" months.

The shipping operation for the standard 20,000 ton concrete facility would consist of six shipping/transfer conveyors serving the hoppered bin bottoms. After the corn is discharged from the selected bin into the shipping/transfer conveyor, it is elevated by either of two shipping/transfer legs into the "headhouse" where the corn is then sampled, weighed and distributed to either of six distribution conveyors or delivered directly to the three shipping bins via direct spouting or conveyors. (Depending upon the final design).

Once the pre-weighed corn in the shipping bins has been approved for ship delivery, the shipping bin gates are activated and the corn would be delivered to the overhead ship loading system.

Three elevated 18"/22" diameter swinging/telescoping spouts, (each fitted with a dust supression device) would be provided to deliver corn via gravity to the ship holds. Feed to each spout would be individually controlled from a control cab located on the center loading tower. The entire delivery system from the shipping bins would be designed for emergency power failures and required operational shut-downs. All conveyors would be designed to start and stop under load. This standard ship loading system would be designed to serve both types of storage facilities.

The total capacity of an initial 20,000 ton concrete facility can be easily increased by "slipping" additional storage silos within 2m of the existing structure and extending the conveyor/electrical systems to serve the additional storage.

The initial concrete facility would be designed with an elevated "headhouse" above the bin tops in order to accomodate the bulk weighing shipping systems. No bin floor gallery would be required as a special neoprene roofing system would be provided over the bin roof slab.

A rack and pinion "people" lift would be provided to serve both operating and maintenance personnel.

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The proposed Standard Design of a 20,000 ton Steel Tank Storage Facility would consist of twenty 1,000 ton hoppered bottom bolted steel tanks consisting of two (2) rows of 10 tanks each for a total storage capacity of about 20,000 tons.

Each of these tanks would also be center-filled and center discharged thus achieving an even tank wall loading. This live load condition is extremely important in the design of thin wall storage tanks.

The approximate physical size of each tank would be 30 ft. (9.12 m) diameter with a straight wall height of 64 ft. (19.45 m) and provided with a 40° hopper bottom. The tank top would be fitted with a 35° sloped cap structurally designed to accept appropriate conveyor and catwalk loadings. However, most structural loadings for the fill system would be transferred directly to independently supported structural towers.

Special length support legs would be provided for transferring tank loads to an appropriate concrete ring cap supported on concrete piles. This design will provide additional height below the tank bottom and slab allowing room for conveyor transfers.

Each row of tanks would be fitted with a duplex downflow aeration system which would provide a .20 cfm/bu (7.86 cfm/ton) airflow rate. This system would allow the holding of pre-shipment 14% moisture corn successfully for a period well over 30 to 45 days. It would also provide a longer safe holding time for high moisture corn waiting on the drier. The same basic aeration design would be applied only to the outside bins of the concrete silo facility.

Each steel tank and main concrete bin would be fitted with three temperature control cables to monitor the stored corn temperature.

The truck receiving system would be virtually the same as previously described for the standard concrete storage layout. All received corn could be sampled, inspected, graded, weighed, cleaned and distributed to the storage tanks. However,

the procedure for shipping corn is quite different with the bolted steel tank design as a double elevation is required in order to load ships with official weights.

The use of an optional dryeration system in conjunction with the drier is not practical under the steel tank design. Only the concrete silo facility can successfully provide for this system as it is necessary to "roast" 130°F corn for 24 hours before cooling. A concrete "roasting" silo is very efficient due to low heat loss with little or no bin sweating. Also the necessary cross-flow aeration system is more easily installed in a concrete bin.

The grain drying system for each type of facility would be based on two 50 t/hr grain driers complete with a gravity type "wet" grain charging system and a common dry grain conveyor designed to "hit" two of the shipping/transfer conveyors.

The above "operating analysis" applies to all proposed designs regardless of storage size.

Depending on availability of land, the adaptability of future steel tank storage to existing storage system is quite easily accomplished provided original storage layout and conveyor design allows for this expansion.

Table 4-6

PARTIAL LIST OF GRAIN FACILITY EQUIPMENT MANUFACTURERS AND CONTRACTORS

	Type of Equipment	Manufacturer	Location
1.	Conveyors - En Masse flow rated at 350 to to 400 ton/hr	Buhler	USA/Mla.
		Tramco	USA
		Redler	UK/Mla.
		Codema	
2.	Gear Reducers Class II Gearing	Falk	USA
		Hewitt-Robbins	USA
		Western Gear	USA
		Westinghouse	USA
		Sumomoto	Japan
3.	Electric Motors 460V-3Phase-60 cycle TEFC and Class II Group G explosion-proof U-frame & T-frame	Fairbanks-Morse	USA
		General Electric	USA
		Westinghouse	USA
		U.S. Motors	USA
		Louis-Allison	USA
		Sumomoto	Japan
4.	Elevator Buckets & elevator bolts	TAPCO	USA
		Tandem-Rhino Hyde Products	USA
		Dura-Bucket	USA
		Maxi-Lift	USA
		Hi-Cap	USA
5.	Leg Belting	Goodyear	USA
		Goodrich	USA
		Scandura	USA
		Mitsubishi	Japan
		Sumomoto	Japan
6.	Leg Pulleys	Dodge	USA
		Linkbelt	USA
		Continental	USA
7.	Bearings	Dodge	USA
		Linkbelt	USA
		Timkin	USA
8.	60 Ton Hydraulic Truck Dumper with 60′ x 10′ platform	Straight	USA
		Aero-Flex	USA
		Kewanee	USA

Table 4-6 (cont'd.)

9.	Truck Platform Scale - 60 ton-load cell with remote readout	Fairbanks-Morse	USA
		Streeter-Amet	USA
		Toledo	USA
		Howe-Richardson	USA/UK/ Mla.
10.	Distributors	Carter-Day	USA
		Huss & Schlieper	USA
		Sidney Grain Machine	USA
		Roby	USA
11.	Corn Scalpers 400T/hr-weather proof cover	Practor	USA
		Carter-Day	USA
		Rotex	USA
		Buhler	USA
		Farm King Allied Inc.	Canada
		Smico	USA
		Triple/S Dynámics	USA
12.	Automatic Corn Sampler spout location 400Ton/hr plus	Gamet	USA
		Denver	USA
		Gustafson	USA
		Moorman	USA
13.	Automatic Bulk Weigher load cell with remote readout 695 ton/hr.	Howe-Richardson	USA
		Fairbank-Morse	USA
		Toledo	USA
		Streeter-Amet	USA
		Compu-Watt	Canada
14.	Hydraulic or electric slide gates, drop gates basket valves	Buhler	USA
		Andco	USA
		Raco	USA
		DCL	USA
15.	Dust Control Systems and Bag Filters	Carter-Day	USA
		Buhler	USA
		MacEquipment	USA
		Roby	USA
		Scientific Dust Collectors	USA
16.	Rack & Pinion Personnel Passenger Lifts	Hiede	USA
		Montgomery	USA
		Otis	USA
		Shelby	USA

Table 4-6 (cont'd.)

17.	Bolted Steel Tanks Corrugated/smooth wall	GSI	USA
		Butler	USA
		New Products	USA
		Columbia	USA
		Chicago-Eastern	USA
		Peabody	USA
		Brock	USA
		Behlen	USA
18.	Hydraulic Couplings & Flex-couplings	Falk	USA
		Dodge	USA
		Linkbelt	USA
19.	Grain Driers	Meyer	USA
		Commercial	USA
		Aeroglide	USA
		Airstream	USA
		Shanzer	USA
		Berico	USA
		GED Dryer	USA
20.	Aeration Systems	Rolfes	USA
		Roby	USA
		Carter-Day	USA
		Atlas	USA
		Airstream	USA
21.	Grain Temperature Monitoring System with automatic read out & recorder	Rolfes	USA
		Pertex	USA
		Inter-Systems	USA
22.	Truck Grain Pneumatic Sampler with delivery system	Seedburo	USA
		MGR Corp.	USA
		Inter-Systems	USA
23.	Grain Inspection/Lab Equipment	Seedburo	USA
		Dicky-John	USA
		Romer Labs	USA
24.	Ship Loading - Dust Control Suppressor for loading spouts	Buhler	USA
		MAC	USA
		Carter-Day	USA
		DCL	USA
		Midwest	USA

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Table 4-6 (cont.d)

25.	Automation	Milltronics	USA
		ASI	USA
		Andco	USA
		Pertex	USA
		Beacon	USA
		Conkey/KWN	USA
26.	Electrical Equipment Lighting fixtures, starters, PLC units-micro processors, etc.	Square-D	USA
		Allen Bradley	USA
		General Electric	USA
		Westinghouse	USA
27.	Sensors & Plug Switches - Bin level sensors, slow down devices, belt alignment devices, micro-switches, hot bearing detectors, etc.	Tandem Products	USA
		Crouse-Hinds	USA
		General Electric	USA
		Square-D	USA
28.	Spout Lining	Rhino Hyde	USA
		A-1 Industries	USA
29.	Explosion Suppression Devices	Fenwal	USA
		Fike Corp.	USA
30.	Halon Fire Protection System	Fenwal	USA
31.	Tramp Steel Removal System	Dings Co.	USA
		Bunting	USA
		Applied Magnetics	USA
32.	Pulley Lagging	RM Holtz	USA
33.	Explosion Venting	BS&B	USA
34.	Concrete Slipform Contractors-Design/Build	Anta	Manila
		Metro	Manila
		Youngglove	USA
		TE Ibberson	USA
		Borton	USA
		ESI	USA
		Todd & Sargent	USA
35.	Bolted Steel Tank Erection Contractors Design/Build	Belmont	Manila
		Behlen-Berico	USA
		Allied Millwrights	USA
		TE Ibberson	USA
		Milverton Millwrights	USA

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4.5 Cost Estimates

Cost estimates were computed on the basis of certain assumptions indicated in each of the following computation sheets and/or tables.

An estimate was made for each alternative type of facility, e.g., concrete slipform silos versus bolted steel tanks. (Refer to Table 4-7 through Table 4-13).

A cost estimate was also made for operating a typical facility, in terms of operational power costs and maintenance costs. (Refer to Table 4-14 through Table 4-20).

Table 4-7

SUMMARY - ESTIMATED CONSTRUCTION COSTS FOR VARIOUS BULK CORN HANDLING FACILITIES

DESCRIPTION STORAGE CAPACITY	TOTAL ESTIMATED CONSTRUCTION COST	COST PER TON
1. Concrete Slipform Silo Facility 20,000 Ton Storage Capacity	$ 13,242,000	$662/Ton
2. Concrete Slipform Silo Facility 10,000 Ton Storage Capacity	9,682,000	$968/Ton
3. Bolted Steel Tank Facility (Corrugated Wall Steel) 20,000 Ton Storage Capacity	9,856,000	$493/Ton
4. Bolted Steel Tank Facility (Corrugated Wall Steel) 10,000 Ton Storage Capacity	7,695,000	$770/Ton
*5. Bolted Steel Tank Facility (Smooth Wall Steel) 20,000 Ton Storage Capacity	11,113,000	$556/Ton
*6. Bolted Steel Tank Facility (Smooth Wall Steel) 10,000 Ton Storage Facility	8,326,000	$833/Ton

* The above Smooth Wall Steel Tank design cost information is for comparative costing of the better quality bolted steel tank storage vs. the most economical bolted type (corrugated walls) vs. the best type of grain storage available (concrete slipform silos).

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Table 4-8

COST BREAKDOWN
20,000-TON STANDARD CONCRETE SLIPFORM FACILITY

	COST ITEMS	LABOR & MATERIAL
1.	Storage-Concrete Slipform Bins	$2,800,000
2.	Piling	1,746,500
3.	Truck Receiving System (including dust control system)	500,130
*4.	Ship Loading System (Structural and Machinery)	829,190
5.	Facility Machinery (house legs, weighing systems, structural supports, conveyors spouting, grain sampling system, etc.)	2,020,220
6.	Structural Steel Headhouse	383,000
7.	Remote Controlled Hydraulic/Electric Gates and Basket Valves	271,200
8.	Dust Control Systems	195,500
9.	Grain Temperature Monitoring System	85,560
10.	Grain Drier System	186,626
11.	Aeration System	103,040
12.	Grain Cleaner System	195,500
13.	Automation	250,000
14.	Electrical	1,368,260
15.	Civil Works	75,000
16.	Facility Buildings	344,000
	SUB-TOTAL	$11,353,726
INDIRECT COSTS -	Assumed 9% Overhead and 7% Profit or 16.63% per NEDA Guidelines (Taxes not included)	$1,888,125
TOTAL ESTIMATED COST		$13,241,851
COST PER TON		$662

*This cost estimate is based on a standard design to fit any location, however, the cost of the ship loading system is variable depending on conveyor distance between storage facility and ship loading towers.

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Table 4-9

COST BREAKDOWN
10,000-TON STANDARD CONCRETE SLIPFORM FACILITY

	COST ITEMS	LABOR & MATERIAL
1.	Storage-Concrete Slipform Bins	$1,505,600
2.	Piling	906,584
3.	Truck Receiving System (including dust control system)	500,130
*4.	Ship Loading System (Structural and Machinery)	828,190
5.	Facility Machinery (house legs, weighing systems, structural supports, conveyors spouting, grain sampling system, etc.)	1,635,850
6.	Structural Steel Headhouse	383,000
7.	Remote Controlled Hydraulic/Electric Gates and Basket Valves	144,990
8.	Dust Control Systems	195,500
9.	Grain Temperature Monitoring System	34,040
10.	Grain Drier System	186,626
11.	Aeration System	51,520
12.	Grain Cleaner System	195,500
13.	Automation	200,000
14.	Electrical	1,113,840
15.	Civil Works	75,000
16.	Facility Buildings	344,000
	SUB-TOTAL	$8,301,370
INDIRECT COSTS -	Assumed 9% Overhead and 7% Profit or 16.63% as NEDA Guidelines (Taxes not included)	$1,380,518
TOTAL ESTIMATED COST		$9,681,888
COST PER TON		$968

*This cost estimate is based on a standard design to fit any location, however, the cost of the ship loading system is a variable depending on conveyor distance between storage facility and ship loading towers.

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Table 4-10

COST BREAKDOWN
20,000-TON STANDARD BOLTED STEEL TANK FACILITY
(CORRUGATED STEEL WALL)

	COST ITEMS	LABOR & MATERIAL
1.	Storage-Bolted Steel Corrugated Tanks	$1,077,720
2.	Piling and Concrete Ring Slab (Pile Cap)	961,885
3.	Truck Receiving System (including dust control system)	582,180
*4.	Ship Loading System (Structural & Machinery)	711,610
5.	Facility Machinery (house legs, weighing systems, structural supports, conveyors, spouting, grain sampling system, etc.)	1,936,838
6.	Structural Steel Headhouse and included catwalks, stairways, supports, etc.	465,345
7.	Remote Controlled Hydraulic/Electric Gates and Basket Valves	281,400
8.	Dust Control Systems	75,000
9.	Grain Temperature Monitoring System	37,369
10.	Grain Drier System	179,126
11.	Aeration System (additional to air system, provided with tanks)	34,500
12.	Grain Cleaner System	196,580
13.	Automation	250,000
14.	Electrical	1,241,970
15.	Civil Works	75,000
16.	Facility Buildings	344,000
	SUB-TOTAL	$8,450,523
INDIRECT COSTS -	Assumed 9% Overhead and 7% Profit or 16.63% per NEDA Guidelines (Taxes not included)	$1,405,322
TOTAL ESTIMATED COST		$9,855,845
COST PER TON		$493

*This cost estimate is based on a standard design to fit any location, however, the cost of the ship loading system is a variable depending on conveyor distance between storage facility and ship loading towers.

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Table 4-11

COST BREAKDOWN
10,000-TON STANDARD BOLTED STEEL TANK FACILITY
(CORRUGATED STEEL WALL)

COST ITEMS	LABOR & MATERIAL
1. Storage-Bolted Steel Corrugated Tanks	$540,860
2. Piling and Concrete Ring Slab (Pile Cap)	526,271
3. Truck Receiving System (including dust control system)	582,180
*4. Ship Loading System (Structural & Machinery)	711,610
5. Facility Machinery (house legs, weighing systems, structural supports, conveyors, spouting, grain sampling system, etc.)	1,423,513
6. Structural Steel Headhouse and included catwalks, stairways, supports, etc.	465,345
7. Remote Controlled Hydraulic/Electric Gates and Basket Valves	181,880
8. Dust Control Systems	75,000
9. Grain Temperature Monitoring System	25,000
10. Grain Drier System	179,126
11. Aeration System (additional to air system, provided with tanks)	18,000
12. Grain Cleaner System	196,580
13. Automation	200,000
14. Electrical	1,053,170
15. Civil Works	75,000
16. Facility Buildings	344,000
SUB-TOTAL	$6,597,535
INDIRECT COSTS - Assumed 9% Overhead and 7% Profit or 16.63% per NEDA Guidelines (Taxes not included)	$1,097,170
TOTAL ESTIMATED COST	$7,694,705
COST PER TON	$770

*This cost estimate is based on a standard design to fit any location, however, the cost of the ship loading system is a variable depending on conveyor distance between storage facility and ship loading towers.

Table 4-12

COST BREAKDOWN
20,000-TON STANDARD BOLTED STEEL TANK FACILITY
(SMOOTH STEEL WALL)

	COST ITEMS	LABOR & MATERIAL
1.	Storage-Bolted Steel Smooth Wall Tanks	$2,155,440
2.	Piling and Concrete Ring Slab (Pile Cap)	961,885
3.	Truck Receiving System (including dust control system)	582,180
*4.	Ship Loading System (Structural & Machinery)	711,610
5.	Facility Machinery (house legs, weighing systems, structural supports, conveyors, spouting, grain sampling system, etc.)	1,936,838
6.	Structural Steel Headhouse and included catwalks, stairways, supports, etc.	465,345
7.	Remote Controlled Hydraulic/Electric Gates and Basket Valves	281,400
8.	Dust Control Systems	75,000
9.	Grain Temperature Monitoring System	37,369
10.	Grain Drier System	179,126
11.	Aeration System (additional to air system, provided with tanks)	34,500
12.	Grain Cleaner System	196,580
13.	Automation	250,000
14.	Electrical	1,241,970
15.	Civil Works	75,000
16.	Facility Buildings	344,000
	SUB-TOTAL	$9,528,243
INDIRECT COSTS -	Assumed 9% Overhead and 7% Profit or 16.63% per NEDA Guidelines (Taxes not included)	$1,584,547
TOTAL ESTIMATED COST		$11,112,790
COST PER TON		$556

*This cost estimate is based on a standard design to fit any location, however, the cost of the ship loading system is a variable depending on conveyor distance between storage facility and ship loading towers.

Table 4-13

COST BREAKDOWN
10,000-TON STANDARD BOLTED STEEL TANK FACILITY
(SMOOTH STEEL WALL)

COST ITEMS	LABOR & MATERIAL
1. Storage-Bolted Steel Smooth Wall Tanks	$1,081,720
2. Piling and Concrete Ring Slab (Pile Cap)	526,271
3. Truck Receiving System (including dust control system)	582,180
*4. Ship Loading System (Structural & Machinery)	711,610
5. Facility Machinery (house legs, weighing systems, structural supports, conveyors, spouting, grain sampling system, etc.)	1,423,513
6. Structural Steel Headhouse and included catwalks, stairways, supports, etc.	465,345
7. Remote Controlled Hydraulic/Electric Gates and Basket Valves	181,880
8. Dust Control Systems	75,000
9. Grain Temperature Monitoring System	25,000
10. Grain Drier System	179,126
11. Aeration System (additional to air system, provided with tanks)	18,000
12. Grain Cleaner System	196,580
13. Automation	200,000
14. Electrical	1,053,170
15. Civil Works	75,000
16. Facility Buildings	344,000
SUB-TOTAL	$7,138,395
INDIRECT COSTS - Assumed 9% overhead and 7% Profit or 16.63% per NEDA Guidelines (Taxes not included)	$1,187,115
TOTAL ESTIMATED COST	$8,325,510
COST PER TON	$833

*This cost estimate is based on a standard design to fit any location, however, the cost of the ship loading system is a variable depending on conveyor distance between storage facility and ship loading towers.

Table 4-14

SUMMARY - ESTIMATED POWER/FUEL
AND MAINTENANCE COST

OPERATING UNIT	COST PER TON	ANNUAL COST
1. Truck Receiving*	$ 0.0526	$ 15,770
2. Shipping*	0.0911	27,330
3. Aeration*	0.0934	28,000
4. Drying**	1.0246	277,020
SUBTOTAL	$ 1.2617	$ 348,120
5. Maintenance***	0.4413	132,400
	$ 1.7030	$ 480,520

Notes:

*Based on 300,000 tons handled annually.
**Based on 270,400 tons equivalent of drying annually.
***Based on one full year after expiration of supplier's warranty.

Table 4-15

EXAMPLE - POWER COST ANALYSIS

TRUCK RECEIVING
(Assume 300,000 ton bulk corn to be received annually).

TOTAL ESTIMATED HP REQUIRED TO UNLOAD CORN RECEIVED BY TRUCK AND DELIVERED TO STORAGE

Truck Dumper	25 HP
Truck Hopper Conveyor	75 HP
Bucket Elevator	125 HP
Truck Dump Pit Dust Control	65 HP
Tank Fill Conveyor	75 HP
Corn Scalper	25 HP
Dust Control	50 HP
TOTAL	440 HP

A. 440 HP x .746 KW/HP = 329 KW P28 = $1.00

B. Assume a .85 Full Load Power Factor

C. Power consumption for truck receiving operation $\frac{329 \text{ KW}}{380 \text{ T/H}} \times .85 = \$.7360$ KW/Ton

D. Assumed Power Cost = P2.00 KWH (2-6-91)

E. Then $.7360 \text{ KWH/Ton} \times \frac{P2.00 \text{ KWH}}{P28/\$1.00} = \$.0526$ per Ton

F. 300,000 Ton x $.0526/Ton = $15,770 per annum

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Table 4-15 (cont'd.)

EXAMPLE - POWER COST ANALYSIS

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3. AERATION
(Assume P28 = $1.00 P2.00/KWH).
Annual Shipment 300,000 Tons

A. Assume 2-3 HP Fans per tank x 20 tanks = 120 HP
120 HP x .746 = 89.52 KW

B. 365 Days x 24 Hrs. x .50 = 4,380 Annual Operating Hours

C. 89.52 KW x 4,380 Hrs. = 392,098 KWH

D. 392,098 KWH @ $\frac{P2.00}{P28}$ = $28,000 annual cost

E. (Assumed 50% operating time) $\frac{\$28,000}{300,000}$ = $.0934 Ton

4. DRYING - Assume 270,400 Ton (2.5% reduction)

Commodity to be dried	- corn
Fuel (Assume liquid propane for example)	
Efficiency (BTUs per # of H_2O)	- 1797 BTU
Cost per ton (20% to 15% reduction)	- 5% reduction at $2.00 ton
Fuel consumption	- 133 gallons/hr.
Drying capacity (each drier)	- 2021 bushels/hr 51.44 ton/hr

A. Drying cost per hour = $102.88
B. Drying cost per ton = $2.00 or $.0507 per bushel for a moisture reduction of 5%
C. Assume two driers operating 15% of available time.
D. Annual operating fuel cost = (365)(24)(.15)(2)(102.88)
= $270,369 (5%)
E. However, assume annual operating cost based on a total drying time of 1314 hours or about 270,369 ton of 17.5% moisture wet corn to 15% (2.5% reduction) this gives a new drying cost of about $1.00 per ton or $0.0253 per bushel for 2.5% moisture reduction.

