Document of

The World Bank

FOR OFFICIAL USE ONLY

Report No. 3815-CHA

STAFF APPRAISAL REPORT

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

May 26, 1982

Projects Department
East Asia and Pacific Regional Office

CURRENCY EQUIVALENTS

Currency Unit - Yuan (Y)

US$1.00 = Y 1.7 (October 1981)
Y 1.00 = US$0.59

WEIGHTS AND MEASURES (METRIC SYSTEM)

1 meter (m)	=	3.28 feet (ft)
1 kilometer (km)	=	0.62 miles
1 hectare (ha)	=	2.47 acres
1 million cubic meters	=	810 acre-feet
1 ton	=	1,000 kilograms (kg)
	=	2,205 pounds
1 kilogram (kg)	=	2.2 pounds

ABBREVIATIONS

ABC - Agricultural Bank of China
CAAS - Chinese Academy of Agricultural Sciences
MCM - Million Cubic Meters
MOA - Ministry of Agriculture
MWC - Ministry of Water Conservancy
PMO - Project Management Office

FISCAL YEAR

January 1 - December 31

CHINA

APPRAISAL OF THE NORTH CHINA PLAIN AGRICULTURE PROJECT

Table of Contents

This report is based on the findings of an appraisal mission to China in October 1981. Mission members included W.P. Ting (Mission Leader), S.J. Khoo and V. Li (IDA) and C. Houston and T.B. Wiens (Consultants).

LIST OF TABLES IN THE MAIN TEXT

ANNEXES

LIST OF FIGURES

MAP

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

1. BACKGROUND

Introduction

1.01 The project would be the first integrated large-scale attack on soil salinity and waterlogging in China. It would serve as a model for future agricultural developments in the North China Plain where crop production is affected by salinity and waterlogging. The project would provide drainage and irrigation for about 200,000 ha, covering parts of nine counties, and would also include agricultural inputs and support services to increase productivity. A population of over 1.2 million, or about 280,000 farm families, would benefit directly from the project through increased production of crops such as wheat, corn, cotton, oilseeds, rice, and earnings from tree planting. The project would also lead to annual foreign exchange savings of about US$70 million.

1.02 This report is based on the findings of a preparation mission which visited China in November 1980 comprising W.T. Smith, T. Daves, R.C.Y. Ng, W.P. Ting (IDA), M. Fireman, and K. Anderson (Consultants); a preappraisal mission in May/June 1981, comprising W.P. Ting, S.J. Khoo, V. Li (IDA), K. Anderson, J.K. Wang and T.B. Wiens (Consultants); and an appraisal mission in October 1981 comprising W.P. Ting, S.J. Khoo, V. Li (IDA), C. Houston, and T.B. Wiens (Consultants).

The Agriculture Sector /1

1.03 Agriculture, including livestock, forestry and fisheries is one of the most important economic sectors in China. It provides sustenance to nearly 1 billion people and is the main source of livelihood for a rural population of some 800 million, and accounts for over 30% of the country's GDP. Agricultural production is carried out by farmers organized into collective units under the commune system and on state farms. Part of the production also comes from privately-controlled household plots.

1.04 Agriculture in China is dominated by foodgrain production, which accounts for some 65% of total agricultural output, and 80% of its cropland.

/1 For more details on China's agriculture sector, see China: Socialist Economic Development, Annex C: Agricultural Development, Report No. 3391-CHA.

Despite the country's vast land area of about 960 million ha, only about 10.4% or 100 million ha are arable. The ratio of population to ha of arable land is just under 10. Thus farming is intensive, with very high inputs of labor, extensive use of chemical and organic fertilizers, and considerable development of irrigation and drainage. Just under half of the arable land is irrigated. China accounts for less than 8% of the world's arable land but provides food for about 22% of the world's population. This has been made possible because of the generally high standards of crop production.

1.05 Foodgrains. The major foodgrains are rice, maize and wheat, which accounted for about 45%, 18% and 17% respectively of total foodgrain production during 1977-79. Soybean, sorghum and millet, which are foodgrains of lesser importance, together accounted for about 7% of total foodgrain output. Foodgrain production during the 1970s increased at an average of more than 3% p.a. from 240 million tons in 1970 to 332 million tons in 1979. The increase resulted mainly from changes in the cropping pattern in favor of the foodgrains which have relatively higher yields, the significant expansion of pump irrigation in the Chang Jiang Basin and North China Plain, and increased use of chemical fertilizers. Foodgrain production was further boosted in 1978 and 1979 by policy changes which provided increased incentives for producers (para. 1.27) and favorable weather conditions, so that output in those years increased by an average annual rate of over 8%. However, production in 1980 declined to 318 million tons from the record 1979 crop of 332 million tons due to poor weather conditions. In recent years, gains in food output have not kept pace with the increase in demand due to growth in population and incomes and increased feedgrain requirements for livestock. The country imported 10.5 million tons of foodgrains in 1979 (1.2 million tons over 1978) or about 3% of total consumption. Grain agreements with major supplier countries indicate that grain imports will range from 12-16 million tons for the next few years.

1.06 Oilseeds. Among the more important oilseeds in China are groundnuts, rapeseed, sesame seed, sunflower seed, and linseed./1 The area sown to oilseeds increased from 4.5 million ha in 1970 to 8.0 million ha in 1980 and production increased from 3.8 to 7.7 million tons during the period. Despite this growth, China imported 0.8 million tons of oilseeds in 1979 and levels of per capita oil availability remain low relative to requirements.

1.07 Cash Crops. These crops include cotton, jute, sugarcane, tea, mulberry (for sericulture), fruits, vegetables and tobacco. Cotton, the most important, accounted for 4.9 million ha or 38% of the area sown to cash crops in 1980. The 1980 crop of 2.7 million tons of lint was a new record. However, production has been insufficient to meet domestic demand as reflected in the increasing levels of cotton imports in recent years. Imports in 1979

/1 Soybeans in China are not included among the oil-bearing crops but among foodgrains.

amounted to 480,000 tons. China is now the world's largest importer of cotton.

1.08 Livestock. Animal husbandry accounts for about 13% of the value of agricultural output. Meat production, largely pork, increased by about 16% p.a. in 1977-80, compared with 3.4% p.a. in 1957-77. Reasons for the rapid increase were higher feedgrain allocations and improved producer incentives. The country's livestock production is dominated by pigs and poultry reared in private plots under intensive systems, integrated with crop production and concentrated in regions with dense population and easy access to markets. With 320 million head in 1979, the country's pig population is the largest in the world. Other livestock includes sheep, goats, cattle and camels, which are found largely on the extensive grasslands in the north and western border regions.

1.09 Fisheries. Total fisheries production increased from 3.2 million tons in 1970 to 4.3 million tons in 1979 or about 3% p.a. Production in recent years, however, has declined, due to a decrease in capture fishery production. Marine fisheries accounted for about 76% and inland fisheries 24% of total production during 1977-79. About three-fourths of the production from inland waters is derived from the culture of fisheries in ponds. This kind of fish culture has a long tradition in China and has developed as an integral part of the farming system.

1.10 Forestry. The forest cover in China increased from 8.6% of the total land area in the early 1950s, to 12.7% at present, or about 120 million ha, located mainly in the northeastern and southwestern parts of the country. So far 28 million ha have been afforested. However, prime timber areas are exploited more rapidly than regrowth occurs. Timber output in 1979 totalled 54 million cu m, compared with 5 million cu m in the early 1950s. Annual fuel-wood utilization amounts to 120 million cu m, roughly two thirds of which is collected by the people. Wood still serves as an important energy source and timber products generally are in short supply.

1.11 Marketing and Pricing. The Government controls the marketing and pricing of agricultural products and inputs . It fixes production quotas for the major crops: grains, oilseeds, cotton and sugar, which are purchased and distributed by state-managed procurement agencies at pre-determined prices. A portion of the production in excess of the quotas, amounts of which are determined before each harvest according to projected yields, are sold to the Government at above-quota prices which are also pre-determined. The rest of the surplus production can be sold to the Government at negotiated prices or on the free market. Production quotas are also established for a range of cash crops and livestock products. Minor crops, such as vegetables and other products produced in household plots, are sold in rural markets at prices regulated either by the provinces or counties. This marketing and pricing system has been broadly maintained since the 1950s, although the importance and scope of free markets have varied over time. Policy reforms since 1976 have expanded the operation of free markets.

The two most important marketing agencies for agriculture are the Ministry of Food, which procures and distributes grain and oilseed crops, and the All China Federation of Supply and Marketing Cooperatives, which purchases most cash crops and distributes some agricultural inputs and tools, as well as consumer goods, in the rural areas. Some products, such as sugar, rubber and pigs for slaughter, are purchased by specialized branches of the Ministry of Commerce.

Irrigated Agriculture

1.12 Major efforts to develop China's land and water resources were begun in the 1950s and were the main focus of rural investment during that decade. Huge projects for flood control, drainage and irrigation employing hundreds of thousands of workers were undertaken on the North China Plain and in other areas. Since 1949, protection from flooding along the major rivers, especially the Yellow River, has been greatly improved. The Ministry of Water Conservancy estimates that nearly a third of the arable land amounting to some 32 million ha of formerly flood-prone lands are now protected by dikes.

1.13 Since 1949 some 86,000 reservoirs have been constructed, with a total storage capacity estimated at about 400 billion cu m. The large reservoirs (320) are used for multiple purposes, flood protection, irrigation and hydropower, while medium-size (2,200) and small facilities (more than 80,000) are usually constructed for irrigation. Individual storage capacities of the large reservoirs exceed 100 million cu m and those of the medium size facilities range from 10-100 million cu m. Total irrigation development is now estimated at some 45 million ha versus about 16 million ha in 1949. This represents some 45% of the total arable area, in contrast to an estimated 17% for other developing countries. About 30 million ha are irrigated by pumping, of which some 11 million ha are irrigated by 2.1 million tubewells, 80% of them in northern China.

Support Services

1.14 Agricultural Research and Extension. The Chinese Academy of Agricultural Sciences (CAAS) is the principal organization for agricultural research work. Subordinate to the Ministry of Agriculture, it has responsibilities for a network of national research institutes and for technical oversight and coordination of provincial research programs. Currently, there are some 31 national research institutes in this Academy, focussing mainly on applied research. Each province also has a local research network with a provincial academy of agriculture as the lead institution. Below the provincial level are prefecture and county-level institutes which have programs of research, demonstration and extension. Other agriculture-related ministries or specialized agencies, including those responsible for forestry, fisheries and irrigation, also sponsor and coordinate research work. Considerable success has been achieved in developing improved rice, wheat and maize varieties that are high yielding, early maturing and resistant to major diseases. The Chinese have also developed and planted on some 5.9 million ha, a hybrid rice that gives 20-30% higher yields than conventional varieties.

1.15 The importance of close coordination between research work and extension activities was recognized early in China. The linkages were further reinforced in recent years, giving rise to a seven-level research and extension network. The three higher levels -- national, provincial and prefectural -are operated by the central and provincial governments and are concerned mostly with research; the four lower levels -- county, commune, brigade and team -- deal mainly with the demonstration and popularization of improved technologies and techniques, training and other extension-related activities. Linkages are maintained through regular meetings of technical staff at different levels, staff exchanges between scientists and skilled farmers, and through bases established by research institutes at the commune and brigade levels. However, the numbers of qualified staff, especially at the middle and senior levels, are severely limited and facilities and equipment are generally lacking. These problems stem from the disruption of scientific research and training during the Cultural Revolution. The authorities are now re-establishing the education system to increase the number of technicians, but with many extension workers near or past normal retirement age, the build-up will take several years to accomplish. A Bank Group-supported project is being prepared to strengthen education and research in the agricultural sciences by providing facilities and technical assistance for selected agricultural colleges and research institutes.

1.16 Training. Responsibility for the management of agricultural education is vested in both the Ministry of Education and ministries responsible for agriculture, water conservancy, forestry, etc. The Ministry of Agriculture is responsible for most of the educational facilities; it supervises seven colleges at the national level and 38 institutions at the provincial level. The Ministry also supports 214 senior secondary schools for agriculture. The agricultural education system is still recovering from the long period of closure and anti-professional bias of the Cultural Revolution. The first graduates from the newly re-established education system will be available in 1982, and a scheme of post-graduate education has only recently been formulated. Critical shortages of staff exist at all levels. This problem is being addressed by a Bank Group-financed project (Ln/Cr-2021/1167) which would strengthen higher education by helping to increase the output and quality of education and research in the disciplines of science and engineering.

1.17 Seed Production. A comprehensive system has been developed for producing seed, especially for cereals. Breeder seeds from colleges, academies, counties or research stations are multiplied by county-managed seed farms. Some communes also operate their own seed breeding and multiplication farms. The seed farms are responsible for purification, storage and testing of seeds. Stock seeds produced by these farms are sold to seed companies for the multiplication of certified seeds. The system is now suffering from poor management and lack of proper drying, processing and storage facilities. The technical supervision given to the collectives responsible for seed multiplication is inadequate, resulting in the production of inferior seeds. The central government has recently embarked on a program to improve the facilities, management and quality control in the production of certified seeds.

1.18 Agrochemicals. Chinese agriculture has long depended on organic fertilizer, particularly pig manure, as the main source of plant nutrients. Chemical fertilizer has also grown in importance and its production reached 52 million tons (gross weight) in 1979, a 24% increase over the level in 1978 and almost double that of 1976. Annual application of chemical fertilizer exceeds 125 kg (nutrient weight), a level more than twice that for all developing countries. Nitrogenous fertilizer accounts for 80% of total production, followed by phosphate (19%) and potassium (1%). The production of the latter nutrients is inadequate and with limited imports, there is a considerable shortage of phosphatic and to a lesser extent, potassic fertilizer. Studies based on soil analysis show that phosphate may now be one of the major limiting factors in increasing crop yields in some of the areas in southern China, where use of chemical nitrogen is heavy.

1.19 To reduce crop losses (estimated at 5-20% in China) due to pests, pesticide application rates have grown rapidly since the mid-1950s. Total production of pesticides in 1979 was 522,000 tons, with insecticides making up the bulk. In the past, more than 120 individual compounds were produced commercially, including some organochlorines like DDT and BHC, which have been banned in many countries. The Government is aware of the problems associated with the use of organochlorines and is shifting to organophosphates, carbamates and other safer pesticides. Fungicides are also widely used for seed treatment and control of foliar diseases. Significant quantities of modern pesticides are imported.