Table 4-15 (cont'd.)

EXAMPLE POWER COST ANALYSIS

F. Power Cost

Assume 4 - 10 HP fan motors
1 - 15 HP 11" dry grain conveyor

Total connected HP = 55

55 HP x .746 = 41.03 KW drier no. 1} Total
40 HP x .746 = 29.84 KW drier no. 2} 70.87 KW

Assume 1314 drying hours total for both driers

51.44 ton x 2 = 102.88 ton/hr

(102.88) (1314) (2) = 270,400 ton per annum 17.5% wet corn

1314 hrs x 70.87 KW = 93,123 KWH

$$93{,}123 \text{ KWH} \times \frac{\text{P2.00 KWH}}{\text{P28 per \$1.00}} = \$6651.66 \text{ annual power cost}$$

$$\text{or} \quad \frac{\$6652}{270{,}369 \text{ ton}} = \$.0246 \text{ per ton}$$

Total Annual Drying Cost

Fuel	-	$ 270,369
Power	-	6,652
Total		$ 277,021 per annum
or		$ 1.026 per ton

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Table 4-15 (cont'd.)

EXAMPLE POWER COST ANALYSIS

5. MAINTENANCE

Assume all major maintenance work and repairs to be performed by outside contractors.

Assume a figure of 1% of total facility cost after the first year of operation ($132,400). During first year of operations, all machinery and equipment is still under warranty. Thus, assume .5% of initial cost for first year operation = $ 66,200.

Summary Maintenance Costs

A.	First year cost only	$66,200
B.	Second full year and preceding years to 2000.	$132,400 per annum, or $ 0.4413 per ton

80.

Table 4-16

SUMMARY - ESTIMATED ANNUAL OPERATING COST FOR A (20,000 TON CONCRETE SLIPFORM FACILITY)

ASSUMPTION:	Annual Shipment	-	300,000 Tons
	Cost Per Kilowatt Hour	-	P2.00
	Annual Maintenance	-	1% of Facility Cost

1.	Administrative and operating personnel payroll costs(Table 4-17)	$ 233,000
	Add fringe benefits (25%).	58,600
2.	Power and Fuel Costs (Table 4-14)	480,520
3.	Facility Maintenance (Estimated at 1% of cost of 20,000-ton concrete slipform silo facility - Table 4-8)	132,420
4.	Office Supplies, Equipment, Miscellaneous Expenses, Etc.	80,000
	ESTIMATED TOTAL	$ 984,540 per year
	COST PER TON	$ 3.2818 per year

NOTE:

Not included in above estimate is the first year capital cost for office furniture, equipment, furnishings, vehicles, fuel, maintenance, shop equipment and spare parts, totalling $315,000 which is equivalent to $1.05 per ton.

Table 4-17

BULK CORN HANDLING FACILITY
OPERATING COSTS
(FIXED AND VARIABLE)

	ADMINISTRATION & OPERATIONS	NUMBER OF PERSONNEL			TOTAL ANNUAL PAYROLL COST
1.	Terminal Manager	1			11,000
2.	Assistant Manager/ Controller	1			10,000
3.	Grain Merchandiser	1			9,000
4.	Operating Superintendent	1			9,000
5.	Grain Superintendent	1			9,000
6.	Plant Engineer	1			9,000
7.	Control Room Operators	2	@	$6,500	13,000
8.	Grain Inspector	2	@	$6,500	13,000
9.	Operating Foreman	2	@	$4,800	9,600
10.	Electricians	2	@	$4,000	8,000
11.	Millwrights	4	@	$3,600	14,400
12.	Truck Dump Operators	3	@	$3,400	10,200
13.	Ship Loading Operators	3	@	$3,400	10,200
14.	Guards	8	@	$3,000	24,000
15.	Laborers	10	@	$2,500	25,000
16.	General Office Personnel (Payroll, Computer Operators, Billing, Purchasing Secretary)	8	@	$3,600	28,800
17.	Office Manager	1			5,800
18.	Driver	2	@	$3,400	6,800
19.	Mechanics	2	@	$3,600	7,200
	TOTAL NUMBER OF PERSONNEL	55		TOTAL EST. SALARY COST	$233,000
	ASSUMED FRINGE BENEFIT (25%)				$58,600

SSUMPTIONS:

1. Facility operator will be a cooperative organization such as the Confederation of Filipino Rice and Corn Associations, Inc.

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Table 4-17 (Cont'd)

BULK CORN HANDLING FACILITY
OPERATING COSTS
(FIXED AND VARIABLE)

2. All stevedoring work shall be under the direct control of the terminal operator as plant employees.

3. All plant operations shall be accomplished by employees of the operator.

4. Number of operating personnel shall be based on peak month operating requirements. Two ten-hour shifts - 7 days a week.

Table 4-18

OVER-DOCK SHIPPING COST COMPARISON

	METHOD OF HANDLING	ESTIMATED COST/TON
1.	Existing procedure of shipping bagged corn in containers (Table 4-19)	$7.801
*2.	Proposed bulk corn handling facility including cleaning, aeration, drying, grading, etc. (Table 4-20)	4.095
	Estimated cost savings per ton if shipped thru the proposed bulk loading facility	$3.706 /Ton

Annual Savings based on a total shipment of 300,000 tons.

300,000 tons @ $3.706 = $ 1 11,800

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Table 4-19

ANALYSIS OF EXISTING CORN
SHIPMENT COST THROUGH PORT

Assumption : Present container method of shipping bagged corn.

	DESCRIPTION OF COST	COST/TON
1.	Bag Cost	$3.000 /Ton
2.	Bagging-Labor Cost (Off-site)	0.640 /Ton
3.	Stuffing container-labor cost (Off-site)	0.446 /Ton
4.	Arrastre Charges	0.652 /Ton
5.	Stevedoring Charges	0.220 /Ton
6.	Losses-Bursted Bags, etc. (1.999%)	2.843 /Ton
	TOTAL ESTIMATED COST	$7.801 /Ton

Table 4-20

ANALYSIS OF CORN SHIPMENT COST THROUGH PROPOSED BULK CORN HANDLING FACILITY (20,000 TON CONCRETE SLIPFORM FACILITY)

	DESCRIPTION	COST/TON
1.	Payroll (Table 4-17)	$0.972
2.	Power and Fuel (Table 4-14)	1.262
3.	Facility Maintenance (Table 4-14)	0.442
4.	Miscellaneous Expenses	0.267
*5.	Arrastre Charges	0.652
*6.	Stevedoring Charges	0.220
**7.	Rent to PPA	0.267
8.	Losses - Normal Shrinkage	0.014
	ESTIMATED TOTAL COST	$4.096 /Ton

Note: All costs based on 300,000 ton throughput.

*These charges are recommended to be eliminated.

**Assume annual rent $4.00 per ton of storage capacity (20,000 ton concrete storage or $80,000 per year).

4.6 Implementation Schedules

The implementation schedules drawn up by the Consultants were based on reasonable time tables which would allow normal decision-making processes to take place and on technological resources available for use during the design and subsequent construction. Table 4-21 shows the time schedules for ten (10) major work phases for each of the three port facilities in the ssequence of their priority, i.e., General Santos, Cagayan de Oro, and finally Davao.

For General Santos, the following implementation schedule is recommended:

	Phases of Work	Duration
a)	Preparation of detailed designs for site preparation and basic civil works, etc.	6 mos.
b)	Preparation of performance specifications for concrete slip-form silos and related equipment.	6 mos.
c)	Advertisement/bidding/award/ signing/approval of civil works contract for (a) above.	9 mos.
d)	Advertisement/bidding/award/ signing/approval of procurement contract for (b) above.	9 mos.
e)	Construction of basic civil works, site preparation, etc. per (c) above.	12 mos.
f)	Procurement contract (design-build) per (d) above, up to fabrication/delivery to site.	15 mos.
g)	Pile foundation works for (f) above.	6 mos.
h)	Slipform construction of concrete silos and installation/erection of equipment.	15 mos.
i)	Recruitment/training or personnel for operation and maintenance.	6 mos.

j) Consultants' supervision services for phases of work from (e) through (i) above. 27 mos.

If implementation is on schedule, the operation of the bulk corn facilities at General Santos would start during the second quarter of 1994.

For Cagayan de Oro, operations would begin during the first quarter of 1995, and for Davao it would be placed "on stream" during the fourth quarter of 1995. Refer to Table 4-21 for details.

TABLE 4-21

SCHEDULE OF WORK

.0.	PHASES OF WORK	1991				1992				1993				1994				1995		
		3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9
1	PREPARATION OF DETAILED DESIGN INCLUDING BID/CONTRACT DOCUMENTS FOR BASIC CIVIL WORKS, FIELD INVESTIGATIONS (TOPO/HYDRO SURVEYS AND SOILS/MATERIALS ANALYSES), UTILITIES AND OVERALL SITE PREPARATION		NTP (CONSULTANTS' SVCS)																	
2	PREPARATION OF PERFORMANCE SPECIFICATIONS FOR CONCRETE SLIP-FORM SILOS AND/OR BOLTED STEEL TANKS, AND CORRESPONDING BULK HANDLING FACILITIES/EQUIPMENT SUCH AS ELEVATORS, CONVEYORS, SHIP LOADERS, ETC.																			
3	ADVERTISEMENT FOR PREQUALIFICATION TO BID FOR THE PROCUREMENT CONTRACT (DESIGN-BUILD) OF CONCRETE SILOS AND/OR STEEL TANKS, AND DESIGN/SHOP DRAWINGS OF CORRESPONDING EQUIPMENT; EVALUATION OF QUALIFICATIONS, SHORTLISTING, BIDDING AND AWARD OF CONTRACT.																			
4	ADVERTISEMENT FOR PREQUALIFICATION TO BID ON BASIC CIVIL WORKS, FIELD INVESTIGATIONS, UTILITIES AND OVERALL SITE PREPARATION; INVITATION TO BID, TENDERING, EVALUATION AND AWARD OF CONTRACT.																			
5	CONSULTANTS' SERVICES FOR THE DESIGN/BUILD/PROCUREMENT CONTRACT (40% AND 100% STAGES), AND SUPERVISION/INSPECTION/SURVEILLANCE OF CONSTRUCTION/FABRICATION/ERECTION/INSTALLATION WORKS, TRAINING FOR OPERATION/MAINTENANCE, PROGRESS ACCOMPLISHMENT/PAYMENT.																			
6	CONSTRUCTION OF BASIC CIVIL WORKS, AND UTILITIES, SITE INVESTIGATIONS, AND OTHER SITE PREPARATION WORKS.																			
7	PROCUREMENT CONTRACT (DESIGN-BUILD), PREPARATION OF SHOP DRAWINGS, FABRICATION, AND SHIPPING TO SITE.																			
8	PILE FOUNDATION WORKS FOR CONCRETE SLIPFORM SILOS AND BOLTED STEEL TANKS, AND OTHER STRUCTURES.																			
9	SLIPFORM CONSTRUCTION OF CONCRETE SILOS AND/OR ERECTION/INSTALLATION OF BOLTED STEEL TANKS, EQUIPMENT AND ANCILLARY FACILITIES, OPERATIONAL TESTING, DRY RUN, DEBUGGING, ETC.																			
10	RECRUITMENT AND TRAINING PERSONNEL FOR OPERATION AND MAINTENANCE.																			

LEGEND:
- GEN. SANTOS
- CAGAYAN DE ORO
- DAVAO

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4.7 Recommended Bulk Corn Facilities

4.7.1 General

The recommendations set forth in the following paragraphs are the results of the Consultants study program performed on various scenarios for the development of selected bulk corn shipping facilities designed to cater to the projected traffic forecast through the year 2000. Design considerations were also incorporated as part of the study to provide for additional future corn storage.

In accordance with the Terms of Reference the Consultants have made specific recommendations for each of the study ports. Two separate sets of recommendations have been developed to accommodate not only a "short term" cost evaluation but also the more important "long term" cost effectiveness.

The "initial cost short-term" recommendations cover the period only to the year 2000 as per the Terms of Reference. However, because of the fact that concrete slipform silos have a known useful life well beyond forty (40) years, we feel it is only prudent that two distinctly different recommendations be set forth as part of the study knowing that the "long term" basis would reach well into the twenty-first century. Both sets of recommendations are described below:

4.7.2 Recommendations Based on Long Term Cost Effectiveness (Year 2000 and Beyond

PORT	RECOMMENDED FACILITY DESCRIPTION	TOTAL ESTIMATED CONSTRUCTION COST
a) Gen. Santos	Concrete Slipform Silo Facility 20,000 ton storage capacity	US $13,242,000
b) Cagayan de Oro	Concrete Slipform Silo Facility 20,000 ton storage capacity	13,242,000
c) Davao	Concrete Slipform Silo Facility 10,000 ton storage capacity	9,682,000
	TOTAL ESTIMATED COST	US $36,166,000

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4.7.3 Recommendations Based on Short Term Cost Effectiveness (Up to the year 2000)

PORT	RECOMMENDED FACILITY DESCRIPTION	TOTAL ESTIMATED CONSTRUCTION COST
a) Gen. Santos	Concrete Slipform Silo Facility 20,000 ton storage capacity	US $13,242,000
b) Cagayan de Oro	Bolted Steel Tank (Corrugated Wall Steel) 20,000 ton storage capacity	9,856,000
c) Davao	Bolted Steel Tank (Corrugated Wall Steel) 10,000 ton storage capacity	7,695,000
	TOTAL ESTIMATED COST	US $30,793,000

4.7.4 PPA Preferences

Concerning the above recommendations, it is important to note that PPA has indicated a strong preference for recommendations based on the long term cost effectiveness evaluation as described in the following sub-sections ("Advantages/ Disadvantages" of the Concrete Slipform Silo Facility" versus "Advantages/Disadvantages of the Bolted Steel Tank Facility"). PPA has also shown concern regarding long term maintenance and land usage as it may affect present and future port operations. Detailed drawings of each of these alternative schemes are shown in the appendices.

4.7.5 Advantages/Disadvantages of the Concrete Slipform Silo Facility

a) Advantages

1. Long Useful Life - (IRS Depreciation Tables presently allow a forty (40) year useful life for concrete silo structures. Previously the IRS depreciation schedule allowed a period of 75 years which physically

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is more accurate. Useful life of all machinery and motors is set at 15 to 20 years depending on usage and quality.

2. Low Yearly Maintenance Cost - Concrete silos are best suited for port operations where resistance to salt water corrosion and severe weather conditions is necessary. Most concrete slipform silos require very little life-time structural maintenance if proper design, engineering inspection and construction methods are originally enforced.

3. Long Term Cost Effectiveness - This financial condition would be achieved by the year 2000 and would continue well past the year 2040 with minimum silo maintenance

4. Minimum Land Usage - The concrete silo design incorporates the important feature of compactness by using all available space (between main bins) for storage. In addition, the vertical silo dimension can be easily used to obtain desired capacity thus keeping usage of valuable port land to a bare minimum. For example, the standard 20,000 ton concrete silo facility requires only 50% of the land required for a 20,000 ton bolted steel tank facility.

   PPA has indicated their concern on this matter regarding excessive loss of back-up open storage area.

5. Best Quality Construction for Grain Storage - Concrete bin walls afford excellent protection of grain from the environment by acting as a waterproof insulator. The insulating properties of concrete tend to prevent most "tank sweating" (condensation) from forming. This phenomena occurs during the night time hours due to changes in the

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ambient temperature. At the same time the warm stored corn acts as a "heat" sink allowing moist warm air to migrate to the cooler bin wall surface causing mositure to drop out along the bin wall as condensation. This type of condensation is especially troublesome with steel tank storage. Aeration is the only practical solution to control this problem.

6. Excellent Merchandising Capabilities - The concrete silo design provides small interstice bins for both the storage of screenings and small quantities of off-grade corn which can be "merchandised" successfully by "getting the most for the least" through blending and mixing operations during shiploading. In addition, the quality of corn can also be upgraded to meet specific quality standards using the same operation.

7. Shipping Bins - Only the concrete silo design provides for construction of "shipping bins" to facilitate the smooth delivery of corn to the ship. The "false bottom" bins allow pre-weighing and grading of corn to be shipped. If, for whatever reason, the corn does not "grade", a series of gates and spouts would be provided as a means of returning the corn to its original bin.

8. Dryeration System - This system is practical only to the concrete silo design. Installation of this system provides a means of doubling the capacity of a standard grain dryer by using a separate "concrete" bin as a "ROASTING and COOLER" extention of a modified drier. This modification consists of changing the normal "cooler" section of the drier to an additional "heater section".

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9. Double elevation is not required for corn shipments under the concrete silo design. All sampling, weighing and cleaning equipment would be structurally located above the storage bins for gravity distribution both to the ship loading system and other locations (bins, cleaner, etc.

10. Easy to operate - Concrete silo design allows for maximum operating flexibility.

11. Expansion of storage capacity can be accomplished at a low cost per ton rate as all major workhouse equipment and electrical works would have already been installed as part of the original facility.

b. Disadvantages

1. Only the initial construction cost of the concrete slipform storage can be considered a disadvatage on a comparison basis with the corrugated bolted steel tank facility. If the comparison was made with a smooth wall bolted steel tank, the initial construction cost difference would be less of a disadvantage.

4.7.6 Advantages/Disadvantages of the Bolted Steel Tank Storage Facility

a) Advantages

1. There are no comparative engineering or operational advantages associated with this type of storage facility. Lower initial construction costs which produce a short term cost effectiveness is the only real advantage of this design.

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b) Comparative Disadvantages

1. Shorter Useful Life. (15 to 20 years for Bolted Steel Tanks. Machinery and equipment, 15 to 20 years).

2. Higher Maintenance Cost. (Salt water environment and bolted joint leakage due to tank "stretching").

3. Lower cost effectiveness after year 2000. (Increasing maintenance costs).

4. Maximum land usage required. (50% more area is required for same storage capacity as concrete silos).

5. Minimum quality construction for grain storage. (Design constraint).

6. Poor merchandising capabilities. (All bins same size).

7. No shipping bins. (Design constraint).

8. Steel tank dryeration system not practical. (Design constraint).

9. Double elevation required for ship loading operation. (Design constraint).

10. Expansion of storage capacity - (maximum land usage required if available).

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4.8 Environmental Impact Statement

4.8.1 General

More often than not, project development would involve a series of events that would trigger some changes in the quality of the natural environment. Some of these changes are beneficial; some are not. It is therefore necessary to identify those changes and to recommend mitigating measures to minimize or neutralize the adverse effects.

4.8.2 Project Environment

The environment affected by the proposed bulk handling facilities could include the hinterland where corn is produced, the roadways through which production is carried, the port site where bulk corn is received/shipped, the bay water over which the vessels travel, the air over these areas, and the flora and the fauna of the land and the sea. However, for this analysis, the project in each port is confined to a concentration of structures on a one-hectare area with the elevator structure extending up to 75 meters.

4.8.3 Effects on the Environment

For purposes of identifying the cause of each effect, the project is divided into environmentally homogenous components, such as the marine works, basic civil works, storage works (e.g., silos), the operational aspects, and the socio-economic impacts.

a) Marine Works. The project would involve very little structural marine work except for driving loading tower piles through the existing wharf. Bulk ship loading operations would be provided with appropriate dust suppression devices on each shipping spout (see Item c and d below), thus, no significant effect on the environment is expected.

b) Basic Civil Works. These works consist of ground preparation, water supply, drainage, sewerage sanitary facilities, electrical/power line and minor structues. Sewerage and sanitary facilities would be properly connected

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to the existing systems. All three ports have adequate sanitary installations. No adverse effect of the basic civil works construction is expected.

c) Storage Silos/Tanks and Attendant Equipment. During the construction period, some noise would be created by the pile-driving operations. This disturbance however, would be temporary lasting about three to four months. Other construction activities would generate minimum noise.

d) Operation. Specific dust control systems will be provided for containment of dust produced during certain facility operations. These operations include truck loading; elevating and weighing; storage and receiving; cleaning and drying and lastly - ship loading. Dust containment is the basis of our proposed facility environmental design.

e) Social-Economic Impact. Port labor is not expected to be adversely effected by construction of a bulk shipping terminal as bulk corn cargo represents only a fraction (4 to 16%) of the total cargo handled at each port. (The exact amount varies with each port).

In addition, during the period of facility construction (15 to 18 months), several hundred employees would be required for peak work periods of construction. The consultants have estimated that a permanent operating force of over fifty personnel would be required at each facility. Likewise, many local suppliers and service companies would also benefit both directly and indirectly from each bulk corn shipping facility.

4.8.4 Summary Statement

In view of the foregoing analysis, the Consultants feel confident that no adverse environmental effects would be created by the project during construction or from facility operations.

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5.0 COST EFFECTIVENESS OF RECOMMENDED BULK FACILITIES

5.1 General

The alternative development plans for bulk corn handling facilities at the Mindanao ports of General Santos, Davao and Cagayan de Oro, as well as the recommended initial installations have been presented in Chapter 4.

As set forth therein, this study assumes that a decision about implementing the proposed bulk facilities will take place immediately, i.e., in 1991. Construction of a concrete slipform facility with a storage capacity of about 20,000 metric tons is recommended for General Santos in 1992. A 20,000-ton concrete slipform facility is also suggested for Cagayan de Oro in 1993 and a 10,000-ton concrete slipform facility for Davao in 1994.

The combined cost of the recommended bulk handling facilities for General Santos and Cagayan de Oro is estimated to be about US$26.5 million. The total for the three ports comes to almost US$36.2 million.

5.2 Indications of Cost Effectiveness

As pointed out in in the section on methodology in Chapter 1, the Terms of Reference for this study specified that the cost effectiveness of the recommended corn handling facilities should be indicated. This phrasing was deliberate. Because of the short time span for this investigation of the Ports of General Santos, Cagayan de Oro and Davao, a detailed, conventional cost benefit analysis could not have been undertaken.

It was noted earlier in this report--also in the section on methodology in Chapter 1--that the recommended bulk handling facilities at the three Mindanao ports would be analyzed as components of an integrated corn project. Chapter 2 sets forth the major components of the integrated corn project, in addition to the recommended bulk corn handling facilities for the three Mindanao loading ports.