1.20 Agricultural Credit. The Agricultural Bank of China (ABC) is responsible for the provision of credit for agriculture and rural development in China. Established in 1951, the Bank has operated as a separate institution only during 1955-57, 1963-65, and from March 1979 onwards. In the intervening years, rural credit operations were handled by the People's Bank of China, the country's central bank. The ABC continues to be under the overall supervision and jurisdiction of the People's Bank. At the end of 1980 it had a head office in Beijing, 27 branch offices-one in each of the provinces and the three municipalities of Beijing, Tianjin, and Shanghai, 374 central subbranch offices in the prefectures, 2,211 subbranch offices in the counties, 24,803 offices in the communes and 403 offices in the state farms. The bank's work, especially the loan and deposit operations, is complemented by some 59,000 local credit cooperatives organized at state farms and at the commune and brigade levels. Although they are separate entities, the credit cooperatives in practice function as the smallest operating units of the bank. They play a major role in the bank's credit operations at the commune and lower levels. The cooperatives act as the bank's agents in channelling short-term and small loans to farmers and the collectives. The larger and longer-term loans are provided directly by the bank.

1.21 In conjunction with the central and local governments, the ABC exercises general responsibility for the planning, allocation and distribution of credit funds, including Government grants and subsidies, for agriculture and related activities. The subsidies and grants are provided

through the bank to the collectives, mainly communes, in support of investments which the Government considers are of high priority. Major recipients of the bank's credit funds are individual farmers, collectives, state farms and certain state-owned enterprises which supply agricultural inputs and procure or process farm products. The bank also promotes, and provides a channel for rural savings as well as banking services, and supervises the management and operations of the credit cooperatives. It had an outstanding loan portfolio of Y 47.6 billion at the end of 1980. About three quarters of the loans are short-term (less than one year) and the remaining medium-term (mostly 1-5 years). The present interest rate charged for short-term loans, mainly for production credit and working capital, is 0.48% per month (5.76% p.a.). Longer-term loans, mainly for agricultural equipment and machinery, are charged at the preferential rate of 4.32% p.a. These interest rates reflect an upward adjustment of about a third in early 1982. A small element in the loan portfolio consists of relief loans at zero interest.

Past Developments

1.22 When the People's Republic was founded in 1949, the agriculture sector was suffering from severe dislocations associated with decades of warfare and civil disturbance. Destruction and deterioration of economic infrastructure were widespread and the institutional framework for production, marketing and technical services was in near total disarray. As a first task in agricultural development, efforts were made to reconstruct the economic infrastructure and restore the institutional framework. Despite limited capital and technical resources, recovery was rapid and pre-war levels of production were attained by 1952/53. Development efforts during the First Five-Year Plan period (1953-57), which concentrated largely on land development and irrigation facilities, raised agricultural production to new record levels. However, production during the next several years was adversely affected by bad weather and the disruptions of the Great Leap Forward movement to an extent that crop output did not recover to 1957/58 levels until about 1964.

1.23 Several measures were taken during the 1960s to revive agricultural production: raising of procurement prices, intensification of research and expansion of input supplies to producer goods industries to increase the production of chemical fertilizer, tractors, irrigation pumps and other equipment. The research effort resulted in the development of many new and improved high-yielding varieties, especially rice and wheat.

1.24 During 1966-76, achieving self-sufficiency in foodgrain production was the focus of agricultural policies. However, progress was slow because of the effects of the Cultural Revolution, which disrupted production and scientific research and training. Cotton and oilseeds production was depressed, and grain output fell short of the full potential. Although there were substantial increases in the availability of such modern inputs as agricultural machinery, irrigation and chemical fertilizers, the growth of agricultural production during the period was only 2.9% p.a., slightly below the long-term trend.

1.25 Since 1977 a number of policy changes have been introduced that are aimed at boosting agricultural production. These have included improved producer incentives, greater autonomy to the collectives and state farms in production and planning decisions and expansion of private plots. These changes, coupled with a large increase in the supply of chemical fertilizer, and favorable weather conditions in 1978-79, resulted in a growth of more than 8% p.a. in agricultural output over these two years. Cash crop production (cotton, oilseeds) recovered sharply and growth of animal husbandry was also rapid. Agricultural ouput in 1980 was checked by poor weather conditions. However an increase in cash crop and meat production helped raise overall agricultural output by 2.7%, so that the average growth (plus sideline industries) over the three-year period 1978-80 was 6.7% p.a.

Development Plan for the 1980s

1.26 The development of agriculture has been accorded high priority by the Government as reflected in its post-1978 statements on economic policy. Thus, the share of agriculture in the state capital construction budget, the source of financing for large schemes and investments, is planned to increase from 14% in 1979 to 18% during 1980-82. Funding for agricultural support services, including research and extension, would also increase from 6.3% to 8% of total plan expenditures during the same period, while annual credit for agriculture is planned to increase from Y 13 billion in 1978 to about Y 26 billion by 1985.

1.27 The basic long-term objective for the agricultural sector is to increase the production of food crops and economic (industrial) crops to meet requirements created by population and income growth. Achievement of this objective will help realize other sector goals of expanding rural employment and minimizing the use of foreign exchange for food and fiber imports. In land-scarce China, attainment of the production objective requires increased productivity from existing cropped areas. Improved incentives to producers are essential in this regard and have been at the heart of recent policy reforms. These incentives include: (a) encouragement of household agricultural activities and individual enterprises through expanding the area of private plots, lifting restrictions on free markets, and widening the range of commodities for local trade; (b) encouragement of larger allocations to individuals out of the collective income; and (c) creation of subcontracting systems within collective agriculture and state farms which permit small production groups or households to retain production in excess of some agreed norm. By increasing yields of food crops and cotton on already-cropped lands, the proposed project would contribute to achievement of Government's objectives for the agricultural sector. The recently improved incentives for producers are expected to contribute to the successful implementation of the project.

Project Formulation

1.28 The Government estimates that some 6 million ha of land in the North China Plain are affected by varying degrees of salinity and waterlogging.

The soils in this area are basically good and, where adequate irrigation and drainage have been provided, crop yields are high. Because of the land constraint in China, the Government objectives are to raise yields on these saline areas as well as reclaim large tracts of saline wasteland. With improved drainage and irrigation, the potential of these lands for increased production is considerable

1.29 Despite considerable progress in water resource development, large areas of the North China Plain still suffer from waterlogging, salinity, and drought. Waterlogging is a condition in which the water table rises so high that it saturates the root zone and damages the crop. It can arise in a variety of situations: in poorly drained, low-lying land; in areas where irrigation has been introduced without adequate drainage; or where the natural drainage systems are impeded by flood embankments, roads, etc. Water tables tend to rise in the rainy season and fall in the dry season and, in the absence of irrigation and drainage, crops can suffer from drought for much of the year and can then be damaged by waterlogging when it rains. Soil salinity occurs, or pre-existing soil salinity is worsened, where a high water table prevents downward percolation and water-borne salts become concentrated in the soil through evaporation. The Government estimates that some 6 million ha of land in the North China Plain are affected in varying degrees by salinity and waterlogging. With irrigation and drainage, these lands can be reclaimed and become highly productive for a wide range of crops.

1.30 The nine counties included in the project were chosen primarily because each one has a large pilot project where irrigation and drainage techniques have been tested to form a basis for large-scale developments. Each county also has a well designed and maintained main drainage system capable of disposing of runoff from the drains in the project areas. Six of the nine counties have waterlogging and salinity problems. The other three counties suffer from widespread waterlogging and drought but soil salinity is not present. The project also includes areas in danger of becoming saline because of inadequate drainage, especially the lateral and sublateral drains needed to carry runoff to the main drains and control the water table.

1.31 The project was prepared by the engineering and agricultural staff in the counties with help from the provincial Land Utilization Bureaus, the Chinese Academy of Agricultural Sciences, and the Land Utilization Bureau of the Ministry of Agriculture. Preparation of the project began in August 1980, and each county prepared detailed project proposals consisting of thematic maps together with detailed quantity and cost estimates. The proposals put forward by the counties included some longstanding plans for river improvement, enlargement of main drains and drainage pumping stations. The proposals for water table control and irrigation systems are based on recent experience in the pilot projects. The depth and spacing of drains and the number and depth of tubewells will vary from place to place according to soil types, the severity of salinity and waterlogging, and aquifer characteristics.

1.32 The proposals were reviewed by a Bank mission in October/November 1980. This mission found the basic concept of the proposed project sound and there was ample evidence of the capability of the counties to implement the project. The mission recommended, however, that the counties and central government agencies develop a consistent set of design criteria for drainage systems, and this was noted by the Government. The Government subsequently revised the project proposal by increasing the number of counties from five to nine. The total project area, was reduced to concentrate on land where the need for salinity control and drainage is most urgent.

1.33 In addition to the construction of drainage and irrigation works, the project would include components designed to enhance the project contribution to land and water development in the North China Plain. A comprehensive soil and water studies would be carried out in each of the project areas to observe the project's impact on soils, water tables, water quality etc. The studies should produce results of value to the future operation of the project and the planning of future projects. At the same time a program to monitor and evaluate the project's agricultural, economic and social effects would be carried out. The project also includes the North China Plain Agricultural Study. The objectives of the study would be to identify the main constraints to higher crop production in selected areas of the North China Plain; to formulate agricultural development plans to overcome these constraints; and to identify and prepare future agricultural projects. Lessons may also be learned which are applicable to the land areas which are already irrigated in the North China Plain.

2. THE PROJECT AREAS

Location

2.01 The project would be located in nine counties: Qihe, Lingxian and Yucheng counties in Shandong province north of the Yellow River, Guoyang, Suixi and Mengcheng (Anhui Province) and Shangqiu, Ningling and Minquan (Henan Province), all south of the Yellow River (see Map IBRD 16135). Lingxian, 300 km southeast of Beijing is the nearest to the capital and Mengcheng, 860 km to the south is the furthest. The project has a cultivable area of about 200,000 ha of which approximately 178,000 ha are presently cultivated. Further details of areas, population, etc., are shown in Table 2.1.

Climate

2.02 About 90% of the rain falls in the period from the end of April through the end of October, and only light snow falls in the winter months. Some 65% of the rain falls in July, August and September mostly in the form of intense storms which cause widespread flooding. Damaging droughts occur nearly every year. Temperatures range from 40°C in the summer to -20°C in the winter. The number of frost-free days ranges from 200 to 220. Climate data (annual means) are summarized in Table 2.2.

Table 2.1: COUNTY AND PROJECT AREA DATA

	Shandong Province			Anhui Province			Henan Province			
	Lingxian	Yucheng	Qihe	Mengcheng	Guoyang	Suixi	Shangqiu	Ningling	Minquan	Total
County Data										
Total area ('000 ha)	140	98	155	206	202	237	152	79	120	1,389
Cultivable area ('000 ha)	101	73	104	128	154	175	101	51	73	959
Population ('000)	528	423	582	830	955	887	842	429	583	6,060
No. of communes	24	19	24	49	71	63	27	18	17	312
No. of production brigades	1,127	951	1,067	507	682	511	532	302	423	6,102
Project Area Data										
Total area ('000 ha)	40	47	54	25	23	21	38	19	30	297
Cultivable area ('000 ha)	29	35	36	13	17	16	25	14	13	198
Population ('000)	135	168	204	81	102	68	187	107	99	1,151
No. of communes	11	18	11	9	8	11	7	6	4	85
No. of production brigades	292	444	382	79	80	60	129	82	86	1,634
1979										
Cultivated area ('000 ha)	25	31	34	13	15	13	24	13	11	179
Irrigated area ('000 ha)	11	6	22	5	6	3	9	5	4	71
from surface water	9	3	14	4	4	1	0	0	0	35
from groundwater	2	3	8	1	2	2	9	5	4	36
Planted area ('000 ha)	28	38	53	20	22	19	34	17	15	246
No. of wells	1,250	1,200	1,480	700	920	980	2,370	1,010	1,490	11,400

Table 2.2: CLIMATE IN THE NINE COUNTIES (Annual means)

	Shandong Province			Anhui Province			Henan Province		
	Lingxian	Yucheng	Qihe	Mengcheng	Guoyang	Suixi	Shangqiu	Ningling	Minquan
Rainfall (mm)	632	621	636	882	830	863	697	659	650
Evaporation (mm) (60 cm pan)	1,412	1,379	1,292	1,225	1,156	1,175	1,191	1,137	1,404
Sunshine hours	2,643	2,557	2,560	2,340	2,338	2,326	2,412	2,219	2,365
Frost-free days	212	214	219	213	213	202	203	216	220

Soils and Topography

2.03 The soils of Qihe, Lingxian, Yucheng, Ningling, Minquan and Shangqiu are mostly coarse to medium-grained silty loams which, when provided with adequate surface drainage, are well suited to wheat, maize and cotton, the main field crops grown in these counties. The project area covers about 150,000 ha of cultivable land in these six counties. About 94,000 ha are affected in varying degrees by salinity, of which about 19,000 ha are uncultivated and much of the remaining 56,000 ha are severely affected by drought and poor drainage.

2.04 The soils of Suixi, Guoyang and Mengcheng counties, known as "shajiang" black soils, are very heavy clays with low to very low permeability. The project areas covering nearly 50,000 ha are subject to waterlogging particularly in low-lying areas where the drainage systems are inadequate. The soils are calcareous throughout with small lime and iron manganese concretions, evidence of a long-term waterlogged condition. The soils are not saline and with adequate drainage can support a wide range of crops, but are probably best suited to rice. Irrigation is also needed to protect the crops from droughts which occur almost every year.

2.05 The project areas are between 20 and 45 meters above sea level with slopes ranging between 1:5,000 and 1:10,000. To the eye the land appears flat with very little relief. However, small differences in elevation can lead to significant differences in land capability. Higher areas generally tend to be free from salinity, whereas low areas commonly suffer from salinity and waterlogging and are subject to crop damage from surface flooding.

Population, Farm Size and Land Tenure

2.06 Farm families account for about 98% of the project area's population of 1,151,000. The average size of cultivated land per farm family is about 0.6 ha. There are 85 communes in the project area which are further subdivided into 1,634 production brigades. Each production brigade comprises on the average 8-15 production teams which are made up of 20-50 families, often the inhabitants of a natural village.

Present Status of Irrigation and Drainage

2.07 Of the 200,000 ha of cultivable land in the project area, about 71,000 ha are presently irrigated; 35,000 ha from surface water and 36,000 from groundwater. Lingxian, Yucheng and Qihe counties are within the areas served by major canal systems supplied through intakes along the left bank of the Yellow River. Mengcheng, Guoyang and Suixi counties are supplied by canals taking off from the Huai River. Shangqiu, Ningling and Minquan counties are supplied by water from wells.

2.08 Channel improvement has been carried out on virtually all of the rivers and streams in the project areas. Rivers have been straightened and deepened, and flood dikes have been constructed. During the flood season river levels are generally above the surrounding ground level and, therefore, large pumping stations have been built to dispose of surface runoff into the rivers. The works are, however, incapable of handling floods over a 1 to 3-year frequency. An important aim of the project would, therefore, be to increase the capacity of the main drainage system. Laterals and sub-laterals have also been constructed in parts of the project area, but they are mostly too widely spaced and too shallow to be fully effective either for surface drainage or for lowering the water table. The project would include deepening the existing lateral/sublateral drains and using them for water table control as well as surface drainage.

Groundwater

2.09 The project areas are underlain by thick sequences of quaternary and recent alluvium consisting of alternating and interfingered layers of clay, silt, and fine sand with occasional coarse sand to fine gravel. Exploratory wells show a thickness of alluvium of at least 400 meters but similar deposits probably continue to considerably greater depths. The principal aquifers are the layer of fine sand interbedded with less permeable layers of silt and clay. In a typical well 50 m deep, there may be two or three layers of sand with a total thickness of 10 to 25 m. Some individual sand layers are as much as 20 m thick; particle sizes are generally from 0.05 to 0.5 mm. The aquifers, although fine-grained, are very permeable with individual wells furnishing from 30 to more than 100 cu m/hr and with specific capacities typically 5 to 15 cu m/hr/m. The quality of groundwater is suitable for irrigation over most of the project areas with total mineralization generally less than 1000 mg/l. Typically the cations are nearly equal parts of sodium, calcium, and magnesium and the dominant anion is bicarbonate. In the Lingxian and Yucheng areas there are some localities underlain by brackish to saline groundwater which would in the future be served by surface water.

2.10 Recharge of the aquifers results from infiltration of rainfall, deep percolation losses from irrigation, and seepage from rivers and canals. Probably as much as 20% to 25% of rainfall is available for recharge although in most areas some of this potential recharge is rejected because groundwater levels are already so close to land surface. Water levels are generally within 1 to 3 m of land surface, with seasonal fluctuations of 1 to 2.5 m. Frequent measurements in many observation wells have shown that water levels rise rapidly in response to rainfall. Groundwater occurs under unconfined or subartesian conditions. Over large areas the individual sand layers are probably hydraulically interconnected and can be treated as a single aquifer. Movement of groundwater is slow, with very low gradient, generally paralleling the local and regional topography.

Pilot Projects

2.11 There are numerous pilot projects in the North China Plain aimed at solving the problems of waterlogging and salinity. The ones listed below for Shandong and Henan provinces are of interest since they are close to the proposed project areas. A pilot project has also recently been set up in Anhui province to address the problem of Shajiang soils. Although some of the pilot projects date back to the mid-1960s and early 1970s most of the work has been accomplished over the past five to six years. The pilot projects in the three provinces are listed below:

Shandong Province

Nanbei Zuhuang, Yucheng County: 2,000 ha established in 1975 operated by Chinese Academy of Agricultural Sciences (CAAS), Soil and Fertilizer Research Institute.

Linxi, Lingxian County: 500 ha established in 1974 also operated by CAAS.

Henan Province

Wuliyang, Shangqiu County: 400 ha operated by Henan Provincial College of Agriculture initiated in 1974.

Li Zhuang, Shangqiu County: 2,300 ha established in 1971 now operated by CAAS and Ministry of Water Conservancy.

Dawu Zhuang, Shangqiu County: 350 ha begun in 1965 and directed by the Henan Provincial Academy of Agricultural Sciences.

Anhui Province

Xiaomadian, Mengcheng County: 2,400 ha established in 1978 operated by Anhui Provincial Academy of Agricultural Sciences.

2.12 Although the pilot projects have been designed and operated by a number of different agencies the technique evolved for controlling salinity and waterlogging is basically the same in each area. This consists of a system of open drainage combining the functions of surface and subsurface drainage, and a supply of water to leach salts from the soils and irrigate the crops. The design of subsurface drains depends to a large degree on judgement and experience gained from large-scale field trials. While numerous formulae have been derived in the USA, China, Russia and other countries, the results they yield are sensitive to small changes in the assumed soil properties (permeability, storativity etc.) which in practice are difficult to measure. The pilot projects have shown that a depth of about 2.5 m is neccessary in the lateral drains to provide effective subsoil drainage. Spacing of laterals

show some variation between pilot projects but, for the soils commonly encountered in Shandong and Henan provinces, a spacing of 400-500 m has been shown to be adequate. Once the water table is lowered the leaching of the soil can be quickly accomplished since salts are present usually in only the top 20-25 cm. Initially, in some projects, the leaching proved to be a lengthy process because of delays in installing tubewells or bringing in surface water. However, where there is adequate pumping capacity the feasibility of flushing salts from the soils with ample quantities of water in less than one year has been demonstrated.

2.13 The nature and magnitude of benefits attributable to improved drainage and irrigation can be seen by comparing the 1979 economic characteristics of a sample of production teams which have benefited from the pilot projects with unimproved production teams farming saline land outside the pilot project area. The improved production teams typically grew less sweet potato and miscellaneous grain and more cash crops. Yields of wheat increased from 1.1 ton/ha for unimproved teams to about 2.9 ton/ha for improved teams; maize, from 2.1 ton/ha to 2.9 ton/ha; soybean, from 0.8 ton/ha to 1.0 ton/ha; and cotton, from 0.3 ton/ha to 0.6 ton/ha. Income from animal husbandry also significantly increased. Collective net income of the unimproved teams was Y 50 per capita (of which Y 43 was distributed to team members, none of which was cash income). In the improved teams, net income averaged Y 123, of which Y 99 was distributed (Y 61 in cash).

3. THE PROJECT

Project Description

3.01 The project would be the first large-scale attack on soil salinity and waterlogging in China and would serve as a model for future development of the more than 6 million ha of land in the North China Plain affected by salinity and waterlogging. The project would provide drainage and irrigation for about 200,000 ha, covering parts of nine counties, and would also include agricultural inputs and support services to increase agricultural productivity. The principal features of the project are:

(a) excavation to increase the capacity of some 70 km of river channels and 1,260 km of existing main and branch drains;

(b) construction of 3,200 km of lateral drains and 8,200 km of sublaterals;

(c) construction of new pumping stations for drainage and irrigation and installation of approximately 3,000 HP of pumping capacity;

(d) construction of about 8,450 tubewells, and procurement of pumps and motors for these wells and for about 4,010 existing wells;

(e) various works to improve water control at the field level consisting of land smoothing on about 60,000 ha, and field ditches and field drains to complement the drainage works and tubewells;

(f) additions of 700 km of 10 kV lines, 1,470 km of 380 V lines, and related substations and provision of transformers;

(g) construction and improvement of 130 km of rural roads;

(h) procurement of agricultural machinery and construction equipment;

(i) procurement of phosphate fertilizer and insecticides;

(j) tree planting along field borders and establishment of orchards and wood lots;

(k) a program to strengthen research and extension services in the project areas;

(l) a comprehensive program of soil and water studies in each project area including technical assistance for the studies; and

(m) an agricultural study of selected areas in the North China Plain to help formulate future agricultural development plans and to identify and prepare future projects.

Project Works

3.02 Drainage Works. Rivers and streams have been canalized to form the main backbone of the drainage systems in each of the project areas. In addition there is a fairly extensive system of branch drains at spacings of 1,500-3,000 m. The aim of the proposed improvements of the river channels and main and branch drains would be to provide discharge capacity needed to handle surface runoff from a five-year storm (about 210 mm over three days, depending on location). In general, the bed levels of existing channels would be lowered by 0.5-1.0 m.

3.03 Lateral drains in most parts of the project are too widely spaced to serve as adequate collectors of storm runoff and are not deep enough to have an appreciable effect on water table depths. As a result of these deficiencies, severe and prolonged flooding often occurs in the project areas and this leads to waterlogging and salinity. A major feature of the project would be to provide a much more effective system of laterals and sublaterals.

3.04 In Shandong and Henan where soils are mainly silty loams the laterals would be at spacings of 400-500 m and be 2.5 m deep. Field observations in the pilot projects (para. 2.12) supported by theoretical analysis show that at such spacings and depths the laterals would ensure drawdown of the water table to about 2 m within 90 to 120 days following the end of the rainy season. They would also be sized to convey runoff from a 5-year storm. Sublaterals, at spacings of 200-250 m, would serve mainly to carry surface runoff to the laterals and be about 1.5 m deep. However, to promote leaching in the saline areas and to ensure water table control some sublaterals would be 2 to 2.5 m deep.

3.05 In Anhui, salinity is not the problem so much as controlling the water table to provide a healthy crop root environment. Lateral drains at a spacing of about 500 m and with a depth of about 2 m would mainly serve to remove surface water. Sublaterals, at the relatively close spacing of 80-100 m with depths of 1.2-1.5 m would be constructed over much of the project areas to ensure that within 10 days of a heavy rain the water table would drop to 0.7 m below ground surface.

3.06 The drainage systems would require many bridges and culverts to carry roads over branch, lateral, and sublateral drains. These would be constructed of brick in most cases but reinforced concrete would be used for large spans. Pumping stations and tubewell pumphouses would be constructed primarily from brick. Concrete pipe for culverts is made in the counties. At some locations it would be necessary to pump drainage flows from the branch drains into the rivers. The total installed capacity of drainage pumps would be about 3,000 HP. Details of the drainage systems are summarized in Table 3.1.

Table 3.1: DRAINAGE SYSTEM

Province:	Shandong	Anhui	Henan
Main and Branch			
Spacing (m)	----- 1,500-3,000 ------		
Depth (m)	------- 2.5-3.5 --------		
Bed width (m)	--------- 5-10 ---------		
Length (km)	580	340	340
Lateral			
Spacing (m)	400-500	500	500
Depth (m)	2.5	2.0	2.5
Bed width (m)	--------- 2-3 ----------		
Length (km)	1,670	720	810
Sublaterals			
Spacing (m)	200-250	80-120	250
Depth (m)	1.5	1.2-1.5	1.5
Bed width (m)	--------- 1.5-2 --------		
Length (km)	3,000	4,000	1,800

3.07 Tubewells. The project would provide for the construction of 8,450 new tubewells and installation of pumps and motors. About 11,130 tubewells have been drilled in the project areas to date and of these the project would provide 4,010 new pumps and motors to replace old and inefficient units. Thus, the project area would have a total of 19,580 tubewells. Depth of wells ranges from 30 m to 100 m. All well drilling is carried out by provincial or county drilling crews who have gained considerable experience over the past few years. Wells are drilled by locally-made rotary rigs. Concrete pipe sections (70 cm diameter for auger holes and 40 cm for drilled holes) are used for casings. The screen portion, a porous concrete pipe made with a uniform fine gravel and just enough cement to form a binder, extends from the bottom of the hole to 6 m from the ground surface. The screen is surrounded by a 10 cm filter pack of washed sand. The top 6 m consists of a plain concrete pipe. The completed wells would be equipped with centrifugal pumps and about 5,920 would be powered by 4 to 5 hp electric motors, and 6,540 by diesel engines. In general, the service unit for a tubewell would be the area bounded by adjacent pairs of laterals and sublaterals; for example, with a lateral spacing of 400 m and sublateral spacing of 200 m, a service unit would be 8 ha. For the project as a whole the average area served by a tubewell would be about 9 ha. The number of new and existing wells and their physical characteristics are summarized in Table 3.2 by province.

Table 3.2: TUBEWELLS

Provinces:	Shandong	Anhui	Henan	Total
Existing wells	3,930	2,600	4,600	11,130
Existing wells to be equipped with new pumps and motors	(1,950)	(725)	(1,335)	(4,010)
Additional wells	5,100	1,040	2,310	8,450
Total wells	9,030	3,640	6,900	19,580
Depth of wells (m)	50-100	20-30	40-70	
Yield (cu m/hr)	50-60	25-50	40-50	

3.08 On-farm works. Field drains would be constructed to carry rainfall runoff to the sublaterals and laterals. These would be V-ditches about 60 cm deep at spacings of 80-100 m. About 1,000 m of field irrigation ditches would be provided for each additional tubewell. The field ditches and drains would be built by each production team within the area it farms. Similarly, land smoothing would be carried out by the production teams in areas where needed to improve water control; it is estimated that about 60,000 ha would require some degree of smoothing. The production teams would employ their own members or members of other production teams as hired labor.

3.09 Rural Electrification. Each county already has rural electrification systems which reach varying proportions of the communes and brigades. Energy is purchased by the county from the nearest power plant or major substation and the interconnecting 110 kV line is usually owned by the county. Within the county, subtransmission is at 10 kV and distribution at 380 V. To expand the system, the project would provide 700 km of 10 kV lines, 1,470 km of 380 V lines, 750 10 kV/380 V transformers (totalling 38,000 kVA) for wells and three substations. Assurances have been obtained from the provincial governments that an adequate power or fuel supply would be made available for tubewells in the project areas.

3.10 Rural Roads. About 130 km of the existing roads in the project areas of Mengcheng, Guoyang, and Suixi counties are narrow and unpaved, making them impassable after heavy rains. About 100 km would be asphalt-surfaced and 30 km would be earth roads.