The demonstration of cost effectiveness will take the form of a series of selected estimates of the impact of the integrated corn project and the proposed bulk corn handling facilities for the three Mindanao ports on various operations of the corn production and distribution network.

Among the selected impacts of the integrated corn project and the recommended bulk handling facilities that will be discussed are:

a) the anticipated increase in Mindanao corn production.

b) the effect of increased production on farmer income.

c) reduction in ship loading time as result of shift from bagged to bulk corn movements.

d) estimated savings in cost of bags used in existing corn transport.

e) other impacts.

5.3 Increase in Mindanao Corn Production

The corn forecast in Chapter 3 is a statement of potential. The realization of this forecast depends on and assumes the timely implementation of the policies , programs and facilities in the integrated corn project. The precise contribution of the recommended bulk corn handling facilities to the attainment of the traffic forecast at the three Mindanao ports cannot be determined with any degree of accuracy. However, it is absolutely certain that if there were no integrated corn project, there would be no gains worth noting in corn production.

It is widely accepted--as noted elsewhere in this report-- that increasing use of hybrid corn offers one of the best hopes for increased corn output in Mindanao. However, increasing use of hybrid varieties is by no means an automatic trend. It is a goal that must be pursued.

As stated in the 1988 Rapid Marketing Appraisal in the Southern Mindanao Region on The Corn Marketing System:

> "Farmers generally opted for the more traditional, white varieties in lieu of yellow hybrids under conditions of environmental stress, poor soils, and/or lack of financing. Hybrids have been considered the hope of the future because they usually have higher yields than open-pollinated varieties. However, the vulnerability of hybrids to droughts and disease meant that there were more risks of crop failure and greater exposure to heavy cash losses, if planted under inappropriate conditions.

"..the South Cotabato area planted to hybrid varieties has decreased from the peak of approximately 30,000 hectares in 1983 to about 14,700 hectares in 1986. Yet that peak may have been illusionary, representing farmers' response to the government's subsidized input program in support/promotion of the hybrid corn industry. Now that those programs have ended, the seed industry contends that its promotion strategy for farmers and traders is causing a sustainable upturn in hybrid seed use, beginning in 1987."

Clearly, the efforts of the seed industry in concert with grain merchandisers, the varied activities undertaken by the Department of Agriculture and other government agencies, plus the dissemination of information about improved agricultural procedures are principal contributors to the expectation of rising grain production. However, failure to make progress on other aspects of the integrated corn program, including the provision of bulk handling facilities, will restrain if not stifle the hoped for increase in corn production.

Table 5-1 shown below, based on the forecast of bulk corn movements set forth in Chapter 3, shows the extent to which anticipated bulk corn movements through the three Mindanao ports in 2000 exceeds the level shown for 1991.

Table 5-1
EXCESS OF BULK CORN MOVEMENTS IN 2000
OVER LEVEL EXPECTED IN 1991

Out Port	Excess Over 1991 (metric tons)
General Santos	183,127
Cagayan de Oro	120,589
Davao	65,775
TOTAL	369,491

The Philippine Department of Agriculture has developed national data on average corn farm production costs and

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returns for the period 1985-1989. The 1989 estimates showed farm gate returns at P4.00 per kilogram. This figure can be applied to the added 369,491 metric tons anticipated for year 2000 to estimate the value of the increase in output at the farm gate. It is appropriate to use a current figure on returns to farmers and then hold it constant through the forecast period. The analytical goal is to estimate the real value of the increased corn output of 369,491 metric tons in 2000, excluding the possible impact of inflation on the return to corn farmers.

At an estimated return of P4.00 per kilogram, the worth of the increased corn output of 369,491 metric tons in 2000 at the farm gate is almost P1.5 billion, or about US$53 million, at a Peso-Dollar exchange rate of 28. This US$53 million, it should be noted, is the value of the increased output in one year alone. Lesser amounts of increased corn production would be available in each of the years through 2000. To illustrate, the value of the increased corn output in 1996--compared to the level of 1991--is almost US$26 million.

The Terms of Reference for this study did not require the preparation of a forecast of bulk corn movements for the years after 2000. Similarly, this investigation was not charged with the responsibility of preparing cost estimates for the components of the integrated corn project other than the bulk handling facilities at the three Mindanao ports. Nonetheless, the data above on the value of increased corn strongly suggest that the integrated corn project--which includes the bulk handling facilities at the three project ports--is cost effective.

If the value of increased bulk corn movements through the Mindanao ports in 1996 is US$26 million in 1996 and US$53 million in 2000, simple interpolation shows that the total value of increased corn production over the span 1996 to 2000 approaches US$200 million. Moreover, since the recommended bulk handling facilities have a useful life substantially in excess of 40 years, the value of the increased corn ouput will be many hundreds of millions of dollars over such a longer term span.

While estimates of the total cost of the integrated corn project have not been developed, there is scant question that the value of increased corn output will dwarf the cost of the integrated corn project, including the US$36.2 million cost of the recommended bulk handling facilities at the three Mindanao ports.

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5.4 Effects of Increased Production on Corn Farmer Income

The most direct way to improve the quality of rural life--in the case of the present study the reference is specifically to the economic conditions of Mindanao corn farmers--is by increasing the income of the average farmer.

USAID, of course, is well aware that improving productivity and efficiency in corn production and distribution activities will benefit traders, transporters, seed and fertilizer suppliers, and feed mills as well as the corn farmer. This is an expected and entirely satisfactory series of impacts as long as it can be demonstrated that the living conditions of the corn farmers have been significantly improved.

The same 1989 Department of Agriculture data used to estimate the value of increased corn output--combined with specific information about corn farming operations in Mindanao--make it possible to estimate the present annual income of the average Mindanao corn farmer.

The Department of Agriculture data indicate that the corn farmers' cash return above total costs was P2,788 per hectare in 1989. In January 1991 Secretary of Agriculture Senen C. Bacani estimated that corn production in 1990 rose 7.2 % above 1989. If it is assumed that corn farmer income rose by the same percentage, then 1990 average income for corn farmers per hectare would be P2,987. At an exchange rate of P28, this would be equivalent to US$106.74.

The average Mindanao corn farm size, based on data in the several rapid marketing appraisals of the corn marketing systems in Northern and Southern Mindanao, is probably about 3 hectares. This would place current average annual income of Mindanao corn farmers at P8,967 or US$320.25. Annual farm income is probably somewhat above this P8,967 average in Bukidnon, where farm size tends to be somewhat larger than in South Cotabato. In the latter area the income is probably a bit below the overall average of P8,967.

The relative disparity between the quality of rural and urban life in the Philippines is illustrated by the fact that the annual income of the average taxi driver of a rented, well maintained, air conditioned cab in Metro Manila is about P72,000, equivalent to US$2,571. The driver of a rented cab which is not air conditioned and not in prime condition has an estimated average income of about P40,000, equivalent to US$1,429 per year.

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Clearly, the average income of the corn farmer--P8,967 or US$320--is severely depressed. Even if--as a result of successful implementation of the integrated corn project--the Mindanao average corn farmer income doubled over the decade through year 2000 to P17,934, it would be only 45 % of what the driver of a non-prime, non-air conditioned taxi in Metro Manila earned in 1990.

5.5 Reduction in Ship Loading Time

During the brief field investigations the Consultants observed vessel operations in the three Mindanao ports. They also obtained fragmentary information on port activity at General Santos and Cagayan de Oro. Very scant data were obtained for the port operations at Davao.

Review of the partial and fragmentary data on port operations showed that the information was sometimes of doubtful value. For example, some statistics suggest a production rate of over 50 tons per hour for bagged corn container loading. However, the containers were "pre-stuffed" off-site, prior to arrival at the port.

Based on the combination of the site visits, review of available data and interviews with officials in inter-island maritime transport, the Consultants developed the following pattern of a "typical" corn loading operation at the Mindanao ports.

Currently, a typical vessel carries 1200 metric tons of of bagged corn and requires a gross loading time six (6) eight-hour shifts. This is equivalent to a loading rate of about 25 tons per hour. This appears to be in line with the data suggesting that the production rate for breakbulk loading of both palletized and non-palletized bagged corn is in the range of 20-30 metric tons per hour. "Bleeder" loading of bulk corn appears to be in the range of 10-20 metric tons per hour. The data cited above on container loading of bagged corn has to be discarded as meaningless. If the amount of time required to "stuff" the container were considered, the production rate would probably be half or less of the indicated rate cited above.

The bulk handling facilities proposed for the Mindanao ports in Chapter 4 incorporate a designed ship loading system capable of delivering high quality "weighed" grain at a rate in excess of 350 metric tons per hour. If a conservative production rate of 300 metric tons per hour is

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used, it means the typical 1200 ton vessel could be loaded in four hours. Since there is necessary time at berth for maintenance, crew liberty and possible bunkering and chandlering, it seems logical to assume that the six (6) eight-hour shifts needed for loading bagged corn could be brought down to no more than one (1) eight-hour shift--a savings of five (5) eight-hour shifts. When this 40-hour savings is related to the 1200 metric tons of corn the savings would equal 0.0333 hours per metric ton.

The interviews conducted during the site investigations indicated that the monthly charter rate for a vessel of this approximate size was P300,000 or US$10,714 per month. Since this charter rate excludes the cost of fuel, it can be used to provide an estimate of ship time cost at berth during cargo operations. When the monthly charter rate of P300,000 is reduced to an hourly cost it comes to P417 or US$14.88.

The estimated savings in ship time through bulk handling, therefore, would be 0.0333 hours per metric ton times $14.88 an hour or US$ 0.50 per metric ton. For a 1200 metric ton corn movement, the total savings would amount to about US$600.

352,965 ?

To put this in perspective, it can be assumed that the bulk handling facilities at General Santos may be completed by the middle of 1994 with a first full year of operation in 1995. The forecast amount of bulk corn movements through the port in 1995 is 335,316 metric tons. If US$600 is saved for every 1,200 metric tons shipped, the total savings in ships time associated with forecast traffic for year 1995 is about US$167,658. The savings over the span mid 1994 through 2000 would be about $1,248,550. For Cagayan de Oro, the first full year of operations would be in 1995 with a shipping forecast of 220,806 tons realizing a savings amounting to US$110,403. Assuming Davao goes on stream in 1995, the total estimated savings in ship time for the three selected ports, covering the span from mid 1994 to 2000, would be US $2,378,430 based on 4,756,862 tons of shipped corn.

In addition to the above savings, this same amount may also be saved at the "receiving ports" if equal facilities were available.

These numbers, it should be noted are so conservative as to be considered extreme. First, since the useful economic life of the recommended bulk handling facilities extends well beyond 40 years, the savings in ships' time will be on a rising arc extending well into the future.

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Even more important, the availability of bulk handling facilities at the Mindanao ports will speed the introduction of larger ships into the inter-island corn trade. Indeed, the facilities include equipment that will permit rapid and efficient loading of vessels of 7,000-ton capacity. The introduction of such larger vessels will create substantial savings in ship operating costs since one such vessel will be equivalent to almost six (6) ships of 1,200-ton capacity.

5.6 Eliminating Use of Bags in Corn Transport

Bulk handling facilities at the ports will eliminate the need for using bags on the corn that is susceptible to bulk transport. Grits as a processed commodity will continue to move in bagged form, of course.

In the course of the field investigations it was determined that the average price of a used bag was about P4.20. Since they were 50-kilo bags, twenty (20) bags would be required per metric ton. Therefore, the bag cost per ton was P84 or US$3.00 per ton.

The combined traffic forecast of bulk corn movements through the three Mindanao ports in 2000 is more than 905,000 metric tons. If the recommended bulk handling facilities were not constructed these 905,000 metric tons of corn would have moved in bags. Since 20 bags are required per metric ton, this quantity of corn would have created a demand for more than 18 million bags. At a price of P4.20 per bag, the total outlay for bags would be almost 76.0 million pesos, equivalent to about US$2.7 million.

This savings in the cost of bags is a very real advantage that can be attributed to the implementation of the proposed bulk handling facilities. This savings will accrue to all sectors in the corn production and distribution network, including users of bulk corn as well as consumers of livestock and poultry products.

The savings in bag costs will rise by some 6% a year--in line with the forecast growth in bulk corn movements--in the years after 2000. The savings in bag costs will begin before 1995, the recommended first full year of operation for the bulk facilities at the Port of General Santos. The savings will also accelerate in early 1995 when the port of Cagayan de Oro is scheduled to begin corn handling operations and, again, in 1996 when similar facilities at Davao become operational.

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5.7 Other Advantages of the Bulk Handling Facilities

There are two other major advantages of the proposed bulk handling facilities which are relevant to the cost effectiveness of such facilities.

One--which was noted earlier--is the useful service life of the recommended facilities. This study--in accord with the Terms of Reference--has confined itself to the period through the year 2000. However, the recommended bulk handling facilities will continue generating benefits well into the middle of the 21st Century. Indeed, the concrete slipform type of storage has been assessed by the Internal Revenue Service of the United States as having a useful life of 40 years (75 years was formly used by IRS for depreciation tables).

Clearly, the cost effectiveness of the recommended bulk handling facilities is substantially greater than an analysis confined to the period through 2000 is capable of indicating.

The second advantage of the bulk handling facilities that should be noted turns on the future role of stevedoring/arrastre labor. If the recommended bulk handling facilities were not implemented, the corn would have to continue moving in bagged form. If the three Mindanao ports remained unimproved, there is a real question whether 905,000 metric tons could move through existing facilities in bagged form. It would probably be an unmanageable and chaotic situation as stevedoring and arrastre labor tried to move such volumes. Indeed, at a loading rate of 25 metric tons per hour, it would be necessary for the Port of General Santos to be loading 2 ships at a time; 24 hours a day for 365 days in order to ship-out the corn forecast (448,000 mt) in year 2000. And this hectic loading rate does not provide time for ships to arrive at the wharf, tie down and, subsequently, depart the loading area.

Another bulk corn handling facility "plus" is the fact, that for the first time, the shipper can challenge the "age old" discriminatory Arrastre/Stevedoring Law with some hope of success in obtaining appropriate changes.

The published (1989) arrastre/stevedoring charges for bagged corn at the three selected Mindanao shipping ports are listed below:

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Table 5-2
ARRASTRE AND STEVEDORING CHARGES (1989)

PORT	ARRASTRE CHARGES	STEVEDORING CHARGES
General Santos	P 22.25 per ton	P 7.75 per ton
Cagayan de Oro	22.70 per ton	8.10 per ton
Davao	21.75 per ton	8.20 per ton

The operational system of the proposed bulk corn facilities would be designed in such a matter that actual requirements for arrastre/stevedoring services would be negligible. However, under the present practices, the above charges would still be applied regardless of the shipper's need. This constraint will continue to deter both existing and future bulk handling facilities unless significant amendments or reductions in above charges are adopted. The development of new efficient bulk handling facilities to replace antiquated shipping methods should not be penalized, but encouraged.

In terms of operational benefits, shortshipments of corn caused by deficiencies in the present antiquated handling system (bursted bags, spillage losses, pilferages, etc.) would be virtually eliminated. Assuming a very conservative loss reduction from 2% to about 0.01% after implementation of the bulk corn shipping terminals, the resulting savings at General Santos alone would exceed US$900,000 in 1995. [(335,316 MT (2.00% - 0.01%) x $135/MT].

Savings in ship dockage fees at both ends would also be significant as these charges are time-based. We estimate that 2 to 3 days of charges can be saved at both the loading and unloading ports. In addition, ship turnaround time would also be reduced, thus, allowing more efficient vessel usage with resulting cost saving especially during peak shipping periods.

Further, if the port corn handling facilities were to remain unimproved, there would be no reduction in existing seasonal surges. Since it is most difficult to meet peak seasonal flows at the present level of corn production and distribution, it would be assuredly impossible to manage the existing seasonal peaks when corn flows reached the level forecast for 2000.

For other port charges in the Port of General Santos, refer to Table 5-3 in the succeeding pages.

table 5-3

TYPICAL PORT HANDLING CHARGES

SCHEDULE OF CARGO HANDLING TARIFF FOR
SOUTH COTABATO INTEGRATED PORT SERVICES, INC. (SCIPSI)
(FOR DOMESTIC & IMPORT/EXPORT CARGO)

The rates quoted below for cargo handling services include charges for cargo handling gear equipment, standard labor complement, overtime, meal hour time and differential pay of arrastre/stevedoring gangs and such other regular services and equipment as defined hereunder:

I. DOMESTIC CARGOES	BASIS	HANDLING RATES ARRASTRE	STEV.
I. GENERAL CARGO			
1.1 Non-Prime Commodities	Rev. Ton	22.15	6.75
1.2 Prime Commodities			
1.2.1 Rice	Rev. Ton	18.70	6.15
1.2.2 Refined Sugar	Rev. Ton	22.15	6.15
1.2.3 Corn	Rev. Ton	17.70	6.15
1.2.4 Canned Milk	Rev. Ton	22.15	6.15
1.2.5 Edible Oil	Rev. Ton	22.15	6.15
1.2.6 Dressed Chicken	Rev. Ton	22.15	6.15
1.2.7 School Supplies	Rev. Ton	22.15	6.15
1.2.8 Canned Fish	Rev. Ton	22.15	6.15
2. LIVE ANIMALS			
2.1 Large (carabao, cattle, horses and the like)	Per Head	20.40	6.75
2.2 Small (Hogs, Goats and the like)	Per Head	2.85	1.35
3. VEHICLES	Rev. Ton	18.30	6.75
4. IRON & STEEL PRODUCTS	Rev. Ton	40.55	6.75
5. LDGS & LUMBER	1000 BD. FT.	30.45	14.05
6. HEAVY LIFT			
6.1 5 to 15 tons	Metric Ton	46.50	6.75
6.2 Over 15 to 20 tons	Metric Ton	58.25	6.75
6.3 Over 20 tons	Metric Ton	67.65	6.75

7. CONTAINERIZED CARGO

7.1 Rates for FCL Domestic Containers where cargo handler furnishes equipment.

		Arrastre Loaded	Arrastre Empty	Stevedoring
10 footer and below	per box	134.90	40.50	53.95
Over 10 to 20 footer	per box	269.80	107.80	89.95
Over 20 to 35 footer	per box	472.20	188.90	89.95
Over 35 to 40 footer	per box	539.65	215.90	89.95

7.2 Where cargo handlers equipment is not utilized, or where the FCL containers are directly loaded unto or unloaded from chassis thereby requiring no other handling.

10 footer & below	per box	87.70	26.30	53.95
Over 10 to 20 footer	per box	175.40	70.15	89.95
Over 20 to 35 footer	per box	306.90	122.75	89.95
Over 35 to 40 footer	per box	350.75	140.30	89.95

7.3 Containers that are stripped (LCL) or stuffed at pier/wharf terminal inside port zone.

7.3.1 The above-prescribed arrastre rates for containers shall not apply, instead the regular or existing arrastre charges (on contents) shall apply, chargeable against owners/consignees of goods.

7.3.2 In addition, stripping or stuffing charges shall be 1/3 of commodity rates to be charged against shipping companies.

NOTE: Stevedoring rate on containerized cargo for non-self sustaining vessel is exclusive of equipment hire if quay/dock crane or any lifting equipment is supplied and used by the contractor/operator.

8. SPECIAL SERVICES/OTHER CHARGES

	BASIS	WITH 18% INCREASE
8.1 Making fast lines at pier/wharf	Per Vessel	88.50
8.2 Letting go line at pier/wharf	Per Vessel	88.50
8.3 Rigging/Unrigging	Per Gang Hour	67.90
8.4 Stand By Time	Per Gang Hour	67.90

II. IMPORT/EXPORT CARGO	BASIS	ARRASTRE	STEVEDORING
1.0 GENERAL CARGO (cargoes in bags, cases, crates, bales, drums & other loose cargoes)	Rev. Ton	24.55	8.60
2.0 LIVE ANIMALS			
2.1 Large (carabao, cattle horses & the like)	Per Head	24.35	2.75
2.2 Small (hogs, goats & the like)	Per head	3.40	1.70
3.0 VEHICLES	Rev. Ton	21.00	8.60
4.0 IRON & STEEL PRODUCTS	Rev. Ton	34.50	8.60
5.0 HEAVY LIFT			
5.1 to to 15 tons	Metric Ton	46.60	6.55
5.2 Over 15 to 20 tons	Metric Ton	58.40	6.55
5.3 Over 20 tons	Metric Ton	67.85	6.55
6.0 LOSS AND LUMBER	1000 BD. FT.	189.30	42.95

7.0 CONTAINERIZED CARGO	BASIS	ARRASTRE W/ 18% INC. LOADED	ARRASTRE W/ 18% INC. EMPTY	STEVEDORING W/ 18% INC.
7.1 Using operator's equipment				
10 footer & below	Per Box	135.75	40.70	65.20
Over 10 to 20 footer	Per Box	271.50	108.60	108.60
Over 20 to 35 footer	Per Box	475.15	190.05	108.60
Over 35 to 40 footer	Per Box	543.05	217.25	108.60

7.2 [illegible]e the cargo operator cannot provide necessary and adequate equipment, use of shipping/ship-owner equipment and/or discharging or loading to and from chassis without handling at pier/wharf aprons, Terminal Storage Areas, container intact (FCL) for direct delivery loading shall be allowed.

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	BASIS	ARRASTRE W/ 18% INC. LOADED	EMPTY	STEVEDORING W/ 18% INC.
10 footer and below	Per Box	88.25	27.15	65.20
Over 10 to 20 footer	Per Box	176.45	70.60	108.60
Over 20 to 35 footer	Per Box	308.85	123.55	108.60
Over 35 to 40 footer	Per Box	352.95	101.20	108.60

7.3 Containers that are stripped (CL) or stuffed at pier/wharf terminal inside port zone.

7.3.1 The above-prescribed arrastre rates for containers shall not apply, instead the regular or existing arrastre charges (on contents) shall apply chargeable against owners/consignees of goods.

7.3.2 In addition, stripping or stuffing charges shall be 1/3 of commodity rates to be charged against shipping companies.

NOTE: STEVEDORING RATE ON CONTAINERIZED CARGO FOR NON-SELF SUSTAINING VESSEL IS EXCLUSIVE OF EQUIPMENT HIRE IF QUAY/ DOCK CRANE OR ANY LIFTIND EQUIPMENT IS SUPPLIED AND USED BY THE CONTRACTOR/OPERATOR.