Agricultural Development

3.11 Agricultural Machinery and Construction Equipment. The project includes farm machinery to provide for greater timeliness in farm operations, particularly during periods of peak labor demand at the time of plowing, sowing and harvesting. Double cropping is practiced over a major portion of the project area, and in view of the variations in the frost-free

periods, timeliness of operation is important. Additional machinery and equipment include: (a) about 720 12-hp two-wheeled tractors and accessories, to be purchased by production teams and groups of individuals; these are in demand because of their multiple uses in cultivation and transport, and the utility of the power train as a power source for well pumps, threshers, and small processing machinery; (b) 50 25-hp tractors and 1,000 accessories for existing 25-50 hp tractors, including sowers, cultivators, and harvesters, to raise the efficiency of their use; (c) 100 power sprayers, to be purchased and managed on a custom basis by county plant protection companies; (d) 160 stationary threshers, to meet increased requirements under the project. About 20 pieces of construction equipment including bulldozers, loaders, backhoes and scrapers would be procured for use on a trial basis in Lingxian county. Provision is also made for sprinkler equipment for trial of sprinkler irrigation in the counties.

3.12 Fertilizer and Agrochemicals. The soils over virtually all of the area covered by the project are deficient in phosphate. Domestic production of phosphatic fertilizers, while increasing, does not meet current demands, and shortfalls are expected in the project areas. Therefore, following completion of the drainage works, and after the salts have been leached from the soil, the project would finance an initial application of diammonium phosphate (DAP), as a soil amendment at a rate of 235 kg/ha. A total of 47,000 tons of DAP would be provided. To meet increased requirements for agrochemicals, the project would also provide 140 tons of imported carbofuran mainly for the control of cotton pests.

3.13 Tree Planting. Because of the need for fuel, construction materials and fodder, only a fraction of crop residues in the project area is currently returned to the soil. As a result, the organic content of the soil is low, contributing to poor soil structure. Tree planting would alleviate the shortage of rural fuel and construction materials and thereby encourage the recycling of crop residues. Commercial forests of Paulownia, Platanus, poplar, elm and other species would be planted at 1,500 trees/ha in a 5 x 1.5 m spacing, with successive thinning. Short stature crops or creepers would be intercropped in the first 3 years after transplanting. Orchards, mainly apples and pears (300 trees/ha), would also be intercropped prior to maturity. Field border plantings and shelter belts at 75 trees/ha would usually be planted in offset pair of rows with 7 x 3 m spacing, to reduce wind penetration. In intercropping of selected grain with Paulownia, trees would be planted with a 50 x 5 m spacing to minimize shading. Tree planting offers a high rate of return to investment, and would contribute to farm incomes. Therefore, the project would include nurseries for the production of about 35 million seedlings for orchards, border plantings, and shelter belts along roads, canals and drains in the project area.

3.14 Research, Extension and Training. Each county has an agricultural research institute and an agrotechnical extension station. The research institutes would verify and assess improved farming practices in different locations in the project areas. The main emphasis would be on varietal screening, fertilizer trials, pest and disease control and production of breeder seeds. Proven techniques would be popularized by the agrotechnical extension stations. Most research and extension facilities are poorly equipped to serve the needs of the collectives and farmers. To meet the research and extension needs of the project, the facilities at county research and extension centers would be improved. The project would include construction of laboratories, dormitories and lecture rooms, and provision of different types of laboratory equipment. Details are given in Annex 1.

3.15 The project would include the local training of extension staff from communes and brigades. The courses would be offered about five times a year, each session lasting about 30 days. The topics covered include (a) varietal improvement; (b) seeds; (c) soil/fertilizer; (d) crop protection; (e) tree planting; (f) livestock; (g) agricultural machinery; (h) irrigation and drainage; and (i) project management. The courses would be given by county research and extension personnel, with assistance from the provincial technical staff. In support of the training program, some additional training facilities and equipment have been included in the project for the county research institutes.

Soil and Water Studies

3.16 A comprehensive program of soil and water studies would be carried out in each of the project areas to guide the operation of the project and provide a basis for the planning and design of future drainage and irrigation projects in the North China Plain. The studies would be undertaken by the technical bureaus in the counties with specialist assistance from the national and provincial agricultural research institutes. The project would finance the program's equipment requirements and consulting services to assist the project authorities in setting up the program and for periodic technical review of the findings. An assurance was obtained from the Government that a report presenting the main findings of the studies, with terms of reference agreed with IDA, would be prepared by the central PMO and submitted to IDA for review not later than December 31, 1986. The program of studies would include:

(a) observations of changes in soil salinity, both short-term for different leaching procedures and long-term changes during project operation;

(b) observation of changes in water table levels both seasonal and long-term;

(c) maintenance of complete records of quantity and quality of all surface and groundwater use in the project areas;

(d) monitoring of tubewell performance including any changes in water quality and yield;

(e) collection and analysis of data to obtain estimates of recharge;

(f) investigations to determine crop water requirements and develop improved irrigation and crop practices;

(g) soil surveys to supplement and upgrade existing soil maps;

(h) soil and fertility studies to identify factors limiting crop yields; and

(i) trials of alternative methods for design and construction of tubewells and drains.

North China Plain Agricultural Study

3.17 The North China Plain contains some of the best land in China for wheat, corn, cotton and oilseeds and cropping intensities of 140 to 150% are achieved in many areas. There is still potential, however, in many parts of the Plain to raise yields and production which in turn would increase farm incomes and reduce China's imports of foodgrains and cotton. The objectives of the study would be to: (a) identify the main physical, agronomic and financial constraints to higher crop production in selected areas of the North China Plain; (b) formulate agricultural development plans to overcome these constraints; and (c) to identify and prepare future agricultural projects. The study would initially concentrate on the lands bordering the Tuhai River in Shandong Province which is parallel to and north of the Huang He. This area covers about 2.7 million ha in a strip of land some 300 km long and 90 km wide. The study covered by this project will probably include this area and two or three other areas of similar size. It is likely that there would be some overlap in studies of selected areas; for example, a study of the second area could well begin before completion of the first area. The studies would be carried out primarily by the staff of the provincial and county agricultural bureaus with assistance from specialist institutes at the provincial and central government levels. Technical support would also be provided by local and foreign consultants.

Water Supply and Demand

3.18 At present about 71,000 ha, just over one third of the total project area, are irrigated, 35,000 ha from surface water and 36,000 ha from groundwater. In the future, with the project, there would be only a small increase in surface water and virtually all of the additional demand would be supplied from groundwater. In general, surface water would be used in areas where the groundwater is unsuitable for irrigation. Water supply and demand at full development for project areas in the three provinces and for the project as a whole are summarized in Table 3.3.

Table 3.3: WATER SUPPLY AND DEMAND

	Shandong	Anhui	Henan	Total
Area Irrigated (ha)	90,900	42,700	48,400	182,000
Surface water (ha)	26,000	8,200	0	34,200
Groundwater (ha)	64,900	34,500	48,400	147,800
Annual demand at crop:				
Crop requirement (MCM)	507	258	265	1,030
Effective rainfall (MCM)	287	155	160	602
Crop irrigation requirement (MCM)	220	103	105	428
Annual supply at source:/a	285	131	131	547
Surface water (MCM)	88	27	0	115
Groundwater (MCM)	197	104	131	432
Average output per well (cu m)	14,000	11,000	16,000	14,000
Annual groundwater use (mm)	300	300	270	
Recharge from rainfall (mm)	130	160	130	
Recharge from irrigation (mm)	45	45	40	
Recharge from rivers (mm)	125	125	100	

/a Includes canal and ditch losses and deep percolation estimated to be 30% for surface water and 20% for groundwater.

3.19 In the long term, the project's water supply would be limited only if pumping exceeds aquifer recharge. As shown in Table 3.3, annual withdrawal from groundwater would be in the order of 300 mm. Recharge would be from three sources: (a) rainfall, (b) deep percolation from applied irrigation water; and (c) seepage from rivers, drains and canals. From observation in the pilot project areas, it estimated that about 20% of the rainfall and 15% of the applied irrigation water go to recharge. There is also evidence in the pilot project areas that periodic floods, passing through rivers and main drains from upstream areas, make a significant contribution to recharge at least equal to recharge from rainfall. As indicated in Table 3.3 there appear to be good prospects for a long-term balance between pumping and recharge. A further possible constraint on water supply would be a significant decline in water quality. However, in all the project counties there are numerous wells that have operated for long periods

without changes in water quality. As explained in para. 3.16, observations to detect any undesirable trends in aquifer depletion or water quality will be an important part of the soil and water studies program.

3.20 Water requirements are based on current irrigation practices in the project areas (Annex 2). These requirements are fairly close to those calculated using the Radiation Formula /1 for the main cereal crops maize, wheat and rice. However, current water use for cotton and oilseeds in areas with the best yields is much less than the calculated figure. Since there is close agreement between the counties on water requirements for cotton and oilseeds, the local estimates were accepted.

Status of Design

3.21 Maps showing the location of main and branch drains, major irrigation canals and structures, groundwater and soil distribution in the nine project counties have been completed (a typical layout is shown in Map IBRD 16375 for Yucheng project area). The maps are based on field surveys conducted by Chinese technicians during project preparation. Auger hole tests were made to determine hydraulic conductivity and, where deep drains exist, actual draw down of observation wells was measured. Based on these measurements, design criteria for deep drains for water table control have been developed and tested in several pilot projects. The provincial and county governments have completed preliminary design of drains and plan to finalize detailed designs of the various project works by September 1982, shortly before the start of construction.

Implementation Schedule

3.22 The project works would be constructed in a period of four years beginning in October 1982. Each county has a detailed plan for the first year's work program. In general, the emphasis in the first year would be on improving main and branch drains and constructing some of the new laterals and sublaterals. The proposed implementation schedule is shown in Figure 3.1. Improvement of main and branch drains and laterals and sublaterals would commence in late 1982 and the work would be confined to the period between December and March when the construction companies could recruit off-season farm labor. Construction of structures and pumping stations would proceed throughout the year as they would be done by permanent county construction crews. Tubewell construction and on-farm works (field ditches and drains and land smoothing), would also be year round. Extension of power lines would proceed in phase with tubewell construction and most would be completed by 1985. Buildings would be constructed mainly in the first two years. Manual labor would be used for virtually all of the excavation and structures. Assurances have been obtained from the Government that by August 31 of each year, detailed work plans for the following year would be prepared for IDA review.

/1 FAO Irrigation and Drainage Paper 24, Crop Water Requirements, Revised 1977.

Cost Estimates

3.23 The total cost of the project is estimated at about US$177.5 million of which US$49.2 million or 28% would be the foreign exchange component. The project has a relatively low foreign exchange component because the earthworks, construction of structures and buildings, and tree planting would be carried out mostly by manual labor using mainly local materials. The foreign exchange costs are based on the estimated imported components of locally-produced materials and goods, mainly materials and fuel. A summary of the cost estimates, detailed in Annex 1, is presented below:

Table 3.4: COST SUMMARY

	Local	Foreign	Total	Local	Foreign	Total	% foreign
	--- (Y million) ---			-- (US$ million) --			exchange
Earthworks	62.4	0	62.4	36.7	0.0	36.7	0
On-farm works	26.0	0	26.0	15.3	0.0	15.3	0
Structures	15.5	5.6	21.1	9.1	3.3	12.4	25
Pumping stations	1.0	0.3	1.4	0.6	0.2	0.8	30
Well drilling	21.6	7.3	29.0	12.7	4.3	17.0	25
Tubewell pumps and motors	10.0	5.4	15.6	6.0	3.2	9.2	35
Rural electrification	8.3	4.4	12.8	4.9	2.6	7.5	35
Rural roads	2.0	0.3	2.4	1.2	0.2	1.4	15
Agricultural machinery and construction equipment	3.0	1.5	4.6	1.8	0.9	2.7	35
Fertilizer and agrochemicals	0	31.8	31.8	0	18.7	18.7	100
Tree planting	7.3	0	7.3	4.3	0	4.3	0
Research, extension and training	4.0	1.7	5.8	2.4	1.0	3.4	30
Studies and training	0.3	2.6	2.9	0.2	1.5	1.7	90
Engineering and management	7.1	0.9	8.0	4.2	0.5	4.7	10
Base Cost (June 82 prices)	168.5	61.8	231.1	99.4	36.4	135.8	27
Physical contingency	18.7	7.5	26.2	11.0	4.4	15.4	-
Expected price increases	30.4	14.3	44.7	17.9	8.4	26.3	-
Total Project Cost	217.6	83.6	302.0	128.3	49.2	177.5	28

3.24 The cost estimates are expressed in June 1982 prices. A physical contingency of 15% has been applied to civil works and equipment costs. Expected price increases which amount to 17% of the base cost plus physical contingencies are based on the following rates of price escalation:

ANNUAL PRICE ESCALATION (%)

	Local	Foreign
1982	6.0	8.0
1983	6.0	8.0
1984	6.0	7.5
1985	6.0	7.0
1986-90	6.0	6.0

Financing

3.25 Of the total project cost of US$177.5 million, the IDA Credit would finance US$60 million (34%). Since the foreign exchange component is small, the 34% is a reasonable contribution to the project total cost. The provincial governments would contribute US$39 million. The cost of on-farm works, about US$20.7 million, would be borne by the production teams. The remaining US$57.8 million would be provided by cash contributions from counties and communes (US$45.8 million) and labor paid for by the collectives to construct drains, drill tubewells and plant trees, equivalent to about US$12 million. A financing plan is shown in Table 3.5.

Procurement

3.26 Civil works (US$66.3 million) and tubewell drilling (US$22.9 million) scattered over nine counties would be carried out employing labor from collectives over a period of three to four years and would not likely attract foreign contractors. This type of force account construction in China is efficient, low-cost, and provides off-season employment for the rural population. It also reinforces the spirit of local participation and self-help which is such an important part of rural development in China.