8.0 SPECIAL SERVICES

	BASIS	WITH 18% INCREASE
8.1 Checking Charges	Per Ton	2.60
8.2 Making fast lines at pier/wharf	Per Vessel	177.00
8.3 Letting go lines at pier/wharf	Per Vessel	177.00
8.4 Rigging/Unrigging, Opening/ Closing Hatches, Shoring, Lashing and Hatch Jobs	Per Gang Hour	103.15
8.5 Stand By Time	Per Gang Hour	103.15
III. PALLETIZED/UNITIZED CARGO	Revenue Ton	85% of Applicable Rates
IV. DANGEROUS/HAZARDOUS CARGO	Revenue Ton	15% of Applicable Rates
V. PRE-HANDLING/POST HANDLING SERVICE (BAGGING, SWEEPING, LOADING TO TRUCK, UNLOADING FROM TRUCK, ETC.)		1/4 of Applicable Arrastre Rate (per Movement)

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VI. Applicable Terms and Conditions

1. Revenue ton as used in this tariff shall be 1000 kilograms or American measurement of 40 cubic feet or 1.1326 cubic meter whichever is higher, as it appears in the manifest or hatch list.

2. Palletized/unitized cargoes refer to a single unit/package of not less than one (1) metric ton or 1.1326 cubic meter with its own fitting/attachment to facilitate loading/unloading.

3. General cargo shall include cargoes in sacks, bags, boxes, crates, cartons, cases, drums, steel products and other loose cargoes.

4; Containerized/container cargoes stuffed inside a container/vans with the external dimensions and ratings as enumerated in series 1 of ISD 668-1976 which are specially designed to facilitate ready handling particularly its transfer from one mode of transport to another without intermediate reloading.

5. Heavy lift charges shall be exclusive of equipment hire if vessel's gear is inadequate for stevedoring services.

6. Regular arrastre services to be rendered by the contractor shall include the following:

6.1. Breakbulk, Bulk, Heavy Lift, Dangerous Cargo

6.1.1 Receive and load cargoes to and from ship's tackle with the use of dock (arrastre) gang and cargo handling equipment;

6.1.2 Check cargoes by marks and quantity, acknowledge and sign receipt of cargo for loading/unloading.

6.1.3 Sort, pile, stow, and classify cargoes in their designated areas in sheds/open storage/warehouses;

6.1.4 Check and recoup bad order and damaged cargoes

6.1.5 Deliver, transfer cargo to and receive from tailend of consignees transportation or ship's tackle;

6.1.6 Secure cargoes from pilferage and losses while under custody: and

6.1.7 Provide checking services if cargo is loaded and check unmanifested cargoes.

6.2 Containerized Cargo

6.2.1 Receiving of containers from vessels unto chassis or trailers provided by shipping companies;

6.2.2 Moving such container on chassis or trailers by shifters from alongside carrying vessel to the storage area in port zone designated for storing container or container yard;

6.2.3 Handling, stowing, and shifting of containers within the port zone;

6.2.4 Loading of containers from place of storage in the port zone unto chasis or trailers either for delivery or transfer;

6.2.5 Receiving, handling, and stowwing containers either loaded or empty coming from place outside port zone;

6.2.6 Moving containers either loaded or empty from storage areas within the port zone and loading them unto vessels alongside the pier; and

6.2.7 Providing checking services if container are loaded or unloaded and check unmanifested containers.

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7. "Stevedoring Services" — are work performed on board vessel, that is the process or act of loading and unloading cargo, stowing inside harches, compartments and on deck or open cargo spaces on board vessel. Related services to stevedoring are the activities of rigging ship's gear, opening and closing hatches, securing cargo stored on board by lashing, shoring and trimming.

8. On non-self sustaining vessel, if quay/dock crane or any lifting equipment is supplied and used by the contractor, the use of the same is chargeable against shipping/agents/companies.

9. Responsibility and Liability For Losses and Damages

A. The contractor shall at its own expense handle all cargoes and all work undertaken by it diligently and skillfully, workmanlike and efficient manner and shall be solely responsible as an independent contractor, and hereby agrees to accept liability and to promptly pay to the shipping company, consignees, consignors or other interested party or parties all damages that may be suffered on account of loss, damage or destruction of any cargo while in the custody or under the control of the contractor in any pier, shed, warehouse, facility or other designated place authorized by PPA to the extent of the actual invoice value of each package which in no case shall be more than Two Thousand Pesos (P2,000.00), for domestic cargo and in no case more than Three Thousand Five Hundred Pesos P3,500.00) for import/export cargoes for each package, unless the value of the cargo is otherwise specified or manifested or communicated in writing together with the declared bill of lading and supported by a certified packing list to the contractor by the interested party or parties before the discharge or loading unto vessel of the goods.

B. The contractor shall not be responsible for the condition of the contents of any package received nor for any loss, injury or damage to the said cargo before or while the goods are being received or remain in the piers, sheds, warehouses or facility if the loss, injury or damage is caused by force majeure or other causes beyond the contractor's control or capacity to prevent or remedy.

C. Any claim must first be initiated by a request for certification of loss or non-delivery of the lost package to the consignee.

D. The contractor shall within 15 days from the date of receipt of the request for certification of loss or non-delivery, issue the said certificate of loss/non-delivery accordingly. If the contractor fails to issue the said certification within 15 days, the certification of loss or non-delivery shall be deemed to have been issued on the 15th day and thereafter, the 15 day period within which to file the formal claim shall commence.

E. The formal claim and the certificate of loss/non--delivery together with the necessary copies of bill of lading, invoice, certified packing list and computation arrived at covering the loss, injury or damage on non-delivery of such goods must be filed with the contractor within 15 days from the date of issuance by the contractor of a certificate of non-delivery or loss. Thereafter no claim shall be entertained by the contractor.

F. All claim shall be resolved by the contractor within 15 days from the date of its filing and any decision or resolution whether in whole or in part must be settled within 7 days from the date thereof.

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6.0 MANAGEMENT AND OPERATION OF THE CORN FACILITIES

6.1 General

This study has investigated alternative approaches to the ownership as well as the management of the proposed bulk corn facilities. Both public sector and private sector candidates were considered.

With respect to ownership the logical candidates are the Philippine Ports Authority and the National Food Authority, both public sector entities with regard to management and operation of the facilities, there is really only one logical possibility, the Confed Grains Multi-Purpose Cooperative, a private sector entity.

6.2 Ownership

It is presumed that the project would be financed by a grant from the United States Agency for International Development. Likewise the completed facilities would then be turned over to an agency of the Philippine Government as mutually agreed upon by USAID and the Philippine Government.

The most obvious candidate appears to be the Philippine Ports Authority as the facilities would be located on their land and, more important, PPA has the statutory right to the physical security of corn once it is inside the port area.

Another possible candidate for ownership is the National Food Authority, whose responsibility covers the distribution of grains, primarily rice and corn. Even without ownership, NFA--as part of its task of stabilizing grain prices--will remain involved in corn procurement, storage, transportation and distribution.

On balance, if for no other reason than its ownership of the property upon which the bulk handling facilities will be built, PPA would appear to be the preferred agency of the Philippine Government to assume ownership of the new facilities. However, in view of the strong move towards "privatization" within the Philippine economy, the Consultants highly recommend that PPA should forego the management and operation of the new corn handling facilities in favor of a private organization.

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6.3 Operation by the Private Sector

The most logical private sector entity that should be assigned the management and operating function is a cooperative association that now carries out production, trading, shipping and processing functions serving the entire grain industry. Essentially, this would put users in control of the facility/facilities. This arrangement offers the best opportunity to assure efficient use of facilities, and, in turn, efficient use of the facilities would provide PPA with a satisfactory return for providing the site of the bulk handling facilities. Although the facilities would be financed by a grant from USAID, they would be entered as an asset on the PPA balance sheet.

The Confed Grains Multi-Purpose Cooperative is a nationwide group formed by the Confederation of Grains Association for the purpose of, among others, promoting the cooperative way of life for improving the social and economic well-being of the people.

6.4 Operating Recommendations

6.4.1 General

The contract between PPA and the operating body should include the scope of responsibilities of both parties and the terms and conditions appropriate to the arrangement. The scope of the services to be undertaken by the operating entity should include receiving corn, sampling for quality control, cleaning, weighing, drying, storing, aeration, classifying and loading into ships, and of course, maintenance and upkeep.

6.4.2 General Terms and Conditions

The following terms and conditions would be made part of the operation/management contract between the custodial owner and the operator/contractor.

a) General Terms

- Description of Contracting Parties
- Life of Contract
- Scope of Contractor's Services
- Owner's Responsibilities
- Bid/Performance/Guarranty Bond

b) Management

- Structure of Organization
- Qualifications of Officers/Key Staff
- Salary/Wage Structure
- Tenure/Fringe Benefits
- Insurance/Retirement
- Office/Equipment Facilities

c) Operation

- Receiving Corn
- Measuring/Quality Control
- Classification/Storage
- Drying/Moisture Content Control
- Transferring/Blending
- Taking Out/Ship Loading
- Automation/Documentation
- Billing/Reconciliation
- Other Activities
- Safety and Security

d) Maintenance

- General Maintenance Requirements
- Preventive/Corrective/Improvement Maintenance
- Grounds and Buildings
- Silos/Elevators/Conveyors
- Ship Loading System
- Weighing System
- Sampling/Testing Equipment
- Automated Control System
- Other Maintenance Equipment/Services

e) Service Fees and Charges

- Receiving Charge
- Testing/Quality Control
- Drying/Weighing
- Storage/Aeration
- Ship Loading
- Other Fees and Charges

f) Payment to Owner

- Fixed Privilege Fee
- Monthly Payment
- Variable Payment
- Fines/Liquidated Damages

g) Relationship with Other Agencies

- Shippers/Traders/Brokers
- Arrastre/Stevedoring Groups
- Shipping/Lighterage Co.
- Government Agencies (PPA, Customs, Coast Guard, Marina, NFA, Quarantine, Plant/Animal Industry, etc.)
- USAID (Donor)

h) Other Terms and Conditions

- Owner's Right to Access/Inspection
- Contract Cancellation
- Force Majeure
- Arbitration
- Insurance
- Others

6.5 Pre-Conditions and Schedules

Decisions on who should operate the bulk handling facilities in each port should preferrably be made three (3) months before the completion of construction to allow recruitment of personnel and training for operation and maintenance. If prequalification and bidding for operation were to be prerequisites for entering into an operational contract, advertisements for interested parties should be put out six (6) months before the completion of construction or start of operation.

In the case of the bulk facilities at General Santos, invitation to prequality should be published at the start of 1994. For Cagayan de Oro and Davao, invitations should be put out in mid 1994 and mid 1995 respectively.

It is recommended that prequalification and bid documents, if public bidding should indeed be the intention, be made part of the Consultants' Terms of Reference. The Consultants should also assist in the evaluation of the proposals to operate and in the award of contract as well as in training and start-up operations.

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APPENDICES

A	-	Pictures
B	-	Drawings
C	-	Comments of PPA/USAID on the Inception Report
D	-	Consultants' Response to the Above Comments
E	-	Terms of Reference

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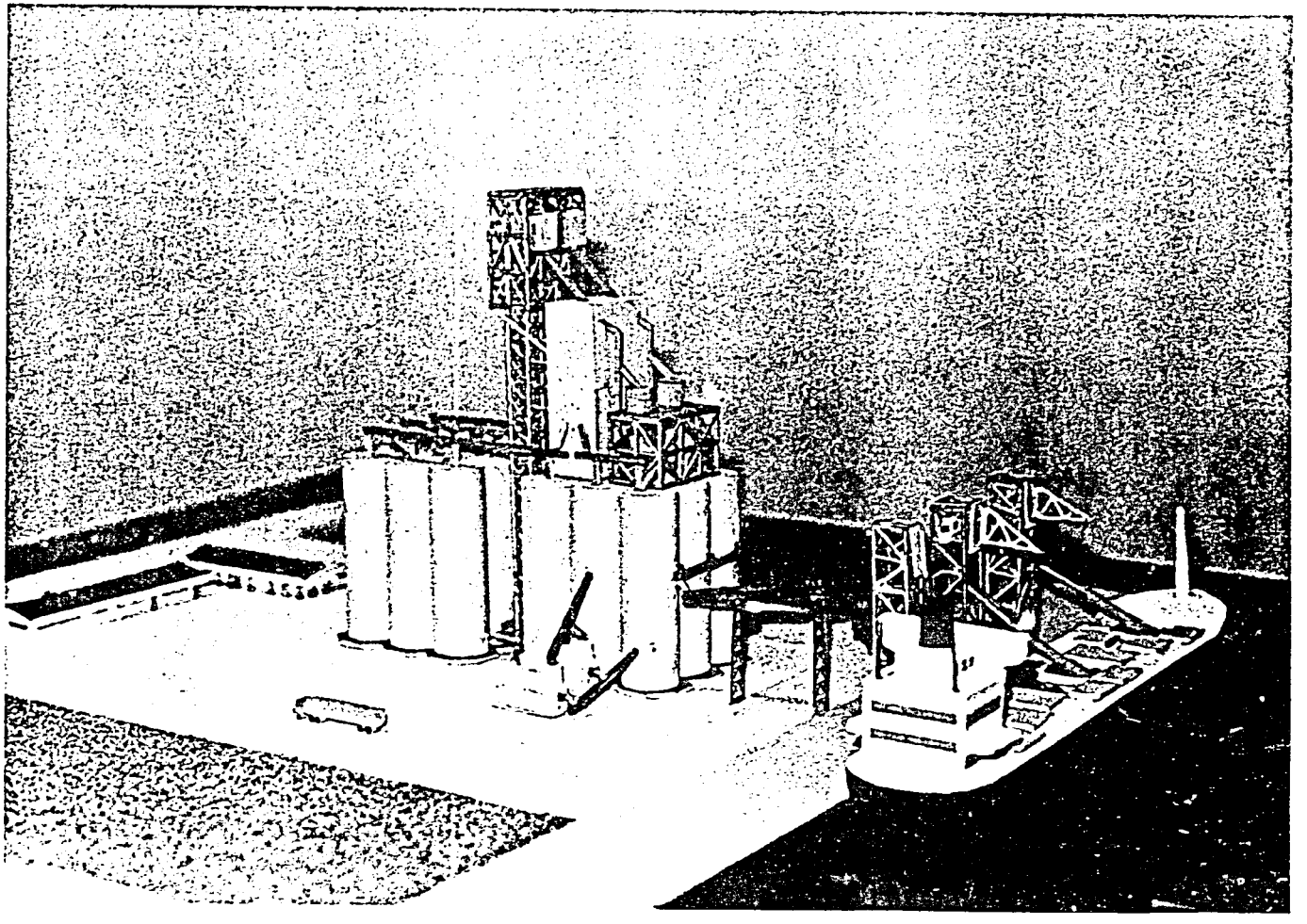

Photo No. 1 View of a scaled model showing a standard 20,000-ton concrete slipform facility loading a 7,000-ton bulk carrier.

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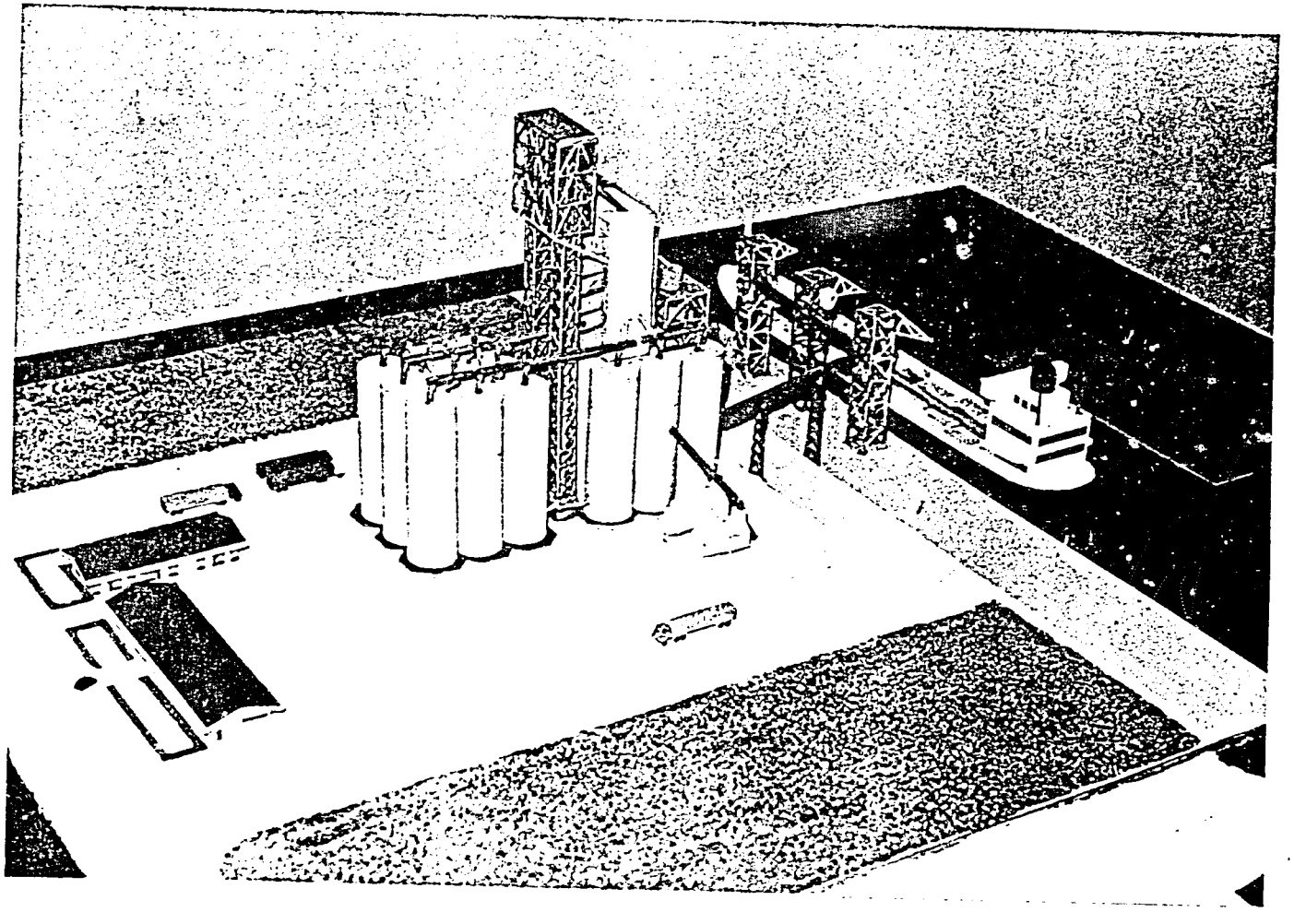

Photo No. 2 Aerial view of the same 20,000-ton bulk loading facility with the two 50-TPH drying equipment near the foot of the concrete slipform silo facility.

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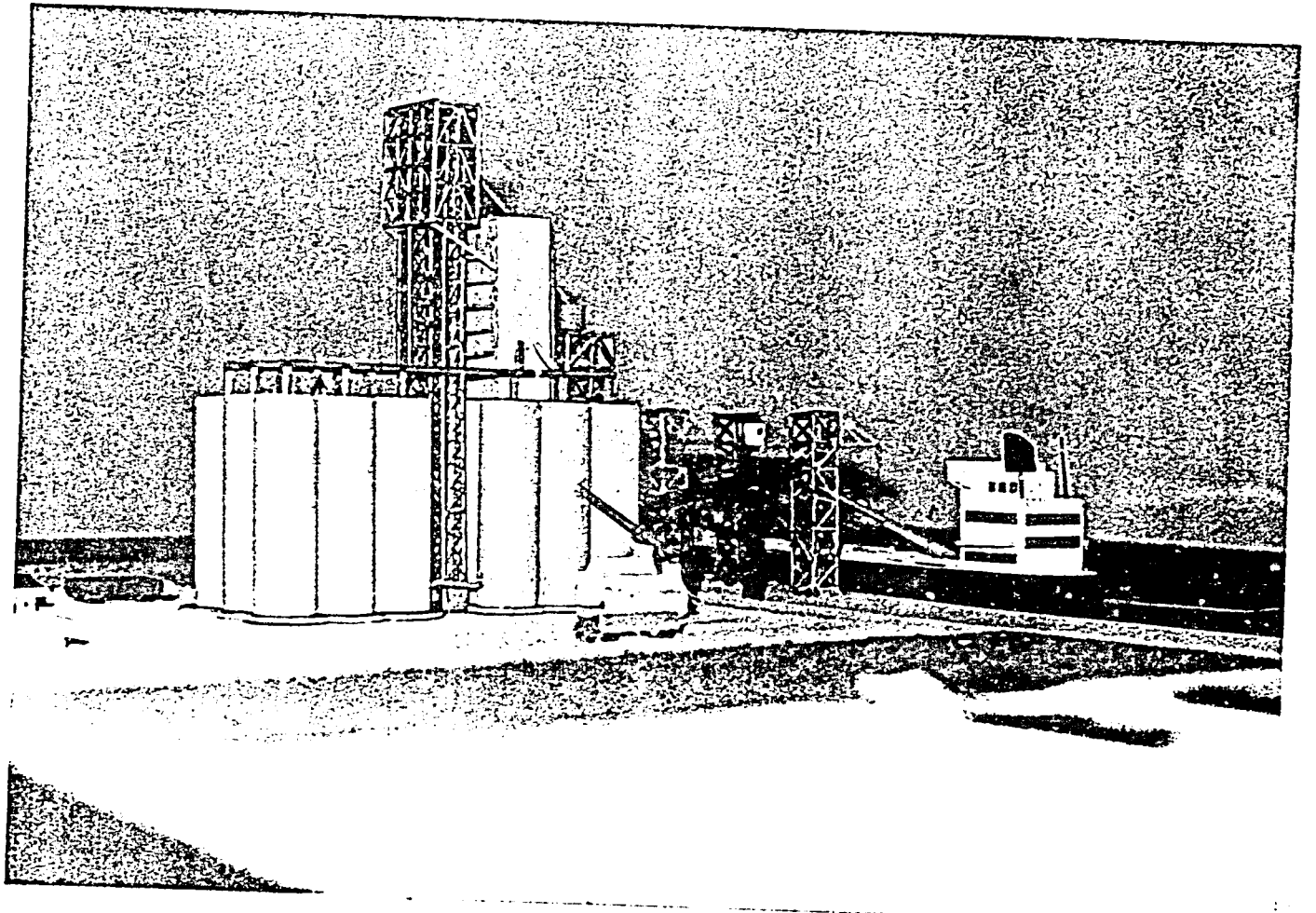

Photo No. 3 View of concrete slipform silo facility towards the sea showing the two 400-ton per hour bucket elevator (designed capacity) at the center and the 350-400 TPH loading platform.

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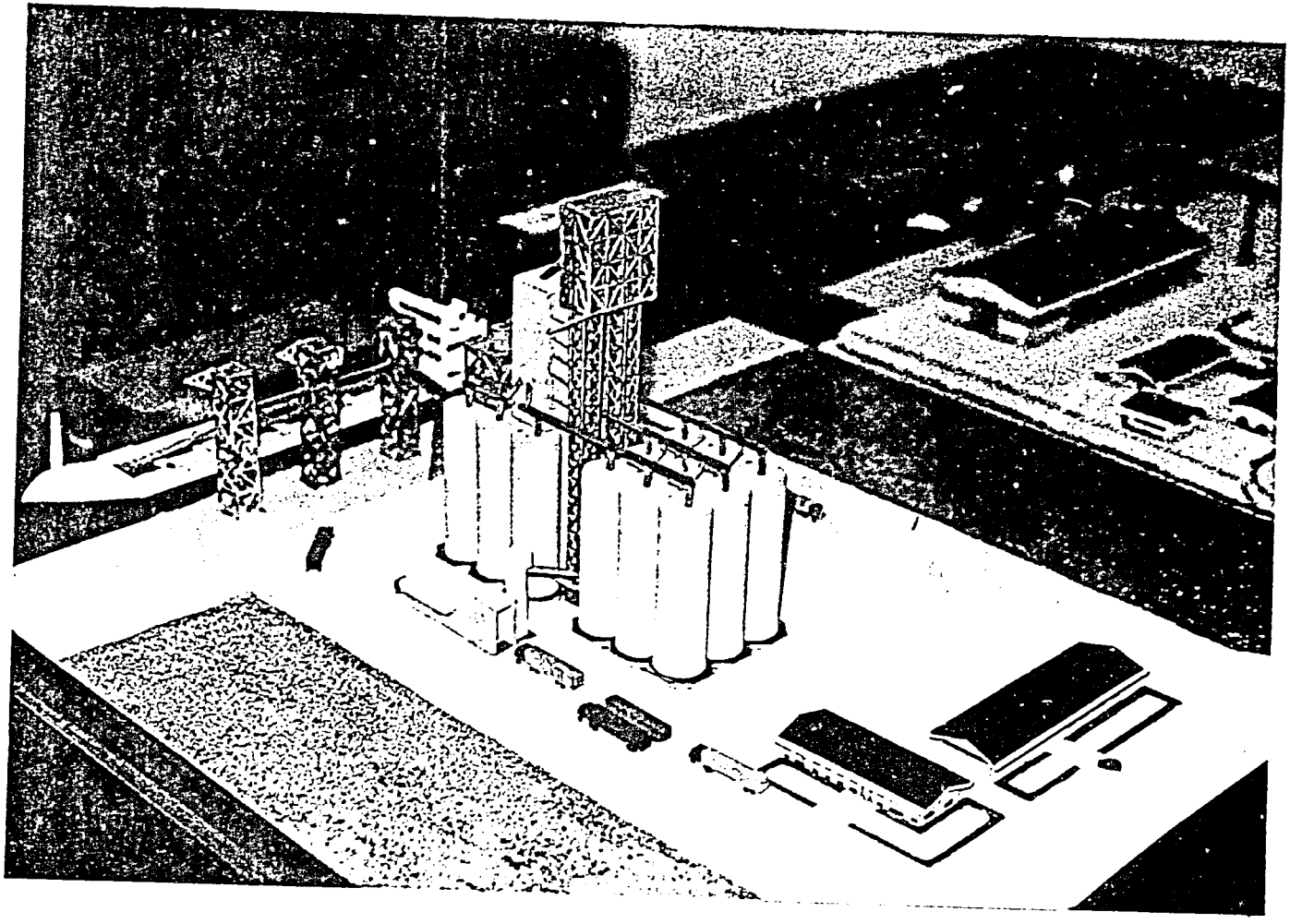

Photo No. 4 — Back view of a scaled model of a 20,000-ton concrete slipform silo facility. Note the bulk truck receiving system in the foreground.

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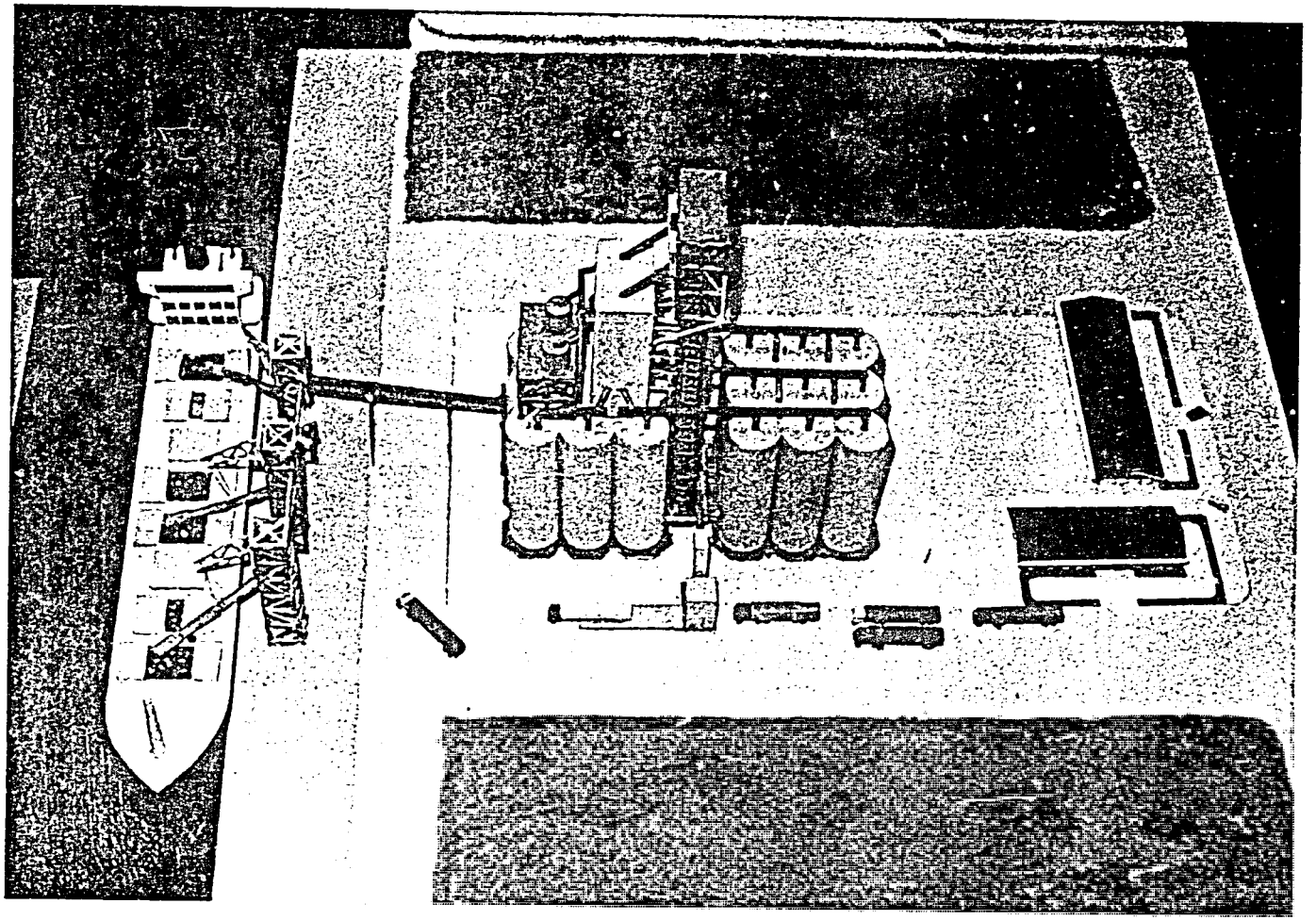

Photo No. 5 Aerial view showing how bulk corn is received from the trucks, elevated to the silos and loaded into bulk carriers.

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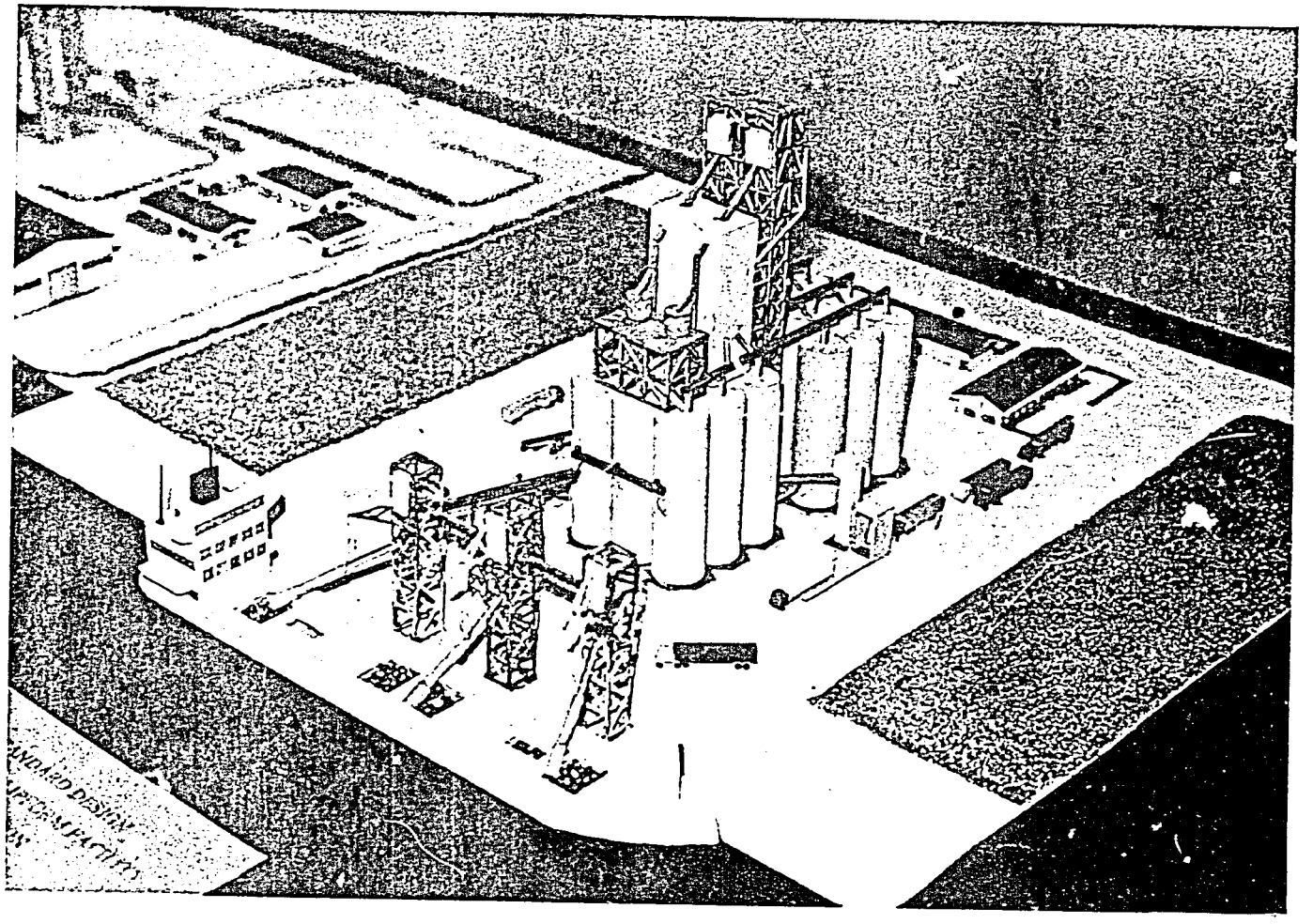

Photo No. 6 Aerial view showing a bulk truck receiving system and a 7,000-ton bulk carrier being served by a 3-spout 350-400 TPH loading platform.

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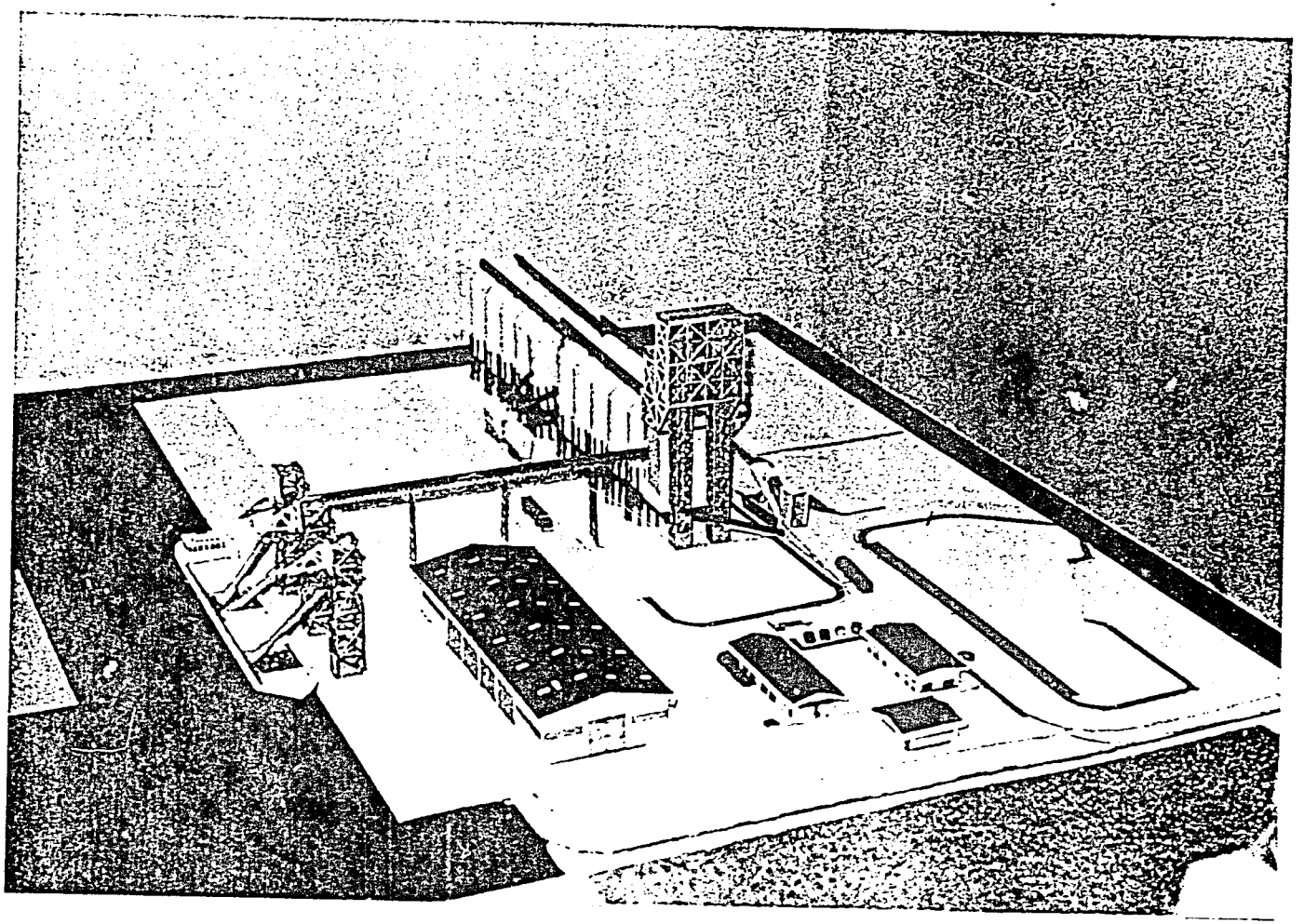

Photo No. 7 Simulated aerial view scaled model of a 20,000-ton bolted steel storage facility. Note the loading platforms identical to those of the concrete slipform silo facility.

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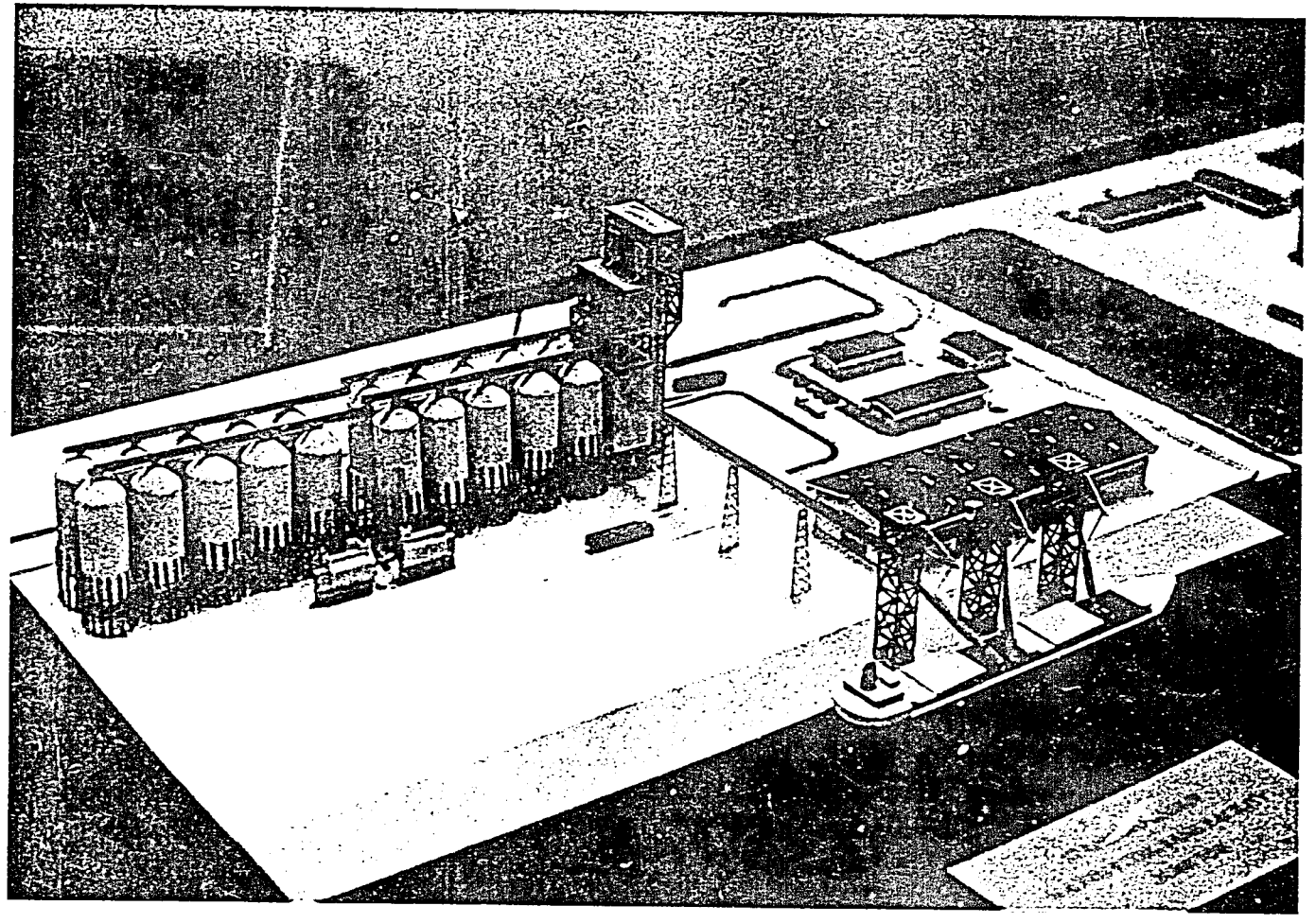

Photo No. 8 View from the waterside showing the two 50-TPH drying equipment at the center foreground and a 3-spout 350-450 TPH loading platform for the 20,000-ton bolted steel tank storage facility.

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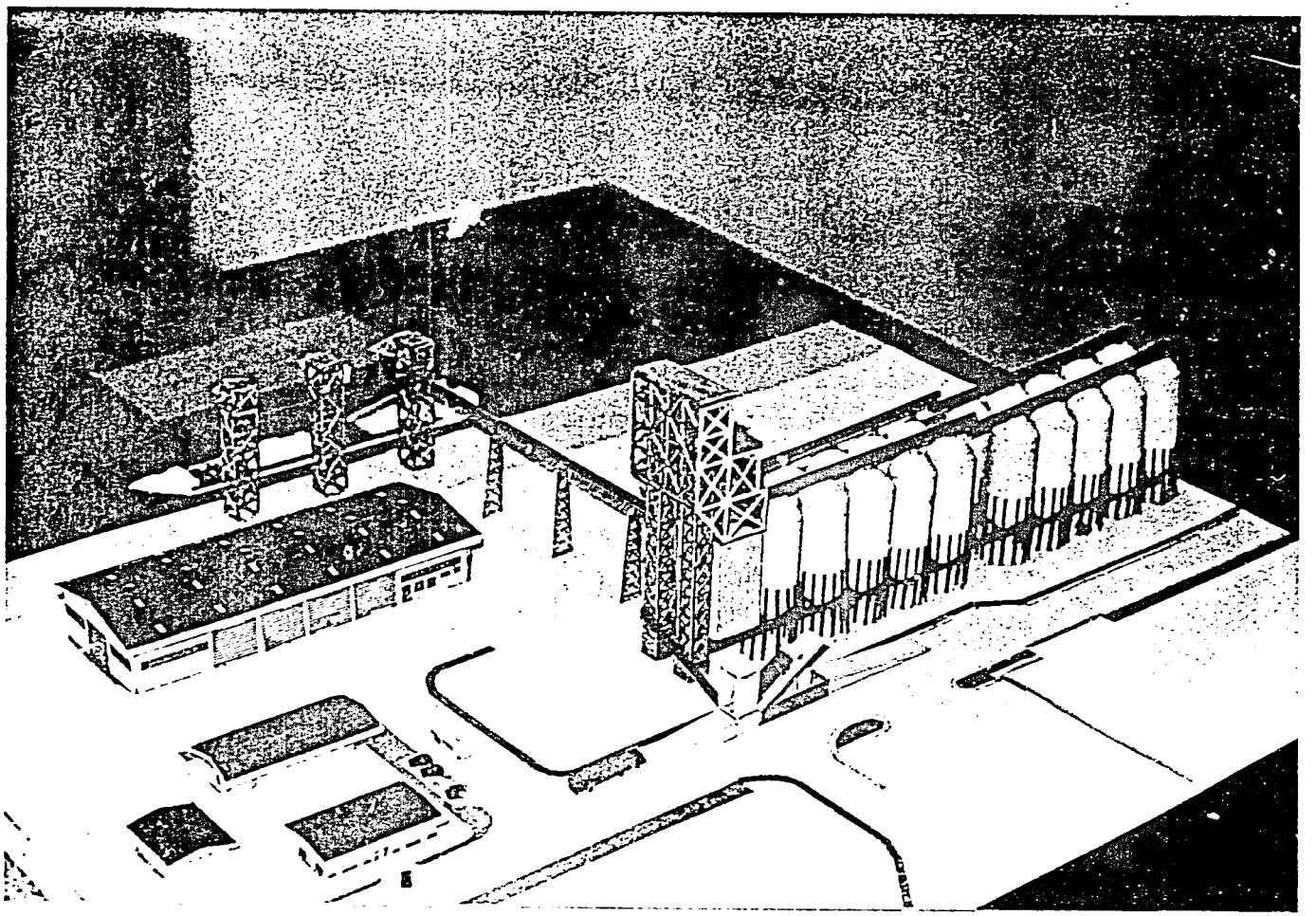

Photo No. 9 View showing the bulk truck receiving system in the foreground and the 3-spout 350-400 TPH ship loading system in the background at the left.