3.27 Phosphate fertilizer and agrochemicals (US$22.0 million), which are in short supply in China, would be imported and therefore procured following international competitive bidding in accordance with Bank Group guidelines. Rural electrification equipment (US$6.3 million) would also be procured through ICB. A 15% preference margin, or prevailing customs duties, whichever is lower, would be extended to local manufacturers in the evaluation of bids. Tubewell pumps and motors (US$12.3 million) and farm equipment (US$3.4 million), would be purchased by collectives scattered across nine counties over a period of three to four years and, therefore, bulk procurement in large contracts would create problems in storage and distribution. Accordingly, the existing procedure would be followed whereby the production teams would purchase such equipment through county supply companies which act as agents for local manufacturers. In each province, there are manufacturers producing acceptable equipment at prices which are competitive with world market prices. Construction equipment (US$0.2 million) to be used for trials of mechanized

Table 3.5: FINANCING PLAN
(US$ million)

	Cost including physical contingencies and price increases	IDA credit /a	Provincial government /b	Cash contributions from counties & communes	Contribution of production team
Earthworks	49.5				
Structures	16.8				
Pumping stations	1.1				
Well drilling	22.9				
Subtotal	90.3	20.1	39.0	24.2	7.0
On-farm works	20.7	-	-	-	20.7
Rural electrification	10.1				
Rural roads	1.9				
Subtotal	12.0	6.3	-	3.7	2.0
Tubewell pumps & motors	12.3				
Machinery & equipment	3.6				
Fertilizer & agrochemicals	22.0				
Subtotal	37.9	31.6	-	6.3	-
Tree planting	5.1				
Research, extension & training	3.9				
Engineering & management	5.6				
Subtotal	14.6	-	-	11.6	3.0
Studies and training	2.0	2.0	-	-	-
Total	177.5	60.0	39.0	45.8	32.7

/a Will be passed on as loan to the provinces, except for the amount of $2.0 million for studies and training.

/b Annual budgets of Y 4 million, Y 5.4 million and Y 4 million have been approved for Shandong, Anhui and Henan respectively.

construction in Lingxian county would also be procured locally since the small number of items involved would not justify setting up the after-sales service needed for imported equipment.

Disbursements

3.28 Disbursement of the proposed credit would be as shown below:

Table 3.6: PROPOSED ALLOCATION OF CREDIT PROCEEDS

Item	Cost including physical contingency and price increases	Amount of credit allocated	Disbursement %
	----- (US$ million) -----		
Earthwork in drains	49.5	9.9	20 of total
Structures	16.8	3.4	20 of total
Well drilling	22.9	4.6	20 of total
Pumps and motors	12.3	6.0	50 of total
Rural electrification	6.3	6.3	100 ex-factory/c.i.f.
Machinery & equipment	3.6	3.6	100 ex-factory/c.i.f.
Agricultural chemicals	22.0	22.0	100 c.i.f.
Studies and training	2.0	2.0	100 of total
Unallocated	-	2.2	-
Total		60.0	

Disbursements for force account works and pumps and motors would be against statements of expenditure supported by progress reports showing physical quantities and unit prices. Annex 9 explains the reasons for this approach. Agreement was reached with the Government on the unit prices for the items listed in Annex 8. Since this is the first Bank Group-financed agricultural project in China, the estimated disbursement schedule was based on the mission's judgement of the implementation capacity of the counties. Most of the civil works construction would be carried out employing the rural population. In view of the past experience with this type of construction the projected schedule is, therefore, shorter compared to Bank Group-financed irrigation and drainage projects. It is estimated that disbursements would be completed by December 1987. Estimated schedules of expenditures and disbursements are presented in Annex 1.

Accounts and Audits

3.29 Each county and provincial Project Management Office would maintain separate accounts in sufficient detail to record all expenditures for force account construction and earthworks and payment to county well drilling crews, equipment supply companies and consultants. The central PMO would collate the half-yearly progress report showing these expenditures both half-yearly and cumulative. For civil works, the expenditure would be broken down according to the major elements of main, branch, lateral, sublateral etc. Assurances were obtained from the Government that the accounts for each province would be audited annually by independent auditors, which are expected to be from the Provincial Bureau of Finance. The project's audited accounts would be submitted to IDA within six months of the close of each financial year.

Environmental Effects

3.30 The project would not lead to any basic change in land use. Drainage and irrigation would reduce salinity, waterlogging, drought, surface flooding and improve the environment for crop production. The project would have no adverse environmental effects.

4. ORGANIZATION AND MANAGEMENT

4.01 The organization for implementing the project would be based primarily on the existing structure of the county governments and their relation to the provincial governments and central government agencies. However, to ensure the efficient channelling of funds and timely execution of the project, Project Management Offices (PMOs) have been set up at the county, provincial and central levels. Organization charts for the project and for the Ministry of Agriculture are shown in Figures 4.1 and 4.2.

Agency Responsibilities

4.02 The County Governments. Implementation of the laterals and sublaterals; rural roads and electrification; and pumping stations under the project would be executed by the relevant technical bureaus of the county governments. A county typically has five or six committees and offices to which these bureaus are attached. The Financial Office is responsible for the activities of the Foreign Investments Bureau, and the state corporations engaged in the purchase, supply, and processing of agricultural produce. In addition, this office coordinates the local branches of the Agricultural Bank, through which production and investment credits are made available to the county. The Agricultural Committee has responsibilities for the activities of the Bureaus of Agriculture, Forestry, Fisheries, Water Conservancy, and Agricultural Mechanization. The Economic Committee oversees the Bureau of Electric Power Supply.

4.03 The design and construction of laterals and sublaterals would be the responsibility of the counties. County construction companies would build structures, but the county would delegate responsibility for earthwork to the communes, with supervision by county engineers. The communes would in turn allocate the earthwork between the production brigades and production teams. Compensation for the earthwork would be a combination of cash, food and work points. Work points are used throughout China to measure individual inputs to collective activities and to form a basis for distributing income from such activities. Each production team keeps detailed records of work points earned by all members of the team capable of work. When some team members work on construction which has no immediate and identifiable effect on their income, the value of each work point is in effect diminished. Consequently, a payment is made to the production team or the workers by the county. The total compensation per workday has a value of Y 0.8-4.0, depending upon the extent of skill and whether the work is off-farm or on-farm. The current rate averages Y 2/day. For off-farm works, current government policy requires that the county provide cash subsidies of Y 1.0-1.4/day, in order not to impose the extra financial burden on the team. For on-farm works (para. 3.08) payment may be entirely work points or cash levied from team households, since the land smoothing and drains directly benefit the team's farm land. The same procedure is followed for the irrigation ditches required to distribute water from the tubewells.

4.04 The Provincial Governments. Responsibility for the excavation of the main drains and design and construction of the branch drains would rest with the provincial governments. This is because the main drains often traverse a number of counties and their design has to be coordinated with other water control works. Provincial construction corporations would carry out the earthworks and structures employing local labor at Y 2/day, and their own full-time skilled labor and supervisors.

4.05 The Agricultural Bank of China (ABC) would be responsible for channelling project funds from the central Government to the provinces, counties and collectives. The bank has an extensive network of branches at the provincial, county and commune levels. The provincial branches would disburse project funds to the provincial government agencies for project works undertaken by them and for expenses of the provincial Project Management Offices (para. 4.09). Likewise, part of the project funds would be channelled through the county branches for project works undertaken by county government agencies and for expenses of the county PMOs (para. 4.07). The remaining project funds would be channelled through ABC's commune branches to farmers and collectives for the construction of tubewells, and purchase of tubewell equipment, agricultural machinery, fertilizer, agrochemicals, and seedlings. These funds would be recovered on behalf of the counties/provinces from recipients in accordance with terms determined by the PMOs, which are likely to be the ABC's existing terms and conditions. Thus funds for fertilizer, agrochemicals and seedlings would be

repaid in periods of up to one year at an interest rate of 0.48% per month (5.76% p.a.) and those for tubewell construction and equipment and agricultural machinery would be repaid in periods of 1-5 years at an interest rate of 4.32% p.a. An increase in these lending rates is possible. They are expected to remain positive in real terms.

4.06 The Ministry of Agriculture (MOA) would have overall responsibility for the project, in cooperation with the Ministry of Water Conservancy. MOA comprises 16 bureaus and offices. Among them, the Bureaus of Land Utilization, Foreign Affairs and Science and Technology and the Academy of Agricultural Engineering Research and Planning would work closely with the provincial and county governments in implementing the project and carrying out the related studies. The Ministry of Water Conservancy, particularly the Bureaus of Farmland Water Conservancy and Planning would, where necessary, provide technical guidance and advice to the provinces and counties.

Project Management and Coordination

4.07 To facilitate project execution by the various bureaus, offices and institutions in each county, the county governments would each establish a Project Management Office (PMO) to handle the day-to-day affairs of the project. In each county a senior official has been appointed as Project Manager to supervise the PMO operations. The PMO would comprise a general administrative office and four sections: engineering and construction, research and training, finance and materials supply, and monitoring and evaluation. It would be responsible for scheduling the work of the existing offices and bureaus involved, such as the Water Conservancy Bureau (mainly responsible for planning and design), and the various supporting bureaus such as Finance and Procurement. The county PMO would also prepare annual budgets for the project, maintain project accounts, monitor the operation and maintenance of irrigation and drainage systems built under the project, organize training for collective members, and monitor and report project progress.

4.08 Supervising the county PMO would be a Project Committee, made up of heads of the relevant administrative and technical units of the local government. The committee would review the plans and programs of implementing agencies and the annual budgets and meet periodically to review progress. The committee would be placed on the same administrative level as the existing committees in the county government. This form of management is based on the model which has been responsible for executing the works in the pilot areas and other major construction undertakings in the counties included in the project.

4.09 A Project Management Office established under the provincial government would carry out the functions of coordinating and supervising project implementation in the participating counties, reviewing technical standards for design, construction, operation and maintenance of project works, ensuring prompt delivery of project inputs and reporting progress to

the central Government. The provincial PMO would be headed by a senior provincial official as Project Manager, and include officials from its technical bureaus. To supervise the provincial PMO and coordinate project implementation within a province, a provincial Project Committee would be set up in parallel with the existing committees in the provincial government. This committee would be led by a high-ranking provincial government official with heads of the relevant bureaus as members.

4.10 Project execution in all nine counties would be coordinated by a central Project Management Office attached to the Ministry of Agriculture. The office would be headed by a Project Coordinator. The central PMO would be responsible for administration of the project as a whole and for overall coordination with the Ministries and other central agencies involved. It would also be responsible for liaising with IDA, preparing applications for IDA disbursements, reviewing annual budgets, and for the procurement of agro-chemicals and rural electrification equipment following international competitive bidding. The China National Technical Import Corporation of the Ministry of Foreign Economic Relations and Trade, which is gaining experience in procurement under ICB procedures, would assist in procurement by handling bid invitation, bid evaluation and contract awards. The central PMO would comprise a secretariat and three sections: finance, research and training, and planning. Assurances were obtained from the Government that the central PMO would be adequately staffed at all times with experienced and qualified personnel, and that IDA would be consulted about any replacement of the Project Coordinator. Assisting the PMO on technical matters would be a technical advisory group made up of representatives from the Beijing University of Agriculture, Chinese Academy of Agricultural Sciences, the Academy of Agricultural Engineering Research and Planning and the Ministries of Geology, Agriculture and Water Conservancy.

4.11 Both the central PMO and the technical advisory group would be under a Central Project Committee to be chaired by a Vice Minister of the MOA with representatives from other relevant Ministries concerned with the project. The Committee would deal with policy matters and interministerial coordination/cooperation, as well as liaise with other state commissions. The Project Coordinator and the managers of the provincial and county PMOs and the technical staff of the PMOs at the different levels have already been appointed.

Monitoring and Evaluation

4.12 The central PMO with the cooperation of the Economic Research Institute of CAAS, and the county and provincial PMOs would monitor and evaluate the impact and economic benefits accruing from the project. Bench-mark surveys would be conducted in the project areas to determine the current conditions and levels of inputs and production. Crop statistics and

physical and financial progress of the project would be collected by the county PMOs. Consultants would be provided under the project (Annex 5) to assist in developing suitable techniques and procedures for monitoring and evaluation. In this connection, half-yearly reports on the progress of the project would be prepared by the central PMO (Annex 8), to be submitted to IDA within one month of the end of each half-year.

4.13 The central PMO would also prepare a Project Completion Report (PCR) on the project not later than six months following the completion of credit disbursements. The PCR which would be submitted to IDA should include an assessment of the operating results and impact of the project, performance of the implementing agencies and the major reasons for their achievements and deficiencies with the view to drawing lessons which may usefully be applied to the preparation and implementation of similar type projects in the future.

Agricultural Support Services

4.14 Agricultural services in the project area, described below, are well organized and would adequately support the farmers in realizing the benefits of desalinization, irrigation, and improved drainage.

4.15 Agricultural Research and Extension. Numerous entities ranging from central research agencies down to the production teams support research into the improvement of saline and Shajiang black soils. At the central level, there is the Chinese Academy of Agricultural Sciences (CAAS) which, aside from its responsibility for providing support and guidance to provincial Academies of Agricultural Science and county-level research institutes, maintains a Saline Soils Improvement Station at Dezhou (Shandong). The latter has been responsible for supervision of pilot projects in Lingxian and Yucheng. The Chinese Academy of Agricultural Engineering Research and Planning, formed in 1979 with 260 researchers from CAAS, the Institute of Forestry, and other organizations, also assisted in the pilot project in Yucheng. The Water Conservancy Scientific Research Institute, under the Ministry of Water Conservancy, conducts research on problems of water conservancy in the Huang, Huai and Hai River basins. Otherwise, major research in the project area is conducted by the provincial academies and agricultural colleges.

4.16 Each county in the project has a county agricultural research institute and, under its supervision, research groups at the commune and brigade levels. The main functions of research at this level are to verify and promote new and improved farming practices. Personnel at the commune level include college and middle school graduates. These institutes lack laboratories and equipment, and there is a need for further staff training at all levels. The project would provide funds for strenghthening and upgrading the research facility in each county. Additional training would also be provided for research and support personnel.

4.17 Around 100 personnel in each county are employed at the county or commune levels in extension work (including research as described above). At the county level, there is usually an agrotechnical extension station with stations for seed improvement, plant protection, agricultural machinery, animal husbandry, and forestry, each with 5-15 employees. Typically each commune also has an agrotechnical extension station with one agronomist. Experimental groups exist in some brigades and teams, which are involved in demonstration trials and seed multiplication. This "four level research network" (county, commune, brigade and team) uses meetings, short training courses, and publications as its main vehicles for extension. Each commune maintains 5-10 ha and each brigade 1-2 ha of demonstration and/or seed multiplication fields. The project would include the expansion of buildings and equipment for county level training of commune and brigade technicians and extension personnel.