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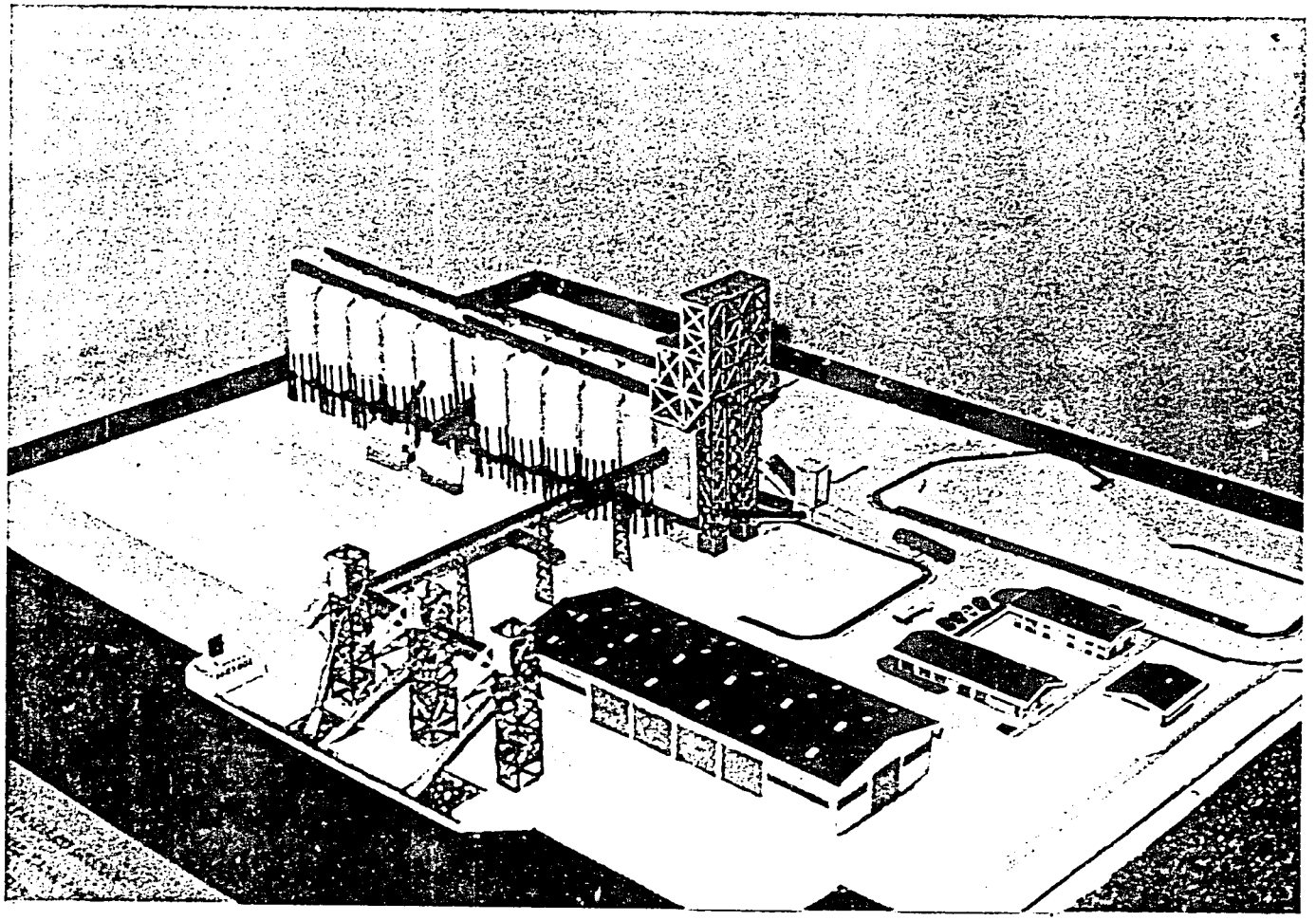

Photo No. 10 View of a 1,000-ton bulk carrier at the loading platform in the foreground and truck receiving system at the right end of the 20,000-ton bolted steel storage tank facility.

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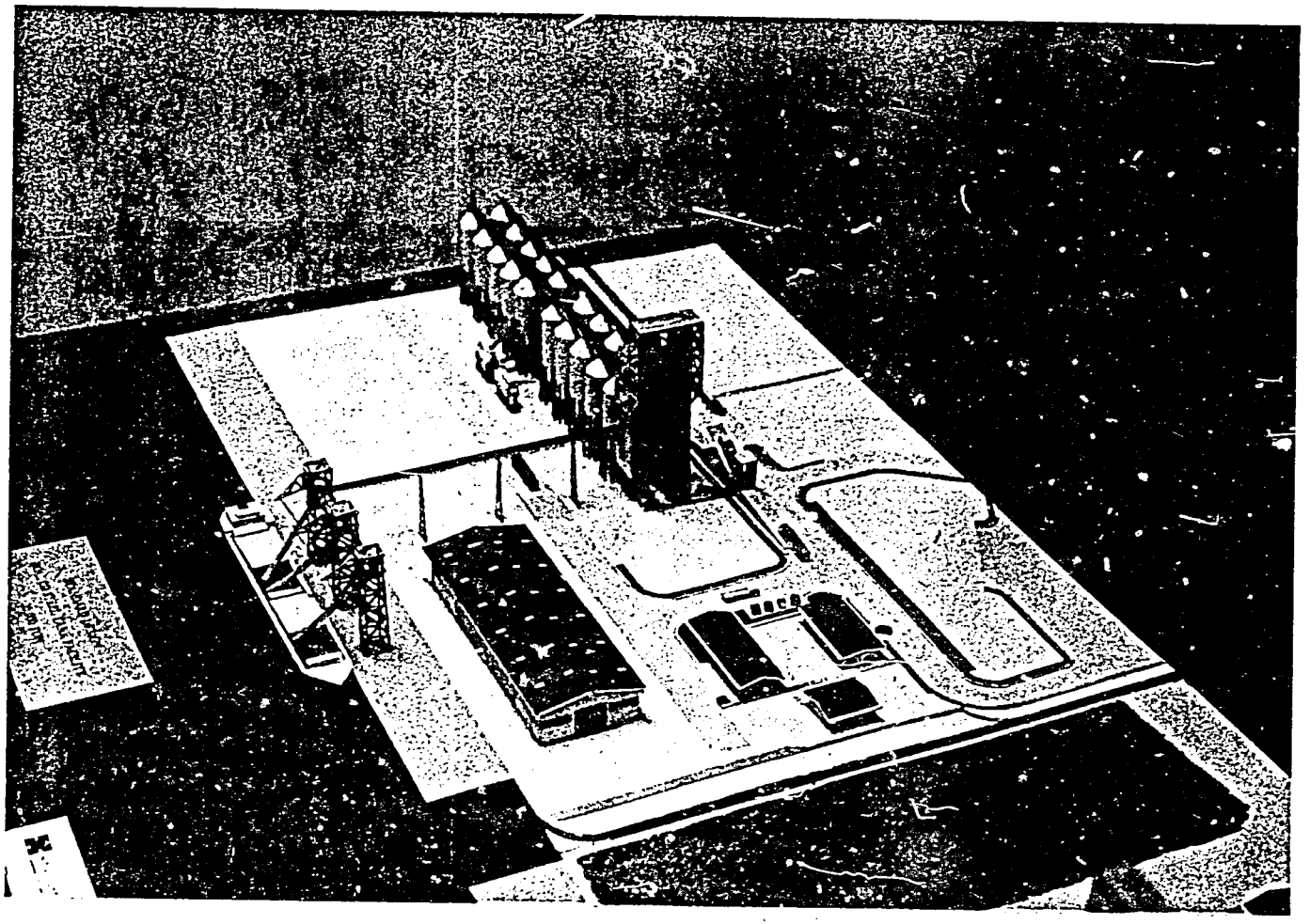

Photo No. 11 Photo of a scaled model showing a simulated aerial view of a 20,000-ton bolted steel storage facility with the 3-spout 350-400 TPH loading platform at the left.

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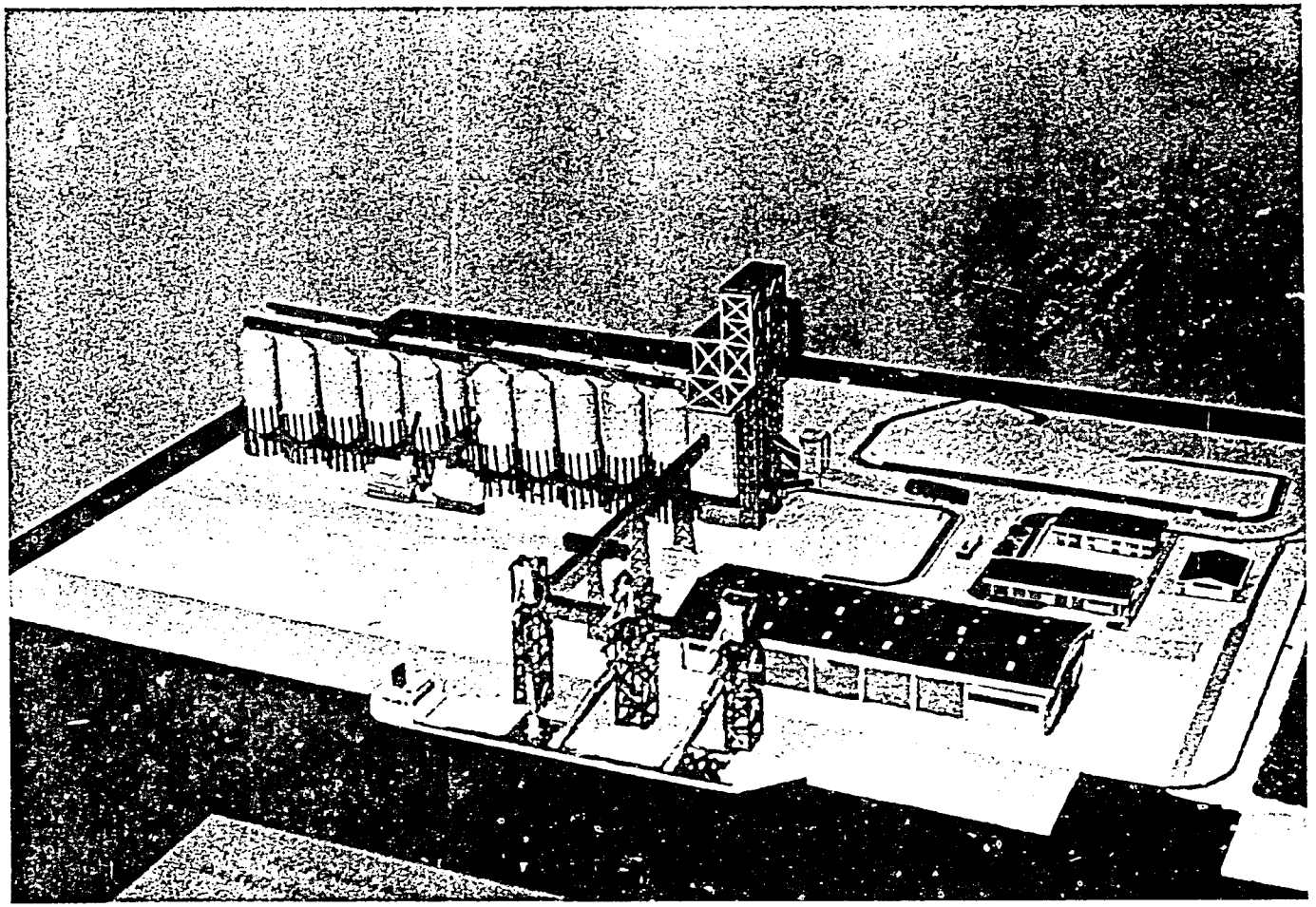

Photo No. 12 Simulated aerial view from the seaside showing the 3-spout 350-400 TPH ship loading system in the foreground of the 20,000-ton bolted steel storage facility. Note the two 50-TPH drier at the middle front of the steel tanks.

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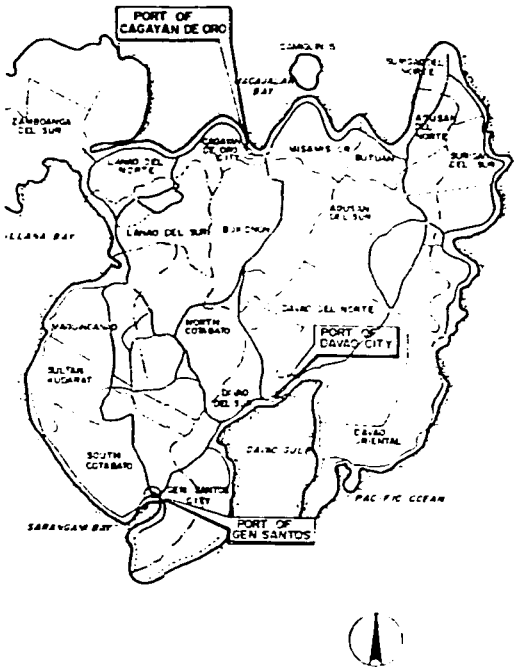
BULK CORN HANDLING FACILITIES

PORTS OF GEN. SANTOS, CAGAYAN DE ORO & DAVAO

PHILIPPINES

INDEX OF DRAWINGS

DRAWING NO	SHEET TITLE
CS - 1	COVER SHEET
MP - 1	CONCRETE SILO - PLAN & DETAILS
MP - 2	BOLTED STEEL SILO-PLAN & DETAILS
	GENERAL SANTOS
GS - 1	SITE DEVELOPMENT PLAN
GS - 2	CONCRETE & BOLTED STEEL SILO-LAYOUTS
GS - 3	BORING LOCATIONS & BORING LOGS
	CAGAYAN DE ORO
CO - 1	SITE DEVELOPMENT PLAN
CO - 2	CONCRETE & BOLTED STEEL SILO-LAYOUTS
CO - 3	BORING LOCATIONS & BORING LOGS
	DAVAO
DO - 1	SITE DEVELOPMENT PLAN
DO - 2	CONCRETE & BOLTED STEEL SILO-LAYOUTS



LOCATION PLAN

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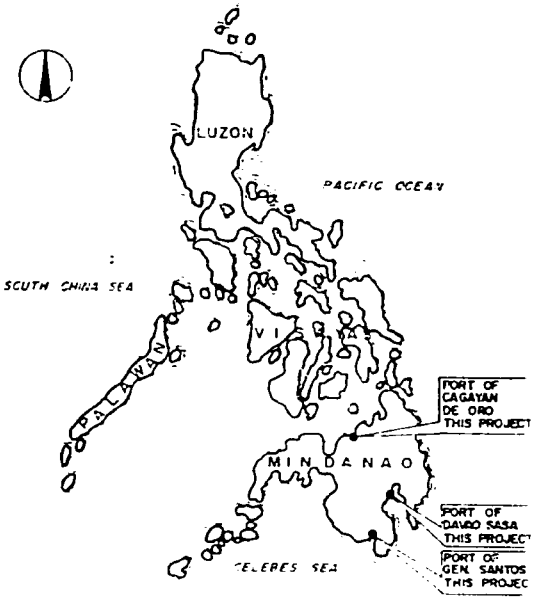

VICINITY MAP

NOT TO SCALE

STV/LYON ASSOCIATES, INC

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

BULK CORN HANDLING F

COVER SHEET

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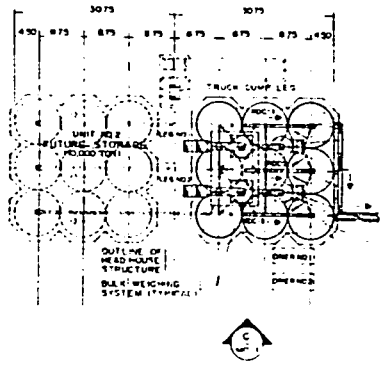
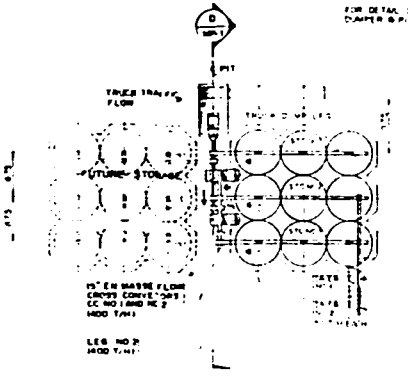
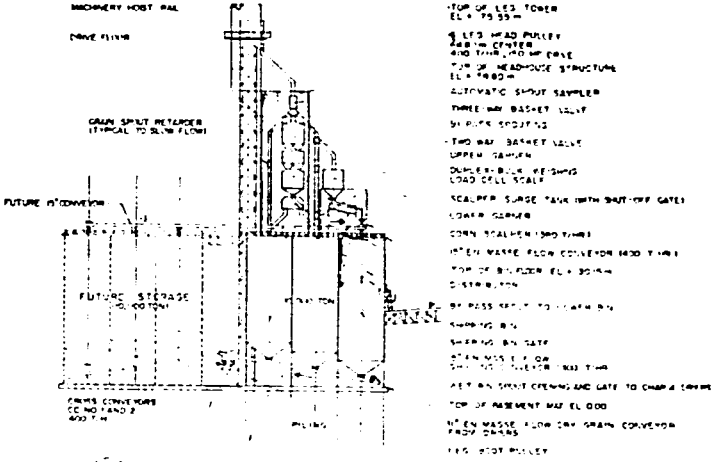


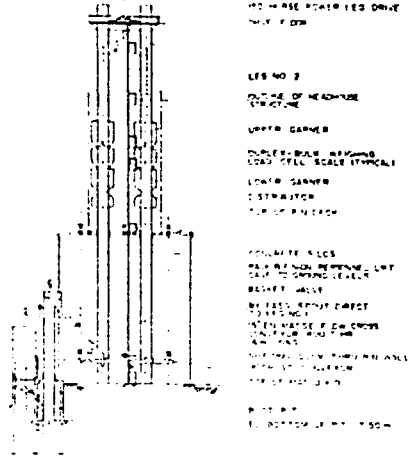
A TYPICAL CONCRETE SILO LAYOUT SHOWING BIN FLOOR CONVEYOR AND EQUIPMENT SYSTEMS



B TYPICAL CONCRETE SILO LAYOUT SHOWING BASEMENT CONVEYOR AND EQUIPMENT SYSTEMS



C ELEVATION



C ELEVATION

GRAPHIC SCALE

STV/LYON ASSOCIATES, INC

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

BULK CORN H

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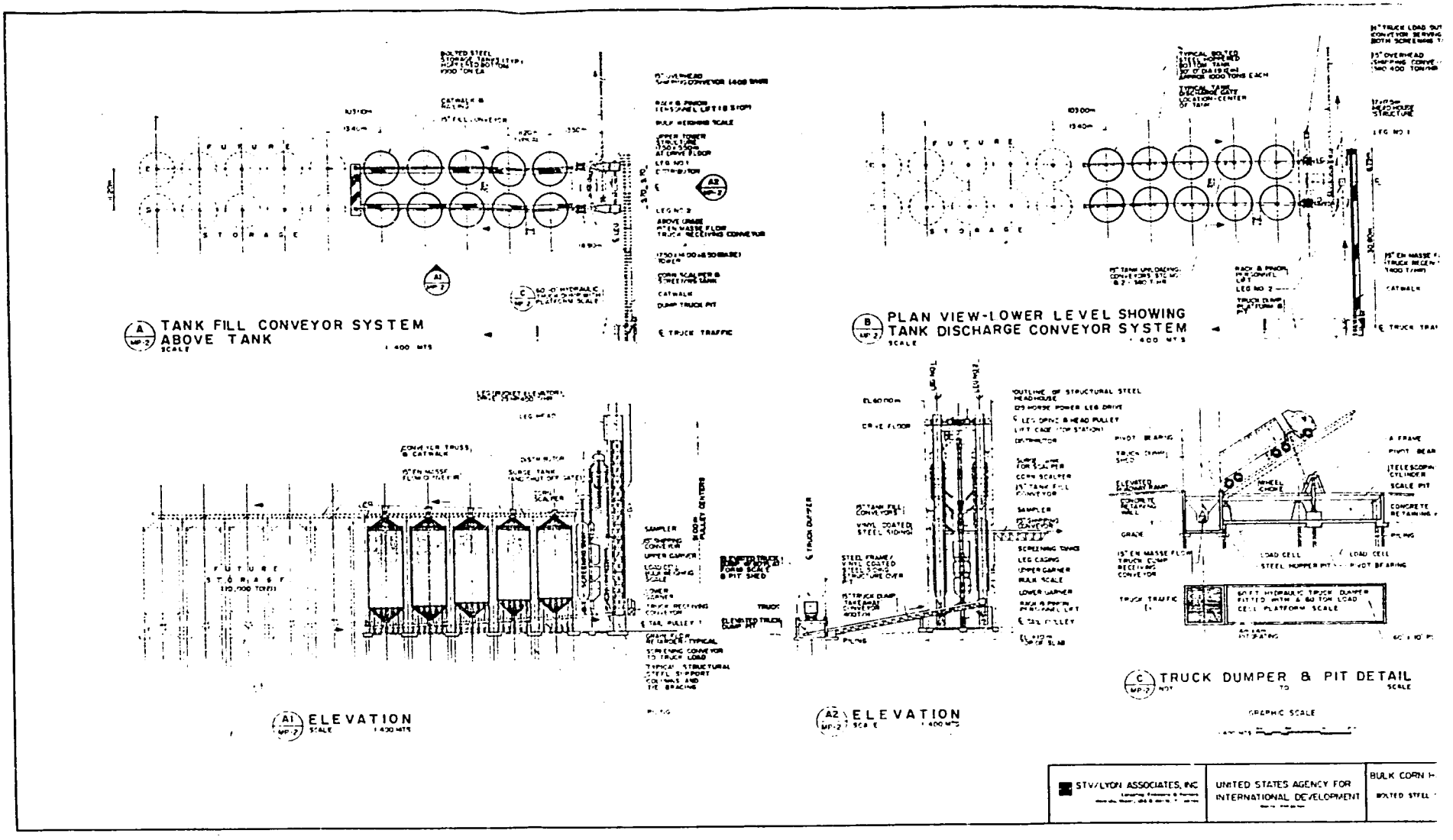

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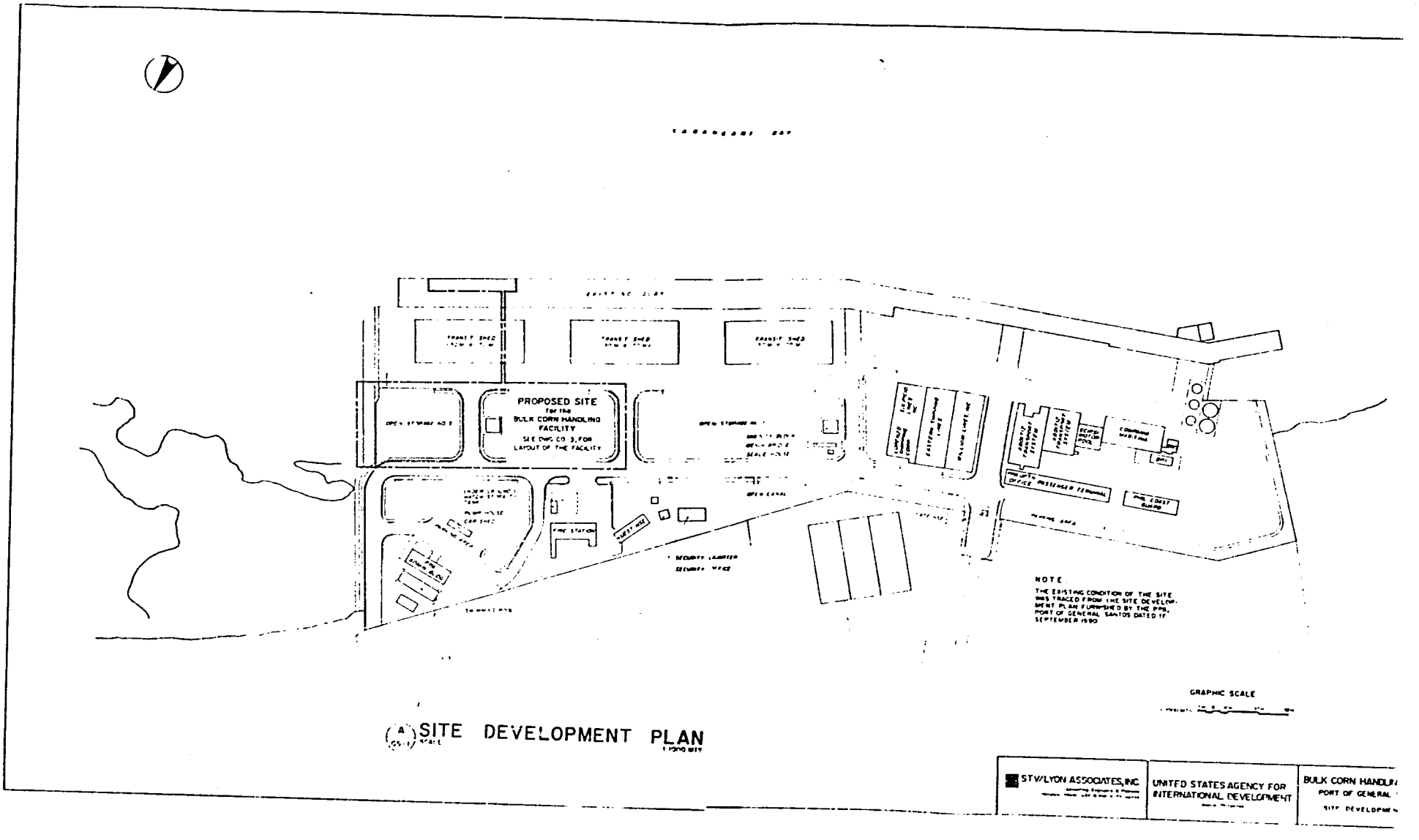

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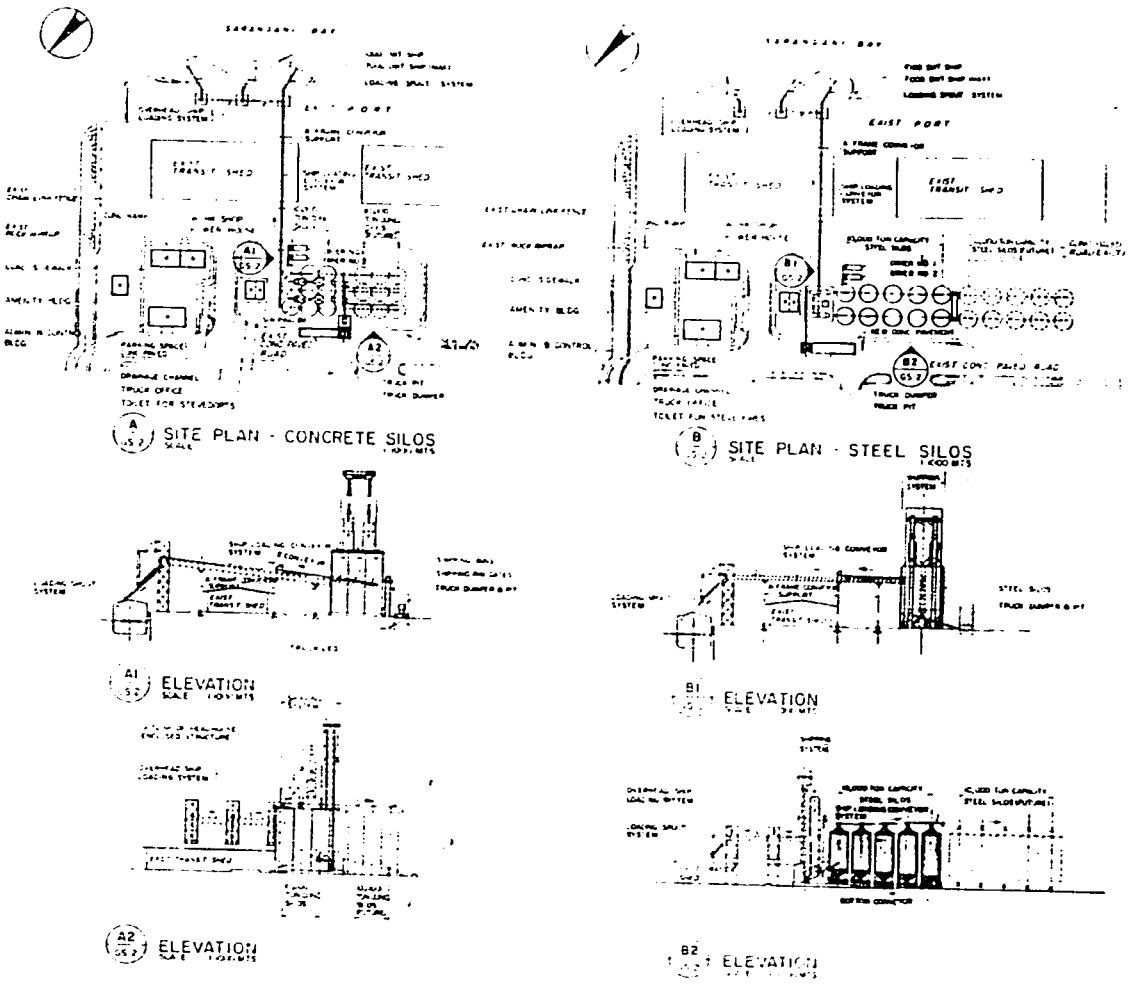

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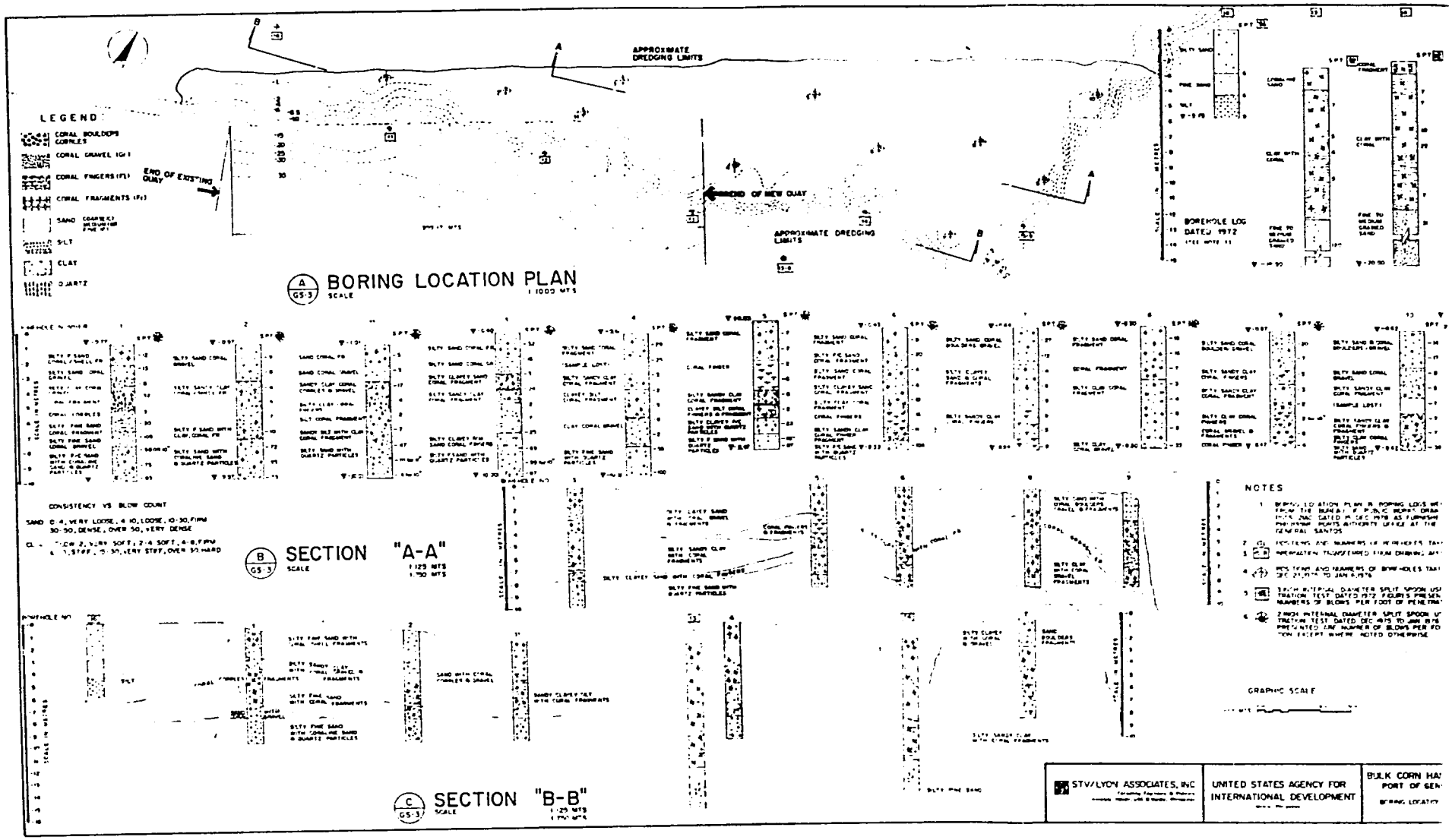
GRAPHIC SCALE

STV/LYON ASSOCIATES, INC.

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

BULK CORN HANDLING FACILITY
PORT OF GENERAL SANTOS

135



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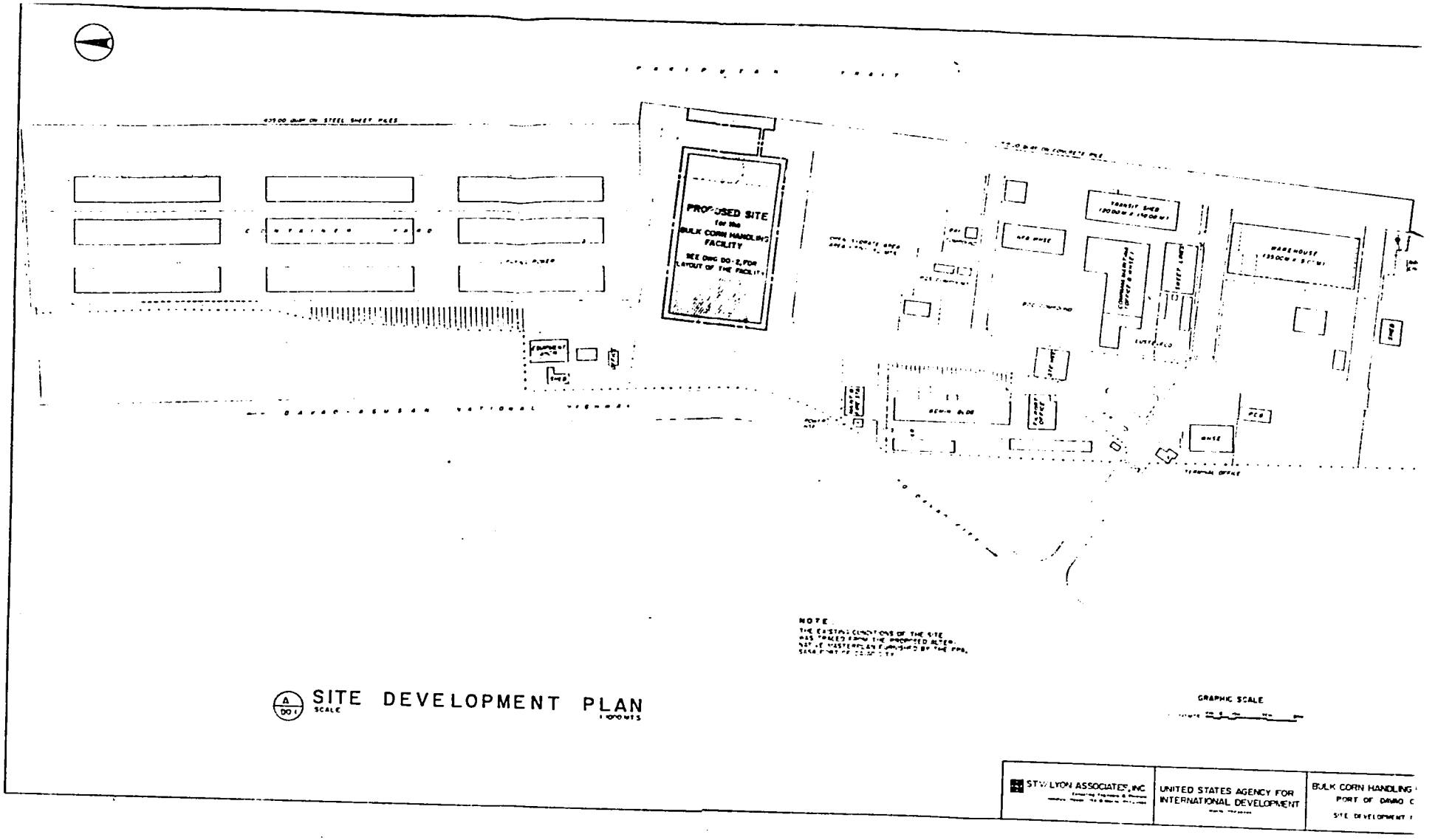

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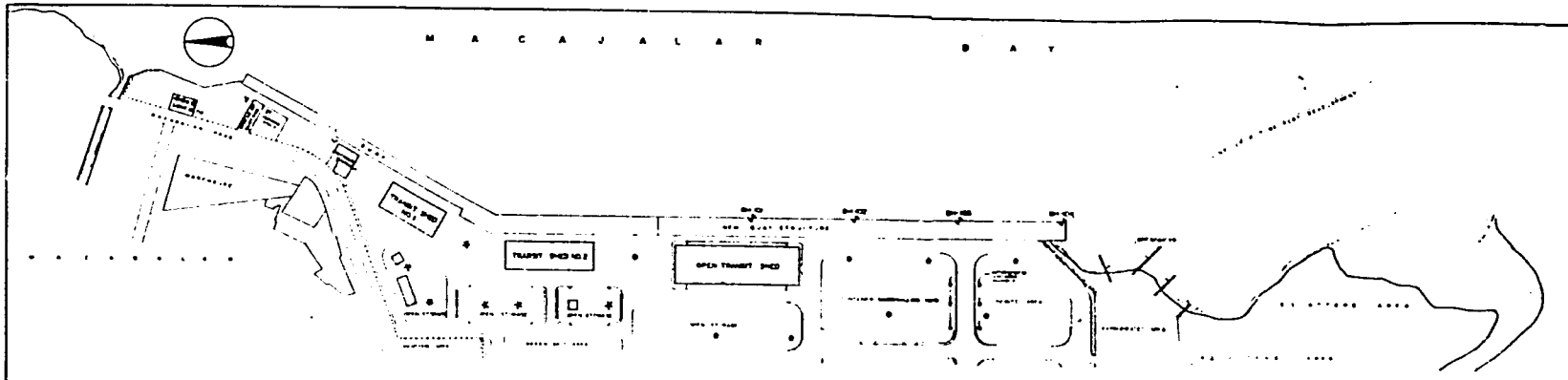
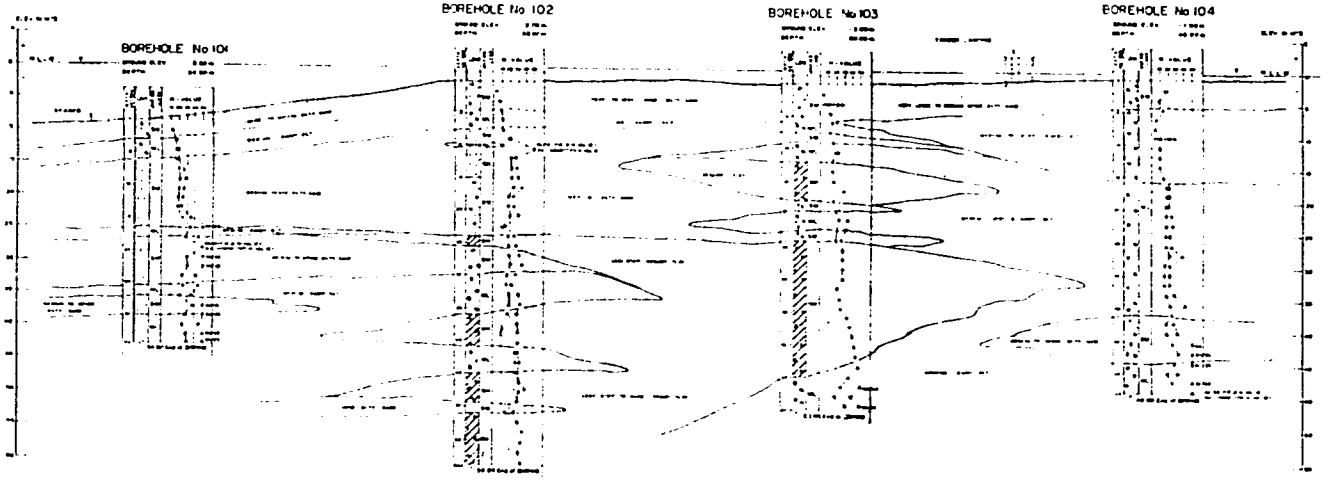


A CO-3 BORING HOLE LOCATION PLAN
SCALE 1:2000 MTS



B CO-3 SOIL PROFILE
NOT TO SCALE

LEGEND:

SM - SILTY SAND

ML - CLAYEY & SANDY SILT

OH - ORGANIC CLAY

NOTE:

BORING HOLE LOCATIONS & BORING LOGS WERE TRACED FROM THE PORTS' FEASIBILITY STUDIES AND DESIGN PROJECT, PHILIPPINE PORTS AUTHORITY, METRO MANILA DWG CO-109, FURNISHED BY THE OFFICE OF THE PHILIPPINE PORTS AUTHORITY PORTS OF CAGAYAN DE ORO

GRAPHIC SCALE

STV/LYON ASSOCIATES, INC	UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT	BULK CORN HANDLING PORT OF CAGAYAN

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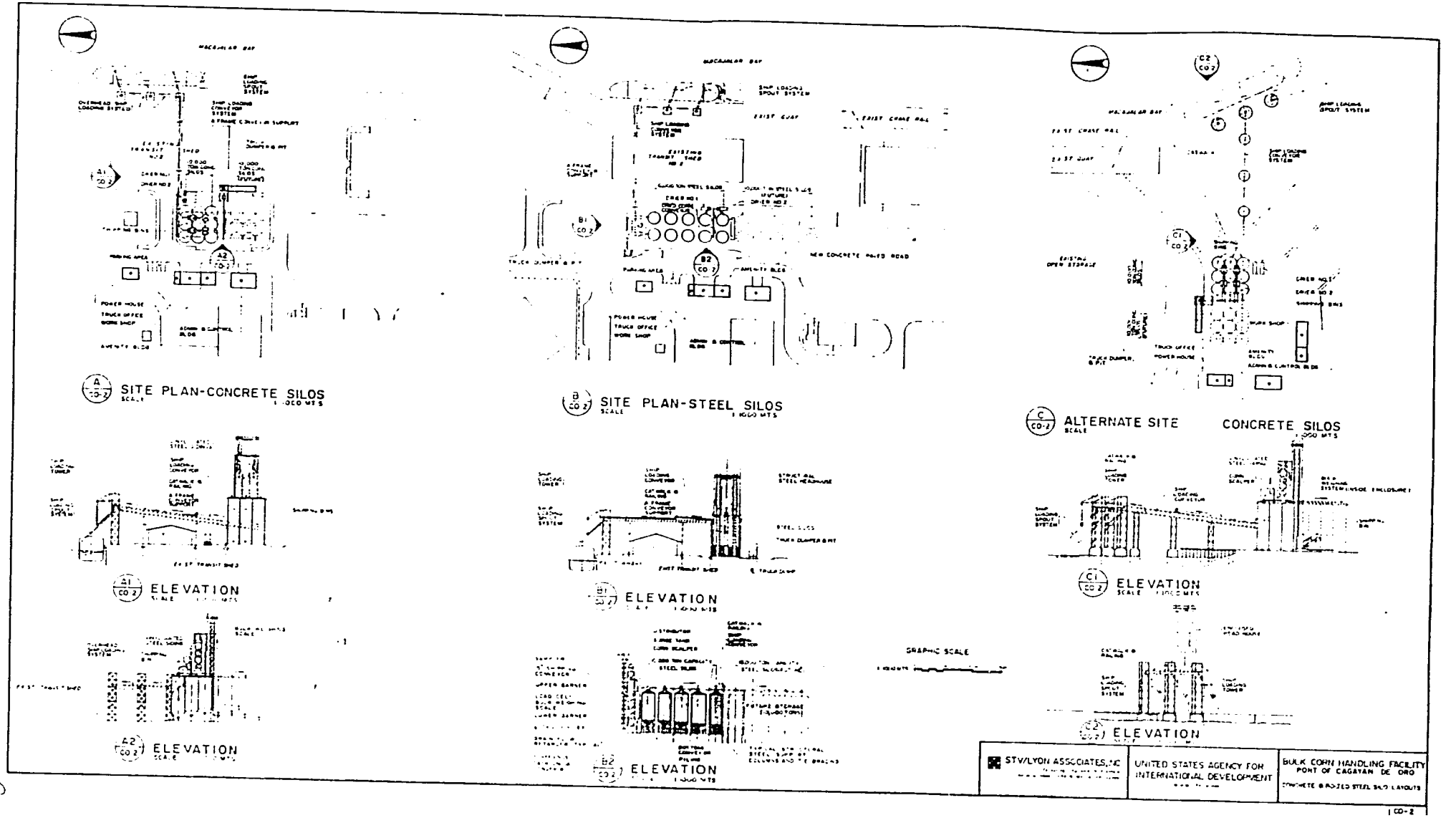