4.18 Seed. Provision of improved seeds in each county is the responsibility of the county seed company. Breeder seeds from the provincial Academy of Agricultural Sciences or the county agricultural research institutes are multiplied either by county-managed seed farms or else by commune production teams or scientific experiment teams under contract to the seed company. To maximize the returns from investments, it is important that good quality seeds are available to production teams and farmers. To strengthen the national seeds program, the Bureau of Seeds, MOA, has established pilot projects in about 120 counties, and the provincial government in about 200 counties. The pilot projects encompass all aspects of production and processing of improved certified seeds. This seed improvement scheme would be extended to the project areas. An assurance was obtained that only seeds certified by or on behalf of the Bureau of Seeds, MOA, would be distributed by the seed companies in the project areas.

4.19 Fertilizer. Chemical fertilizer use in the project areas currently averages about 60 kg/ha nitrogen and 40 kg/ha phosphate (nutrient weight). Domestic production of fertilizer has been given high priority by the Government and will continue to grow as a result of large plants that are already under construction. Five of these plants are in provinces where the project is located. Smaller plants at the county level are being modernized, and will provide most of the fertilizer required by the project areas, supplemented by supplies from provincial fertilizer plants. Adequate nitrogenous fertilizer will be available from these plants to meet the needs of the project areas at full development. Soil survey results indicate phosphate deficiency in most of the project areas, and the demand in China for phosphate is expected to grow rapidly, especially with the projected expansion in land planted to legumes, oilseeds and cotton. Domestic production of phosphatic fertilizers at present falls far short of requirements, hence imports will have to be expanded. Provision has been made under the project to import diammonium phosphate for application in deficit areas. Supply stations of the Supply and Marketing Cooperative are established at each commune and would be responsible for provision of fertilizer and other inputs to the production teams.

4.20 Agrochemicals. Pesticides are readily available in the project area through the Supply and Marketing Cooperative. Higher standards of pest control, especially for cotton, will be needed to achieve the higher yields, resulting from better water control. The project includes procurement of carbofuran and the purchase of power sprayers for use in orchards and cotton. Expanding domestic production will be sufficient to meet requirements for other agrochemicals.

Consulting Services

4.21 The Government would employ consultants to assist in (a) the soil and water studies program, (b) monitoring and evaluation, and (c) the North China Plain Agricultural Study. The services under (a) and (b) would best be provided by a consulting firm able to call on a wide range of experts on short-term assignment. The assignment would begin in early 1983 and continue over a period of four years. The consultant input is estimated at about 35 man-months. The North China Plain Agricultural Study would also require experts on short-term assignments to cover a wide range of disciplines, and again there would be advantages in having these services provided by a consulting firm with experience in such studies. The estimated input is 52 man-months, and the assignment would begin in mid-1983 and be completed by the end of 1985. The use of consulting firms rather than individual consultants would be much simpler from the standpoint of administration, it would ensure that the work is properly coordinated and also give the implementing agencies access to a wide range of experts. Consulting firms would also help in purchasing field and laboratory equipment and in organizing and conducting overseas training courses for project personnel. The estimated overall man-month cost for specialists would be about $12,000, inclusive of salaries, overhead, overseas allowances, travel, and living expenses while in China. Assurances were obtained that the North China Plain Agricultural Study would commence by July 1, 1983 under terms of reference agreed with IDA, and that all consultants under the project would be selected in accordance with Bank Group guidelines for consultants.

Operation and Maintenance

4.22 The county Bureau of Water Conservancy would be responsible for the operation and maintenance (O&M) of river improvements and main pumping stations. O&M of main and branch drains and their structures would be carried out by the communes under the direction of the Bureau of Water Conservancy which would inspect the project works periodically. The commune sets aside funds for O&M every year. Likewise, the production brigades would provide funds for O&M of lateral and sublateral drains and their structures under the direction of the commune. Production teams would operate and maintain on-farm drains and tubewells, and members would provide the labor and funds. The collectives can also apply to the Provincial

Government for O&M subsidies in special cases such as floods and drought. The county Project Management Office would appoint persons in the communes and brigades to be in charge of O&M in the project areas. The annual cost of operating and maintaining the drainage systems and tubewells is estimated at about US$13/ha.

5. AGRICULTURAL PRODUCTION

Present Cropping Patterns

5.01 The total cultivated area is about 178,000 ha. However, the total cropped area at present is estimated at some 245,000 ha, which represents a cropping intensity of 138%. Of this area, wheat, which is the most important foodgrain, accounts for some 93,000 ha; maize, 49,000 ha; soybeans, 24,000 ha; sweet potatoes, 24,000 ha; rice, 1,900 ha; and miscellaneous grains (primarily sorghum and millet), 14,000 ha. Maize is more prevalent as a spring-summer crop in Shandong than in Henan and Anhui, where several years of drought have contributed to a resurgence of sorghum, millet, and sweet potato. Oilseeds are planted on 9,500 ha, the most important being peanuts, with 4,300 ha, and the remaining area split between rape and sesame. Cotton, with 27,000 ha, is by far the most important cash crop, but kenaf, vegetables and tobacco are also grown. Leguminous green manure (sesbania, vetch, and alfalfa) is intercropped or grown on wasteland.

5.02 The most commonly encountered cropping system is wheat/maize, with winter wheat (or barley) grown from late October to early June and maize often sown in May between the rows of wheat before harvest. Other systems based on wheat include wheat/soybean and wheat/sweet potato. Rotation schemes generally feature three crops in two years. Single-cropped foodgrains, oilseeds and cash crops are usually sown in the spring from early- to mid-April.

Future Cropping Patterns

5.03 Without the project, no significant change in cropping patterns is anticipated. Recent changes in relative crop prices, more attention to farm income levels, and decentralization of production planning have already led to significant increases in acreage in oilseeds, cotton and other cash crops, at the expense of reduced grain acreage and some decrease in overall cropping intensity.

5.04 With the project, improved irrigation and drainage would lead to significant yield increases and this in turn would lead the farmers to reduce the area under foodgrains, and increase the area under cash crops. The acreage under sweet potato and maize would be cut back. These crops are considered less desirable for human consumption. Wheat, sorghum, millet and

soybean would be maintained at present levels. In the project counties in Anhui, the area planted to rice would increase from 1% to 5% of the total cropped area.

5.05 Substantially increased area would be devoted to the oilseed crops and cotton, because of their profitability. Rape is expected to increase from 2,700 to 4,700 ha; peanuts from 4,300 to 9,000 ha; sesame from 2,500 to 3,700 ha; and cotton from 26,800 to 32,700 ha. Present and future cropping patterns, yields and production are shown in Table 5.1.

Table 5.1: CROPPING PATTERN, CROP YIELDS AND PRODUCTION

	Cropped area		Yield		Production	
	Present	Future/a	Present	Future	Present	Future
	---('000 ha)---		---(ton/ha)----		--('000 ton)---	
Wheat	92.6	93.2	1.4	2.2	129.3	208.1
Maize	49.0	45.0	2.1	2.9	103.0	131.2
Rice	1.9	3.6	3.0	4.2	5.6	15.3
Other grain	13.8	13.8	0.9	1.9	12.6	25.6
Sweet potato	23.8	15.3	2.6	4.4	61.6	66.9
Soybean	24.1	25.1	0.9	1.4	21.7	34.3
Rape	2.7	4.7	0.4	0.8	1.1	3.9
Peanut	4.3	9.0	1.1	1.8	4.6	16.5
Sesame	2.5	3.7	0.4	0.8	1.0	3.1
Cotton	26.8	32.7	0.5	0.7	13.6	23.7
Other crops	3.8	4.2	1.4	1.8	5.3	7.8
Total	245.0	250.4			359.4	536.4

/a At full development.

5.06 Changes in land use with project are shown in Table 5.2. Of 210,000 ha of land which could be used for agricultural production, 25,000 ha of wasteland would be reclaimed for use in crop cultivation, commercial forests and orchards. This would be partially offset by the loss of 6,000 ha absorbed by drainage works. Area cultivated in crops would increase by 4,000 ha, and overall cropping intensity would remain the same, at 138%.

Table 5.2: PRESENT AND FUTURE LAND USE
('000 ha)

	Present	Future with project
Cultivated crop area	178	182
Forests and orchards	7	22
Reclaimable wasteland	25	0
Total	210	204

5.07 Figure 5.1 shows the proposed cropping calendar. There are no major differences between the proposed calendar and existing practice.

Yields and Production

5.08 In the past, increased yields have been obtained for some crops due to growth in numbers of tubewells, a rapid increase in supplies of chemical fertilizer beginning in 1978, and the decentralization of farm management in 1980/81. In the future without the project, modest increases in yields and production of wheat, maize, soybean, and kenaf are likely to continue because only the yields of these crops have responded to larger applications of chemical fertilizers in the absence of improvements in water conservancy and management. With the project, increase in yields of all crops would occur, comparable to those which have already occurred in the pilot projects (Table 5.1). Total production of foodgrains with the project would increase 44%, from 334,000 tons at present to 481,000 tons. The combination of increased acreage and yields would triple oilseed production, from 7,000 to 24,000 tons, and increase cotton production by 74%, from 14,000 to 24,000 tons.

Subsidiary Production

5.09 Because of higher crop yields with the project, the crop area required to meet subsistence and quota requirements would decrease, the supply of fodder would be augmented, and farm cash flow increased. Therefore, the project would permit considerable diversification into subsidiary farm production which would not occur without the project. Funds and improved support services provided by the project would permit growth of tree planting (Annex 3). With the project, the area in commercial forests would increase by 13,000 ha, orchards by 2,000 ha, field border plantings

scattered over the project area by 116,000 ha (area of fields enclosed), and intercropping of trees (primarily Paulownia) with grain by 44,000 ha (area of grain intercropped). Production of fruit would increase by 13,000 tons. Over a 20-year cycle, the production of 1.9 million tons of fuelwood and 1.2 million cu m of harvested lumber would alleviate the severe shortage of rural fuel and construction materials and permit a higher proportion of crop residues to be returned to the soil. The high net revenues derived from tree planting would contribute to farm incomes.

5.10 With the project, a higher proportion of increased crop residue and a greater proportion of grain production would be available for use as feed and fodder. A small portion of reclaimed land would also be utilized as additional forage area. The number of animals raised is expected to show substantial growth, resulting in greater supply of animal manure which would contribute to soil improvement and supplement chemical fertilizer as a source of plant nutrients required to attain target yields.

Drying, Storage and Processing

5.11 In most of the project areas, farmers have sufficient on-farm sun-drying areas, including drying space on farm roads and along drains, to meet current needs, but additional floor space would be required to accommodate production increases. The project would provide funds for construction of additional 40,000 sq m of concrete drying floors. Storage of distributed grain and other crops is at the farm level, and capacity is easily expanded. Undistributed or marketed grain, oilseeds, and cash crops are stored variously at team, commune, or county facilities, and existing storage capacity (with the exception of minor cash crops) exceeds projected increases in marketed volume under the project. Most of the counties included in the project have factories for processing grain, oilseeds and cotton; where needed, the collectives plan to construct such facilities. In addition, many communes have small processing facilities, and most teams have mills to process distributed grain. Existing capacity plus planned additions would meet expected requirements under the project.

6. MARKETS, PRICES, FARM INCOMES AND PROJECT CHARGES

Market Prospects

6.01 China's production of virtually all of the crops grown in the project area has been insufficient to meet domestic consumption requirements, and this has been reflected in increasing imports of these

crops in recent years. Net imports of grain, mainly wheat, were estimated at 14.7 million tons in 1980. In 1979 China imported over 0.8 million tons of oilseeds and 0.85 million tons of raw cotton. Imports of these crops are expected to continue at about the same levels through the 1980s. The incremental output from the project (Table 5.1) would be easily absorbed by the market, since it represents a small fraction of the imports required to meet domestic needs.

6.02 The large volume of imports has been an essential part of Government policy of raising supplies of basic foodstuffs while easing procurement pressure in the rural areas. Government domestic grain procurement rose only about 4 million tons from 1977 to 1980, despite a 35 million ton increase in production. In the future, procurements are expected to rise at a more rapid rate to meet the requirements of the large urban population and regions specializing in cash crops. The project areas in Shandong and Anhui are among the areas which are expected to make major contributions to increased Government grain and cotton procurements.

Prices

6.03 The state has a near monopoly on crop procurement, and determines all procurement prices. Until major price increases in 1979, procurement prices had remained at about the same level for more than a decade. Soybean prices are expected to be increased by 20% by mid-1982. Present (mid-1982) farm gate prices are based on prevailing procurement price levels, with an upward adjustment of 20% for soybean prices.

6.04 There are three tiers to the procurement price structure: quota, above-quota, and negotiated prices. Quota procurement prices apply to the annual quota responsibilities of each team or household, amounts which in the project area have been unchanged since 1971 and are not expected to increase in the future. Above-quota prices apply to sales exceeding the quota, the targets for which are determined 1-2 months prior to the harvest of each crop. Above-quota prices exceed quota prices by 50% for grains and oilseeds, 30% for cotton, and varying amounts for other crops. Negotiated prices apply to sales by individual farmers (out of the amounts retained by them or grown on private plots) to the state and occasionally to sales by production teams in excess of above-quota targets. They are individually negotiated and are similar to the prices prevailing on the free market. In the project area at present negotiated prices normally exceed above-quota prices by 10-20%. Quota and above-quota prices are uniform throughout the project area for produce of equivalent quality.

6.05 The average farm gate price of each crop used in the financial analysis of the project is a weighted average of quota, above quota, and negotiated prices. The weights for the quota and above-quota prices are the amounts of each crop sold at these prices. The weights for the negotiated prices are the amounts retained by or distributed to individual farmers, including amounts used as seed and feed, based on estimates provided by local authorities. Since teams may sell the excess over quota and above-quota targets and individuals may sell any amount at free market or negotiated prices, these prices best approximate the financial opportunity cost of self-consumed crops. Based on present quota prices, and with the margin for above-quota and negotiated prices indicated in para. 6.04 above, average future prices for each crop are estimated from its projected quota sales, above-quota sales, and retained production.

6.06 For the economic analysis of the project, all farm inputs and outputs were evaluated at projected 1986 economic prices expressed in mid-1982 constant prices. The economic prices at the farm gate are based on Bank Group commodity price forecasts, adjusted for quality, international and domestic transport, and processing costs. Detailed derivations for 1982 and 1986 prices are shown in Annex 3. For crops which are not traded, economic prices are based on financial prices adjusted by the ratio of economic prices to financial prices of traded crops for the appropriate crop category (foodgrain, oilseeds, or fibers). For want of comparable world price data on which to compute border prices, all other products and all nontraded inputs are evaluated at financial prices, with the exception of those shown in Annex 3. Prices used for the financial and economic analyses are summarized in Table 6.1

Farm Incomes

6.07 The traditional concept of farm income derived from an individually operated plot is not applicable in the project area, where the land is farmed collectively. To estimate farm family incomes a notional farm budget has been prepared for a farm size of 0.7 ha, which is the average area of land per farm family. Net farm income was taken as equal to the gross value of production of crops, and tree products, less operating costs, including depreciation and repairs of farm equipment, and taxes; plus income earned outside the collective sector (Annex 3). The present average annual net farm income per capita in the project area is about Y 173 (US$102). At full development it would rise to Y 290 (US$171), an increase of 67%.

Project Charges

6.08 Cost recovery for the project would have several elements. Payment of unskilled labor (Y 28 million) for on-farm works, well-drilling, tree planting and part of rural electrification would be the responsibility of the production teams. An additional portion of project expenditure (Y 57 million) would be recovered from repayments to ABC of project funds advanced to beneficiaries for purchase of machinery, tubewells, chemical fertilizer and

Table 6.1: CROP PRICES

	Price per ton			
	1982		1986	
	US$	Y/a	US$	Y/a
US No. 1 soft red winter wheat, f.o.b. Gulf Ports,	229		237	
Financial		557		558
Economic		471		484
US No. 2 yellow maize, f.o.b., Gulf,	218		226	
Financial		363		364
Economic		452		465
Thai 5% broken rice, f.o.b., Bangkok,	429		458	
Financial		380		381
Economic		547		582
Soybean, c.i.f., European ports	427		433	
Financial		784		790
Economic		778		788
Peanut, c.i.f., European ports	844		719	
Financial		1,026		1,059
Economic		967		828
Rape, c.i.f. European ports	515		479	
Financial		984		1,094
Economic		928		867
Cottonseed, c.i.f. European ports,	367		345	
Financial		223		223
Economic		676		639
Mexican lint cotton SM1-16", c.i.f. N. Europe,	2,388		2,831	
Financial		3,730		4,311
Economic		4,401		5,131

/a At farm-gate.

agricultural chemicals. Excluding indirect charges, the cost recovery index from these items would amount to 28% (Table 6.2). Operation, maintenance and replacement costs for tubewell irrigation would be borne by the farmers. Irrigation fees paid for surface water deliveries would meet operation and maintenance charges for surface irrigation systems.

Table 6.2: COST RECOVERY /a
(Y million)

	Total
Project cost (capital and recurring)	242
Direct Cost Recovery	
Production team contribution /b	23
Machinery and input repayment /c	39
Tubewells O&M /d	5
Total direct recovery	67
Cost recovery index	28%
Indirect Cost Recovery	
Procurement pricing /e	40
Cost recovery index including indirect charges	44%

/a All calculations are in 1982 financial prices discounted at 12% over 30-year evaluation period and represent incremental conditions, i.e., with minus without the project.

/b From Table 3.5, less price contingencies and discounting annual expenditures.

/c Including interest payments at 4.32%/year for long-term finance with average term of 4 years and 5.76%/year for short-term finance with average term of 1 year.

/d At Y 50/well/year maintenance plus Y 1,000 per well every 15 years for pump and motor replacement.

/e Net increment in quota and above-quota procurement, valued at the difference between 1982 free market and procurement prices.

6.09 Inclusion of indirect cost recovery substantially increases the cost recovery index. A portion of crops and animal products are sold to the Government at administered prices which are generally lower than prices that

would prevail in free markets. In the future with project, annual government crop procurements at quota and above-quota procurement prices would increase by Y 91 million. The free market value of these procurements would be Y 101 million, and the difference of Y 10 million annually would represent indirect cost recovery. This would raise the cost recovery index to 44%.

6.10 A total cost recovery index of 44% is considered satisfactory. Since per capita farm income at full development would only be US$171, the Government does not intend to impose additional project charges.

7. BENEFITS, JUSTIFICATION AND RISKS

7.01 General. The proposed project would increase yields on a total of 182,000 ha of cultivated land, by additional or improved irrigation on 153,000 ha; improved drainage on 139,000 ha; and improvement of 47,000 ha of Shajiang black soil. Wheat and maize would continue to be the principal crops, but 14,000 ha would be converted from foodgrains or wasteland into oilseeds or fiber crops. About 25,000 ha of wasteland would be brought into cultivation, forests or orchards. At full development, approximately 280,000 families, or 1.2 million individuals, would benefit directly from increased production. The annual demand for farm labor would increase by about 15 million man-days, equivalent to about 50,000 full-time jobs. The network of rural roads and electrification completed by the project would improve market access and facilitate the development of rural sideline industries. The research and extension infrastructure developed by the project would be of future benefit to an administrative area four times the size of the project area. The project would serve as a large-scale trial and demonstration of techniques for desalinization, which could subsequently be applied to the remainder of some 6 million ha of land affected by salinity and waterlogging. The project would meet the Government's objectives of increased production of food and fiber crops at a capital cost of about US$570 per benefited farm family, or US$800 per hectare. At full development, the project would result in a reduction in annual imports of grain worth US$27 million; soybeans worth US$4 million; oilseeds worth US$12 million; and fiber crops worth US$26 million, totaling US$69 million.

7.02 Foreign Exchange. All tradeable components are valued directly in foreign exchange and converted to local currency at the official exchange rate of Y 1.7 = US$1 /1 and adjusted for local transport and handling. No detailed studies of conversion rates for foreign exchange or local conversion rates have been conducted, but preliminary and tentative estimates were made and

---

/1 Exchange rate at time of appraisal.

used in the sensitivity analysis. The conversion factors were 1.05 for agricultural products and byproducts, 2.99 for electricity, 1.46 for fuel, 0.98 for lumber, 1.03 for cement, 1.17 for steel, and 1.04 for locally procured machinery.

7.03 Farm Labor. At full development, there would be about 280,000 farm families in the project area, with an average family size of 4.6 persons. During peak periods about 1.7 workers per family would be available for farming activities. Assuming 25 workdays per month at peak periods, the monthly labor available would be 11.9 million man-days. Total labor requirements in crop cultivation were estimated by activity and month (Annex 3) and total monthly labor requirements in the future with and without project are shown in Annex 4. Labor requirements in tree planting were also estimated (Annex 3). The peak monthly demand falls in June and September and is 9.1 million and 8.4 million man-days respectively, compared to the available supply of 11.9 million man-days. The balance of the labor force in these months would be fully utilized on animal husbandry and private plots. As an estimate of a market wage rate (Y 1.60/man-day), the economic analysis utilizes the average value of distributed collective income per manday, adjusted to the standard of a 15 work point man-day and valuing distributed commodities at free market prices.

7.04 Investment Costs. As calculated for the economic analysis, total investment cost is US$151 million (including physical contingencies but excluding price contingencies). In determining the US$ value, local costs were converted at the official exchange rate of US$1 = Y 1.7.

7.05 Operation and Maintenance Costs. The estimated annual O&M costs are US$2.5 million; additional costs of US$1.6 million for replacement of tubewell pumps and equipment are incurred at 15-year intervals. O&M costs include pump station staffing (US$0.01 million); maintenance of off-farm and canals (estimated at annual earthwork requirements of 2.7 cu m/m of main or branch drain and 1.5 cu m/m for laterals and sublaterals, at Y 1/cu m, or US$1.5 million total); maintenance of structures (at 2% of original cost annually); repair of the electric power network (at 3% of initial cost or US$0.2 million); and tubewell maintenance (at US$29/well/year, totalling US$0.4 million). On-farm repair costs and depreciation, including maintenance of on-farm drainage and irrigation channels and farm machinery, are accounted for in farm production costs.

7.06 Production and Benefits. Expected future yields, cropping intensities and production with and without the project are discussed in Chapter 5. The physical input requirements, unit prices and labor requirements are presented in Annex 3, and the gross and net economic returns and labor costs in crop cultivation in Annex 4. Production, unit costs, and net returns to tree planting are computed in financial prices in Annex 3. Due to the lack of international price data, the economic returns to this subsidiary activity are evaluated at financial prices. A summary of project benefits is shown in Table 7.1.

Table 7.1: SUMMARY OF ECONOMIC BENEFITS /a
(US$ million)

	Net annual return to project area without costing farm labor		Incremental net return	Less incremental farm labor cost	Incremental net value of production
	Without project	With project			
Crops	123.5	192.1	68.6	10.5	58.1
Trees	6.7	22.6	15.9	3.6	12.3
Total	130.2	214.7	84.5	14.1	70.4

/a At full development 1991 for crops, and 1994-97 for trees.

7.07 Distribution of Benefits. Members of the poorer teams within the project areas, that is, those which currently lack irrigation facilities or have a higher proportion of saline land, would receive the greatest benefits from the project. In the recent past credit for other than current input purchases has been largely unavailable to the poorer teams, whereas higher ability to repay has made it easier for better-off teams to finance further investment. With the project, additional funds would become available and inequity in the distribution of agricultural credit would be reduced.

7.08 According to national statistics on distributed collective income per capita (1979), 16% of production teams had distributions of Y 40 or less per capita, 11% of Y 41-50, 32% of Y 51-80, 16% of Y 81-100, and 25% of over Y 100. Of the nine counties included in the project, two would be classified in the bottom 16%, six in the second-lowest 11%, and one in the median category, based on the official measure of distributed collective income. Noncollective income represents about 60% of total distributed income in the project area which probably exceeds the national average proportion, and helps to narrow the gap between incomes in the project area and the national average. On average, incomes of project beneficiaries fall at the bottom of the second quartile and many into the lowest quartile of the rural income distribution.

7.09 Development Phasing. Project works are phased over the period 1982-86. Benefits would begin almost immediately, as tubewells are installed and drainage systems completed. Crop yields would reach their maximum over the five years after completion of works. The project, including the benefits from tree planting would reach full development by 1991 for crops, and 1997 for tree planting (Annex 4).

7.10 Economic Rate of Return. Using the foregoing assumptions and discounting the project's benefits and costs over 30 years the economic rate of return is 30%. The high returns are due largely to the selection of project areas where main drains are in place and shallow groundwater is available for irrigation development.

7.11 Sensitivity Analysis. Sensitivity of the rate of return was tested to cost overruns, reductions and delays of benefits, and the effects of applying estimated conversion factors to project costs and benefits. The effects of these changes in assumptions are shown below. Further testing to determine which variables would be most crucial to the success of the project utilized two meaures of sensitivity: the crossover value and the elasticity./1 The results are presented in Annex 4, and discussed below.

Alternative	Rate of return (%)
A 20% increase in construction costs	26
A combination of 20% increase in construction costs and a two-year delay in project benefits	19
A 25% reduction in project net benefits because projected yields are not reached or costs of production exceed projections	23
Application of conversion factors	33

7.12 The project's economic rate of return showed little sensitivity to variations in the cost estimate or assumptions made concerning the timing of agricultural benefits. The rate of return would be reduced to 19% in case of a combination of a 20% construction cost overrun and a two-year delay in project benefits. The analysis of crossover values indicates that project

/1 The crossover value is the value of the variable tested at which net present value of project costs and benefits (discounted at 12%) is reduced to zero. The elasticity is the percent change in net present value due to a 1% change in the variable.

returns are moderately sensitive to projected increases in crop yields. If yields were to be 15% lower than anticipated, the rate of return would fall to 12%. However, this would entail increases of only 20% in crop yields compared to the future without project. It is highly unlikely that the project would have such a small impact on crop yields. Sensitivity to assumed values of other variables, including crop prices, construction costs, development period, and crop production costs is uniformly low, and there is little likelihood that the crossover values would occur.

7.13 Risks. The project areas have been carefully chosen to maximize the probability of success. Each has an existing main drainage system and each has a pilot area where drainage irrigation and land development techniques have already been successfully demonstrated, therefore, no major technical problems of implementation are anticipated. The project would be the first IDA-assisted agricultural project in China and would be implemented at a time of change in rural institutions and farmers' incentives. However, the basic strength of the county governments should protect the project from any significant administrative problems.

8. AGREEMENTS REACHED AND RECOMMENDATION

8.01 At negotiations, agreement was reached with the Government on the following points:

(a) the provincial governments would ensure that an adequate power or fuel supply is made available for tubewells in the project areas (para. 3.09);

(b) a report presenting the main findings of the soil and water studies, with terms of reference agreed with IDA would be prepared by the central PMO and submitted to IDA for review not later than December 31, 1986 (para. 3.16);

(c) by August 31 of each year, detailed work plans for the following year would be prepared for IDA review (para. 3.22);

(d) unit prices for the items listed in Annex 8 have been agreed with IDA (para. 3.28);

(e) the county and provincial PMOs would maintain separate accounts for the project. These would be collated and examined by the central Project Management Office and audited annually by independent auditors which are expected to be from the Provincial Bureau of Finance. The project's audited accounts together with the auditor's report would be submitted to IDA within six months of the close of each financial year (para. 3.29)

(f) the Government would ensure that the central Project Management Office would be adequately staffed at all times with experienced and qualified personnel, and that IDA would be consulted about any replacement of the Project Coordinator (para. 4.10);

(g) only seeds certified by or on behalf of the Bureau of Seeds, MOA, would be distributed by the seed companies in the project areas (para. 4.18); and

(h) the North China Plain Agricultural Study would commence by July 1, 1983 under terms of reference agreed with IDA; and that all consultants under the project would be selected in accordance with Bank Group guidelines for consultants (para. 4.21).

8.02 With the above assurances, the project would be suitable for an IDA credit of SDR 54 million (US$60 million equivalent) on standard IDA terms. The Borrower would be the People's Republic of China.