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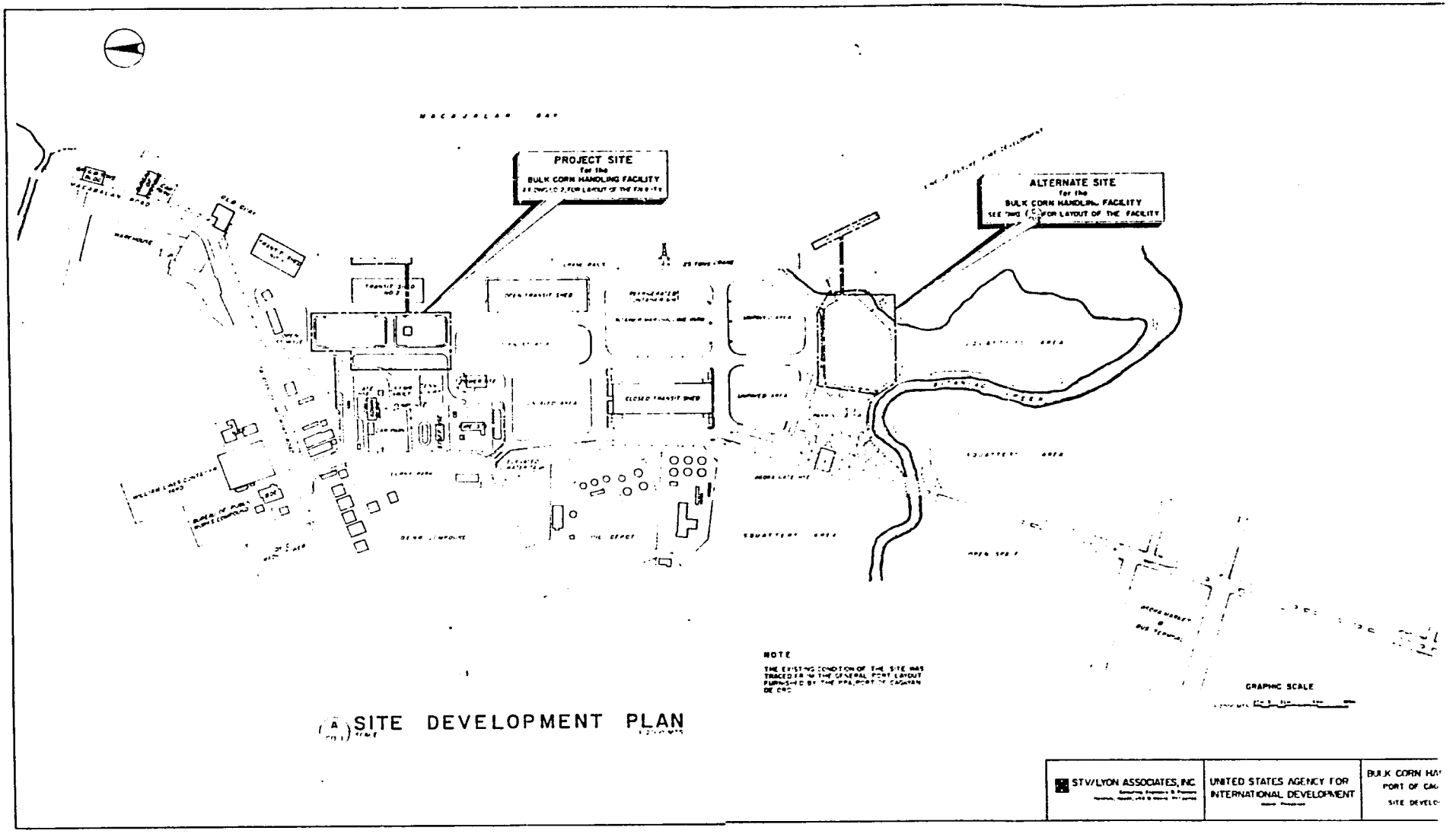

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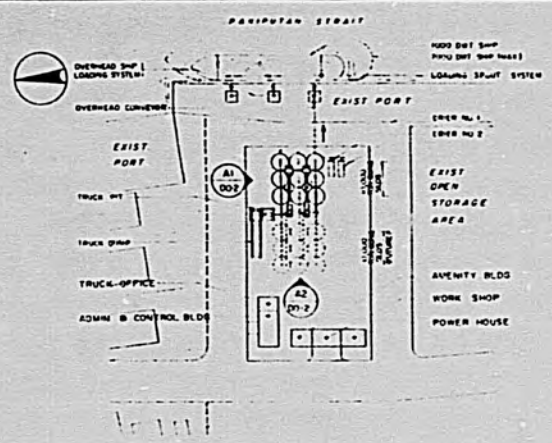
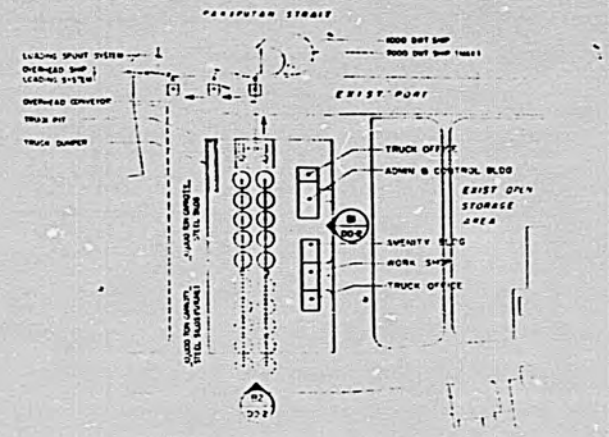
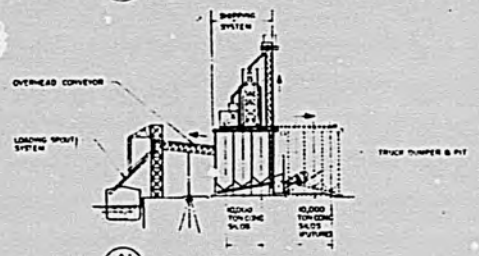


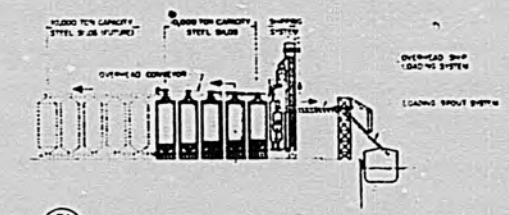
A DO-2 CONCRETE SILOS - PLAN
SCALE 1:1000 MTS



B DO-2 STEEL SILOS - PLAN
SCALE 1:1000 MTS



A1 DO-2 ELEVATION
SCALE 1:1000 MTS



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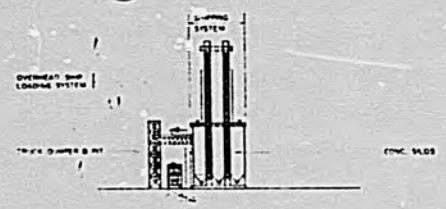
SCALE 1:1000 MTS



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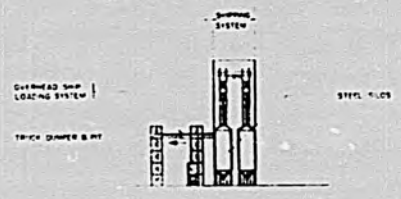

B2 DO-2 ELEVATION
SCALE 1:1000 MTS

GRAPHIC SCALE

STV/LYON ASSOCIATES, INC	UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT	BULK CORN HANDLING FA PORT OF DAVAO CIT CONCRETE & BOLTED STEEL SILO

141

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
Manila, Philippines

Magsaysay Center
Roxas Boulevard

Telephone: 521-71-16

JAN 25 1991

RECEIVED
JAN 25 1991
LYON ASSOCIATES, INC.
MANILA OFFICE

Mr. Ottis Fowler, P.E.
Executive Vice President
STV/Lyon Associates, Inc.
5th Floor, RMC Building
1680 Roxas Blvd., Manila

Dear Mr. Fowler:

Enclosed is a copy of a letter we received from Mr. Tomas C. Quintos, Manager of the Project Development Department, Philippine Ports Authority, forwarding comments on your Inception Report of the Study for the Development of Facilities to Handle Domestic Corn at the Ports of General Santos City, Davao, and Cagayan de Oro (AID Contract OTR-0000-1-00-7208-00, Delivery Order 12).

We would appreciate it very much if you would address Mr. Quintos' concern in developing your final report.

Thank you very much.

Sincerely,

Mike DeMetre

Michael C. DeMetre
Chief Engineer
Office of Capital Projects

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Republika ng Pilipinas
PANGASIWAAN NG DAUNGAN NG PILIPINAS
(PHILIPPINE PORTS AUTHORITY)
Marsman Bldg., South Harbor, Port Area
Manila, Philippines

TELEPHONE NOS. 47-92-04
40-81-66
48-24-93

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JAN 18 7 36 AM '91
USAID/C&R

16 January 1991

Mr. Leroy Purifoy
Acting Chief, Office of Capital Projects
U.S. Agency for International Development
Ramon Magsaysay Building
1680 Roxas Blvd.
Manila

Dear Mr. Purifoy:

This is with reference to the Inception Report for the "Study for the Development of Facilities to Handle Domestic Corn at the Ports of General Santos, Davao and Cagayan de Oro.

Attached are our comments which we hope the consultants should take into consideration in their study.

Very truly yours,

TOMAS C. QUINTOS, JR.
Manager, Project Development Dept.

ACTION TAKEN: Letter to STU/Lyon
Date 1-24-91

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JAN 17 1991
RECEPTION
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COMMENTS ON THE INCEPTION REPORT

A. PROJECTIONS:

1. Based on the growth rate ofcorn traffic in the ports since 1980, the assumed growth rate in the next ten (10) years at 6% appears realistic. However, there is a need to look into two (2) aspects which may dampen future traffic at the ports namely.

   a. Would the corn production in the area be able to sustain the projected traffic or would the demand for corn be able to absorb such traffic?

   b. Would the development of feed meal industries at the agro proceessing complex in General Santos City reduce bulk corn traffic.

2. A big volume of the corn grains are in bags either palletized or containerized. On the other hand, one of the findings of the consultant is the lack of vessels to transport corn in bulk. The Report does not indicate whether the lack of vessels has forced the shippers/consignees to transport their corn on bags even if the handling cost is much higher than if handled on bulk. Or the shippers may have preferred the corn in bags because the handling cost for container is cheaper. This is an important analysis to make because it will affect the viability of proposed bulk handling facilities.

B. EXISTING PORT AND SHIPPING OPERATIONS:

3. The Report does not indicate the present productivities in the handling of corn in bulk, palletized and containerized. I would assume that these information be included in the final report as it relates to the productivity of the proposed bulk handling facilities.

C. ALTERNATIVE SITES:

4. The Consultant have not identified the advantages and disadvantages of the various alternative site development plan.

5. Pending the quantification of the cost of the alternatives which together with the advantages/disadvantages will serve as an input in the decision of the site, PPA prefers the following sites:

a. Port of General Santos = Scheme C or Scheme D
b. Port of Cagayan de Oro = either Scheme A or Scheme C

6. There is a need to look deeper if a bulk handling facility for corn grain be provided at the Port of Davao.

STV/LYON ASSOCIATES, INC.

ENGINEERS, ARCHITECTS & PLANNERS.
5th FLOOR, RAMON MAGSAYSAY CENTER
1680 ROXAS BOULEVARD, ERMITA 1000
MANILA, PHILIPPINES
TEL 521-87-50 TELEX 40397 LYON PM FAX (63-2) 521-0749

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January 31, 1991

RECEIVED
FEB 01 1991
USAID.
RECEPTION
DESK

Philippine Ports Authority
Marsman Building
South Harbor, Port Area
Manila, Philippines

Attention : Tomas C. Quintos, Jr.
Manager, Project Development Dept.

Subject : "Study for the Development of Facilities to Handle Domestic Corn at the Ports of General Santos, Davao and Cagayan de Oro" - Inception Report

Dear Mr. Quintos, Jr.:

Concerning the above Inception Report, the Consultants appreciate PPA's comments on their initial study findings and observations as expressed in your January 16th letter to Leroy Purifoy of USAID. PPA's comments will be taken into consideration in the preparation of our final report.

The balance of this memorandum sets forth some of the thoughts that come to mind as we reviewed the PPA comments.

With respect to Point 1 under A. PROJECTIONS, we are, naturally, pleased that our traffic forecast is considered "realistic". Indeed, as the investigation proceeds, we have come to believe that the anticipated 6% rate of growth in bulk corn shipments is on the conservative side.

We do not feel that the traffic forecast - or the recommended bulk facilities, for that matter - will be influenced by the possible developments noted in 1.a and 1.b. Regarding 1.a, we are convinced that the potential for expanded corn production in the Mindanao areas tributary to the ports of General Santos, Cagayan de Oro and Davao goes well beyond the amount we have projected. The increasing switch to, and more effective use of, yellow hybrid varieties holds the possibility of sharply higher corn output. To cite but one statistic, present average corn yield is less than 2 mt/hectare. With existing yellow hybrids, productivity in the range 5-6 mt/hectare is an attainable target.

146 Angie 2/1/91 3:55

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Finally, with respect to 1.a, we believe that the national hog, livestock and poultry industries will continue at their present growth rates of 10% per year, thereby assuring the demand for all corn that can be produced.

Point 1.b raises the question of whether the growth of feedmill industries in General Santos will cut down on bulk shipments of corn through the three Mindanao ports. Our observations on this matter follow:

1. The possible expansion of feedmill activity in Mindanao was considered in preparing our forecast. It was one of the reasons that we consensusly arrived at a conservative 6% per year rate of growth.

2. The feedmill and livestock industry in Mindanao is not a high volume operation but is a specialty activity that supplies high quality meat at high prices. We do not expect the character of the Mindanao feedmill-livestock operations to change. Hence, any possible expansion in feedmill-livestock operations in Mindanao is expected to be quite modest and will not have an observable impact on the bulk corn traffic forecast.

3. Finally, even at the present level of corn traffic, the technique of shipping in bags exerts a restraining and depressing effect on the whole network of corn industry operations. Therefore, we wish to stress that the feasibility of the recommended bulk facilities does not require that any particular forecast level be attained. The present volume provides ample justification.

With respect to Point 2 in the PPA comments, we wish to note that we have cast the analysis of the recommended bulk facilities as one of the components in an integrated corn project. We are well aware that in addition to the improved port facilities, there must be projects to improve farmer productivity, inland transport to loading ports, improved inter-island shipping service, off-loading facilities at the receiving end, etc.

We fully agree that the lack of vessels as well as the lack of bulk handling facilities have led to uneconomic practices. Among the results of these practices are higher costs of transporting corn as well as using containers, which are best

suited to high value-low bulk commodities, for the movement of corn in bags. This, of course, is a double burden as bagged corn handicaps the entire corn sector and the use of containers for carrying corn is contrary to elementary principles of transportation. With regard to B.3, EXISTING PORT AND SHIPPING OPERATIONS, our thoughts are shown below.

The usage of containers and breakbulk carriers for inter-island transportation of corn is, as noted above, a necessity as no other corn handling system is now available. The existing low tariff for inter-island shipment of corn (imposed by the government), presently offers no inducement, for ship owners to provide an adequate number of bottoms for corn transport. However, it is the Consultant's opinion that this situation could be changed, if appropriate bulk handling facilities were provided at both ends of the operation. Ship loading production rates would be increased from the existing low of 18 tons per hour to more than 350 tons per hour, thus, allowing ship turnaround time to be reduced as much as 5 or 6 days per trip.

All corn traders interviewed concurred with our point of view about the need for changing from the present antiquated method of handling corn to a modern bulk marketing system.

Some statistical data suggest a production rate of about 53 tons per hour for bagged corn container loading. However, this figure is misleading and is based on "pre-stuffing" of containers off-site, prior to arrival at the port.

The production rate for breakbulk loading of both palletized and non-palletized bagged corn in other phases of the production and distribution process appears to be about 24 tons per hour. "Bleeder" loading of bulk corn averages between 18 to 24 T/H.

In comparison with these production rates, the proposed Bulk Corn Handling Facilities will have a designed shiploading system capable of delivering high quality "weighed" grain at a rate of more than 350 tons per hour. This advantage alone will stimulate the corn industry to increase their efficiency in other phases of the production and distribution process to the benefit of all participants. Larger bulk carrying vessels could be fully utilized for the first time, resulting in lower transportation costs and reduced in-port handling charges.

With regard to Point C., 4, 5 and 6, ALTERNATIVE SITES, we offer the following comments.

The Consultants final report will identify the advantages and disadvantages of various site locations at each selected port. In addition, the Consultants will make specific recommendations, as to type and size of each facility, based not only on costs but also on the physical compatibility requirements of the site location and, most important, the anticipated growth of future grain traffic.

Concerning the Port of Davao, the Consultants have stated in the Inception Report, under initial findings and observations, "There appears to be sufficient potential qualities of bulk corn available in each of the three ports, especially at General Santos and Cagayan de Oro, for bulk handlling consideration." This opinion has not changed.

Although the corn forecast for Davao continues to run about 50% less than that of General Santos and Cagayan de Oro, a bulk handling facility should still be considered as a viable undertaking for this port.

Respectfully yours,

STV/LYON ASSOCIATES, INC.

Richard C. Kerr

RICHARD C. KERR, P.E.
Project Manager

cc: Michael DeMetre, USAID
Leroy Purifoy, USAID

bc: Ottis Fowler
Howard Gary
Benedicto Selirio

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TERMS OF REFERENCE FOR A STUDY FOR THE DEVELOPMENT OF FACILITIES TO HANDLE DOMESTIC CORN AT THE PORTS OF GENERAL SANTOS CITY, DAVAO AND CAGAYAN DE ORO

I. OBJECTIVE

The objective is to undertake a Study to determine the feasibility for the future development of domestic corn handling facilities at the selected ports along with storage (silo), equipment for drying, grading and bagging operations and the necessary cargo handling equipment to facilitate the loading of domestic corn at the Ports of General Santos City, Davao and Cagayan de Oro. More specifically, the objectives of the Engineering Study are those listed below:

1. Based upon the estimated volume of corn shipped out of the port broken down in bulk and bagged cargo, determine the amount of corn traffic which could be handled cost effectively and efficiently by these ports annually up to the year 2000 and the constraints likely to be encountered in the efficient handling of such traffic.

2. Determine the physical bulk and bagged corn handling facilities and cargo handling equipment required at the ports and technical soundness and cost effectiveness of various alternatives in catering to the given traffic forecast up to the year 2000.

3. Identify the most cost-effective solution with particular attention to the need for additional handling facilities for the particular type of corn commodity (bulk or bagged) to be handled.

4. Propose phased investment priorities and operational improvements over the next 10 years, for optimizing the productivity of existing assets and catering to the traffic growth.

5. Prepare preliminary engineering designs and cost estimates for the facilities identified above and carry out a cost effective analysis to determine the least cost solution without jeopardizing the technical soundness and operational efficiency of the recommended cargo handling system.

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II. SCOPE OF THE ENGINEERING STUDY

1. The Study will include all investigations and analyses, unless noted otherwise, necessary for recommending a technically sound and cost effective program for the efficient and effective handling of the domestic corn traffic in the next 10 years. The Study will identify a project that applies appropriate technology and is technically sound and cost effective.

2. In carrying out the Study, the Consultants will liaise closely with officials of the Philippine Ports Authority (PPA) and major users of such a facility and draw on relevant previous studies undertaken for handling bulk commodities at the ports of General Santos City, including the Manila Grain Terminal Feasibility Studies financed by the Asian Development Bank and the Technical Development Project, grain handling studies financed by the Japan International Cooperation Agency and the Review of Manila Port Development Strategies funded by the World Bank.

3. In preparing the Study, the Consultants will examine the facilities at the three loading ports as well as at the unloading ports of Manila and Cebu. Detailed interviews will be held with private companies and public agencies involved with the domestic corn trade that are using or have potential to use the various ports.

4. The Consultants will perform the tasks outlined below:

   a. Taking into account the drying and grading facilities for corn, the method (bulk and/or bagged cargo) by which domestic corn will be shipped and the type of domestic bottoms that will be used, analyze the current cargo handling operations for domestic corn at these ports and identify areas for improving cargo handling efficiency.

   b. Carry out a reconnaissance of the existing port facilities, and warehouse equipment and develop an inventory of physical facilities, and additional equipment that will be required under various future development scenarios.

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c. Identify alternative handling systems that could be introduced in the future, such as a corn bagging and/or bulk terminal facilities, including the types of equipment, their specifications, backup space and storage facilities, dryers and grading equipment which might be required.

d. Identify locations and layout for the proposed corn handling facilities and review available relevant soil, climatological, topographical, hydrographical, hydrological, siltation and dredging and other engineering data consistent with the objectives of the Study.

e. Prepare estimates of the future volume of corn shipped out of the three ports, broken down in bulk and bagged cargo, up to the year 2000, and establish the likely destinations of such traffic.

f. Based on the foregoing, analyze alternative suitable sites for the development of bulk corn terminals and/or corn bagging, drying and grading facilities, define a broad soope of the project and prepare a series of preliminary layouts and cost estimates.

g. Establish the likely impact of each of the alternative development program or the costs of handling and shipping corn from the three ports to destinations in the Philippines.

h. Based on the foregoing, recommend a series of port improvements programs for bulk corn handling facilities, including the specific recommended equipment, the technical specifications of the equipment and the bid documents sufficient for a call for proposals in the United States and Philippines, together with cargo handling equipment for pallet loading and general ship handling assistance that is technically sound and cost effective.

III. REPORTS

The Consultants are required to submit the reports listed below:

1. An Inception Report outlining the detailed work program and proposed methodology for the Study, including the data to be used and their sources, after completion of 30 days of field work. (To USAID 15 copies).

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2. A Draft Final Report giving the results of the Study within three months of starting work. The Draft Final Report will identify a development program for the efficient and effective handling of bulk domestic corn in the Ports of General Santos, Davao and Cagayan de Oro. In addition, the Report shall demonstrate that the proposed investment priorities utilize appropriate technology, is technically sound and cost effective. (To USAID 15 copies).

3. A Final Report incorporating the comments on the Draft Final Report within thirty (30) days of receipt of such comments. (To USAID 15 copies).