ANNEX 1
Table 1

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Project Cost Summary

	Cost (Y million)	Cost (US$ million)
Earthworks		
Rivers, main and branch drains	10.6	6.2
Lateral and sublaterals	51.9	30.5
Subtotal	62.5	36.7
On-farm Works		
Land smoothing	15.0	8.9
Irrigation ditches	2.6	1.5
Field drains	7.4	4.3
Ditch lining	0.9	0.5
Drying floors	0.2	0.1
Subtotal	26.1	15.3
Structures		
Bridges	16.3	9.6
Other	4.7	2.8
Subtotal	21.0	12.4
Pumping Stations	1.4	0.8
Well Drilling and Housing	28.8	17.0
Pumps and Motors	15.6	9.2
Rural Electrification		
Transmission line	8.1	4.8
Transformers	2.6	1.5
Substations	1.2	0.7
Other	0.8	0.5
Subtotal	12.7	7.5
Roads	2.3	1.4
Agricultural Machinery and Construction Equipment	4.6	2.7
Fertilizer and Agrochemicals	31.8	18.7
Tree Planting	7.4	4.3
Research, Extension and Training		
Equipment	0.8	0.5
Seed breeding	0.9	0.5
Training	1.2	0.7
Buildings	1.0	0.6
Other	1.9	1.1
Subtotal	5.8	3.4
Studies and Training	3.0	1.7
Engineering and Management	8.0	4.7
Base Cost	231.0	135.8
Physical contingency	26.1	15.4
Expected price increases	44.7	26.3
Total Cost	301.8	177.5

ANNEX 1
Table 2

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Schedule of Expenditures
(US$ million)

IDA fiscal year	1983	1984	1985	1986	1987	Total
Earthworks	5.1	10.8	12.1	10.3	3.9	42.2
On-farm works	1.7	4.1	5.3	4.4	2.0	17.5
Structures	1.7	3.7	4.4	3.4	1.1	14.3
Pumping stations	-	-	0.4	0.5	-	0.9
Well drilling	4.5	5.0	5.0	5.0	-	19.5
Tubewell pumps and motors	0.8	3.2	3.3	2.4	0.8	10.5
Rural electrification	1.0	3.0	3.0	1.6	-	8.6
Roads	-	0.8	0.8	-	-	1.6
Agricultural machinery and construction equipment	-	0.4	1.3	1.4	-	3.1
Fertilizer and agrochemicals	-	3.0	3.7	6.0	6.0	18.7
Tree planting	-	-	1.2	2.0	1.1	4.3
Research, extension and training	-	0.8	1.2	1.4	-	3.4
Studies and training	0.3	0.4	0.5	0.5	0.2	1.9
Engineering and management	1.2	1.2	1.0	0.6	0.7	4.7
Base cost plus physical contingency	16.3	36.4	43.2	39.5	15.8	151.2
Expected price increases	0.6	3.6	7.3	9.7	5.1	26.3
Total	16.9	40.0	50.5	49.2	20.9	177.5

ANNEX 1
Table 2A

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Expected Price Increases
(US$ million)

	Total	IDA fiscal year 1983	1984	1985	1986	1987
Local						
Base cost plus physical contingencies	110.2	11.9	26.5	31.5	28.8	11.5
Expected price increases	17.9	0.4	2.4	5.0	6.6	3.5
Foreign						
Base cost plus physical contingencies	41.0	4.4	9.9	11.7	10.7	4.3
Expected price increases	8.4	0.2	1.2	2.3	3.1	1.6
Totals						
Base cost plus physical contingencies	151.2	16.3	36.4	43.2	39.5	15.8
Expected price increases	26.3	0.6	3.6	7.3	9.7	5.1
Total	177.5	16.9	40.0	50.5	49.2	20.9
Annual Escalation Rates (%)						
Local		6.0	6.0	6.0	6.0	6.0
Foreign		8.0	7.5	7.0	6.0	6.0
Multiplier						
Local		0.03	0.09	0.16	0.23	0.30
Foreign		0.05	0.12	0.20	0.29	0.38

ANNEX 1
Table 3

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Estimated Disbursement Schedule
(US$ million)

IDA fiscal year and semester	Cumulative disbursements	%	IBRD/IDA irrigation and drainage disbursement profile (%)
1983			
1st	1.0		
2nd	4.0	7	4
1984			
1st	9.0		
2nd	14.0	23	14
1985			
1st	22.0		
2nd	30.0	50	29
1986			
1st	38.0		
2nd	48.0	80	48
1987			
1st	53.0		
2nd	60.0	100	65
1988			
1st	-		
2nd	-	-	80
1989			
1st	-		
2nd	-	-	91
1990			
1st	-		
2nd	-	-	98
1991			
1st	-	-	100

Proposed closing date: December 31, 1987.

Note: The disbursement schedule was estimated on the assumption that the effective date of credit would not be later than August 1, 1982.

ANNEX 1
Table 4

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Cost Estimates: Tubewells

Item	Amount(Y)
Wages, drilling crew	350
Labor	300
Transportation	150
Fuel and lubricants	170
Pipe, blank, 10 m	60
Pipe, screen, 60 m	360
Gravel pack	300
Foot valve	20
Equipment depreciation	150
Miscellaneous materials	190
Outlet box	250
Building	1,110
Drill and install well: Subtotal	3,410

County	New wells	Existing wells to be equipped	Pumps	Electric motor	Diesel motor
Lingxian	1,130	1,020	2,150	1,050	1,100
Yucheng	1,570	930	2,500	1,700	800
Qihe	2,400	-	2,400	860	1,540
Mengcheng	115	245	360	-	360
Guoyang	155	435	590	80	510
Suixi	770	45	815	400	415
Shangqiu	1,260	525	1,785	890	895
Ningling	680	470	1,150	580	570
Minquan	370	340	710	360	350
Total	8,450	4,010	12,460	5,920	6,540
Unit price (Y)	3,410	-	690	350	750
Amount (Y million)	28.8	-	8.6	2.0	5.0

ANNEX 1
Table 5

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Cost Estimates: Earthwork and Bridges

	Earthwork					Bridges	
	Drains		On-farm works				
	Main & branch	Laterals & sublaterals	Field drains	Irrigation ditches	Land smoothing	Across main drains	Across laterals & sublaterals
	('000 cu m)				(ha)	(no.)	
Lingxian	4,800	10,800	630	1,550	-	90	150
Yucheng	600	13,100	760	1,880	14,100	82	770
Qihe	1,600	13,500	780	1,930	16,000	106	1,360
Mengcheng	300	4,900	280	700	8,900	28	2,430
Guoyang	600	6,300	370	910	6,200	9	1,720
Suixi	1,400	6,000	350	860	2,900	23	2,060
Shangqiu	1,900	9,400	540	1,340	6,300	67	1,580
Ningling	800	5,300	300	750	2,300	68	1,920
Minquan	1,300	4,800	280	700	3,300	65	1,210
Total	13,300	74,100	4,290	10,620	60,000	538	13,200
Unit price (Y)	0.8	0.7	0.6	0.7	250	10,700	800
Amount (Y mln)	10.6	51.9	2.6	7.4	15.0	5.7	10.6

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Cost Estimates - Agricultural Machinery and Construction Equipment

Item	Rating	Price (Y'000)	Qty. (no.)	Amount (Y'000)
Construction				
Bulldozer, 70-80 hp		20.0	2	40
Loader		16.5	3	50
Backhoe		3.0	5	15
Backhoe, 0.5-1.0 cu m		40.0	4	160
Towed scraper		2.0	5	10
Tractors				
Tractor, 25 hp		8.0	50	400
Hand tractor, 12 hp		3.5	720	2,500
Tractor Accessories				
Cultivator, small-scale		1.4	208	290
Plow, double-share		0.1	80	8
Sower, 7-tined		0.5	258	130
Windrow harvester		5.0	2	10
Windrow harvester, small		0.6	280	170
Tractor cart, 1-ton		1.0	200	200
Other Agricultural				
Rotary thresher		0.5	160	80
Power sprayer		0.4	100	40
Sprinkler irrigation		-	-	340
Miscellaneous		-	-	170
Total				4,613

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Cost Estimates - Rural Electrification

Area	10 kV transmission lines			3 80 V transmission lines			Transformers			Expansion/constr. of substation			Other amount	Total amount
	Unit price (Y)	Qty. (km)	Amount (Y '000)	Unit price (Y)	Qty. (km)	Amount (Y '000)	Unit price (Y)	Qty.	Amount (Y '000)	Unit price (Y)	Qty.	Amount (Y '000)	(Y '000)	(Y '000)
Lingxian	-	-	-	4,000	150	600	3,500	170	600	-	-	-	-	-
Yucheng	-	-	-	4,000	630	2,530	3,500	300	1,050	150,000	4	600	-	-
Qihe	3,185	50	160	4,000	105	420	3,500	120	420	150,000	1	150	-	-
Mengcheng	3,185	83	265	-	-	-	-	-	-	-	-	-	-	-
Guoyang	3,185	184	585	4,000	25	105	3,500	40	140	150,000	2	300	-	-
Suixi	3,185	283	900	4,000	160	640	3,500	40	140	150,000	1	150	-	-
Shangqiu	-	-	-	4,000	50	200	-	-	-	-	-	-	700	-
Ningling	3,185	100	320	4,000	225	900	3,500	40	140	-	-	-	80	-
Minquan	-	-	-	4,000	125	500	3,500	40	140	-	-	-	-	-
Total		700	2,230		1,470	5,895		750	2,630		8	1,200	780	12,735

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Research, Extension and Training Expenditures
(Y '000)

	Lingxian	Qihe	Yucheng	Mengcheng	Guoyang	Suixi	Shangqiu	Minquan	Ningling	Total
Equipment	125	85	270	74	135	86	12	0	70	857
Optical	26	10	100	18	40	15	3	0	30	242
Measurement	32	3	4	18	30	25	0	0	14	126
Analytical	24	35	60	18	35	15	8	0	16	211
Seed	5	/a	56	0	0	0	0	0	0	61
Other	38	37	50	20	30	31	1	0	10	217
Seed breeding	0	430	0	0	0	150	120	168	0	868
Training	280	100	100	109	156	165	105	105	70	1,190
Buildings	65	150	100	117	180	114	234	0	0	960
Other /b	320	361	356	395	150	177	10	95	30	1,894
Total	790	1,126	826	695	621	692	480	368	170	5,768

/a Less than Y 1,000.

/b Includes test wells, extension expenses, salaries of some technicians, and miscellaneous research expenses.

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Project Management Cost Estimates
(Y '000)

	Yucheng	Qihe	Lingxian	Shandong Province	Suixi	Guoyang	Mengcheng	Anhui Province	Shangqiu	Minquan	Ningling	Henan Province	Total
Buildings	354	320	356	150	150	140	86	150	92	72	95	150	2,115
Office equipment	24	55	27	20	27	10	10	20	15	15	15	20	273
Supporting Services /a	377	325	250	150	270	252	164	150	124	95	57	150	2,364
Staff /b	229	210	192	-	200	192	190		550	203	248		2,214
Vehicles	63	121	82	50	60	50	50	50	35	34	35	50	680
Furnishings	65	81	43	30	23	18	20	30	15	15	15	30	385
Subtotal	1,112	1,112	950	400	730	662	520	400	831	434	465	400	8,016/c

/a Incremental costs of travel, manning offices, supplies and administrative services.

/b Incremental staff.

/c Staff training costs are not included here but in the Research Extension and Training component.

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Climatological Data

Province	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave.	
Temperature (Average) (°C)														
Shandong	-3.0	-0.5	6.4	13.9	20.7	25.6	26.7	25.7	20.6	14.3	6.2	-0.6	13.0	
Anhui	0.0	2.1	8.1	14.8	20.6	25.9	27.7	26.9	21.6	15.9	8.9	2.5	14.6	
Henan	-0.6	1.7	7.5	14.6	20.5	25.9	27.1	26.3	21.1	15.2	7.9	1.5	14.1	
Average	-1.2	1.1	7.3	14.4	20.6	25.8	27.2	26.3	21.1	15.1	7.7	1.1	13.9	
													Total	
Rainfall (mm)														
Shandong	4	7	10	35	32	64	206	152	53	32	19	6	620	
Anhui	17	25	46	65	67	97	218	129	74	39	29	16	822	
Henan	0	13	28	52	42	81	187	127	70	41	18	11	680	
Average	7	15	28	51	47	81	204	136	66	37	22	11	707	
													Total	
													20 cm pan	60 cm pan (0.68)
Evaporation (mm)														
Shandong	48	77	160	248	313	350	217	175	156	143	85	53	2,025	1,377
Anhui	66	84	148	189	246	322	240	217	167	152	99	70	1,999	1,359
Henan	51	70	133	188	251	308	218	188	157	123	78	55	1,814	1,234
Average	55	77	147	208	270	327	225	193	160	139	87	59	1,946	1,323
													Total	
Hours of Sunshine														
Anhui	163	155	180	194	226	242	228	236	186	196	166	167	2,339	
Henan	164	161	188	203	241	258	233	238	200	204	171	168	2,429	
Average	164	158	184	199	234	250	231	237	193	200	169	168	2,387	

ANNEX 2
Table 2

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Crop Water, Irrigation and Pump Requirements (cu m/ha)

Summary by Province

Crop	Shandong	Anhui	Henan
Cotton			
Crop water requirement	6,370	6,160	6,330
Crop irrigation requirement	2,720	2,780	2,640
Wheat			
Crop water requirement	3,980	3,860	3,880
Crop irrigation requirement	3,030	2,090	2,530
Maize			
Crop water requirement	4,630	4,560	4,680
Crop irrigation requirement	1,580	2,080	1,770
Soybeans			
Crop water requirement	4,810	4,720	4,840
Crop irrigation requirement	1,480	2,100	1,810
Peanuts			
Crop water requirement	5,280	5,060	5,220
Crop irrigation requirement	2,480	2,380	2,310
Rice			
Crop water requirement	7,220	6,960	7,160
Crop irrigation requirement	3,580	3,710	3,550
Sorghum			
Crop water requirement	4,670	4,590	4,710
Crop irrigation requirement	1,350	1,840	1,510
Millet			
Crop water requirement	3,800	3,740	3,820
Crop irrigation requirement	1,100	930	1,120

Crop water requirement = evapotranspiration requirement./a
Crop irrigation requirement = amount of irrigation water required after deducting effective rainfall.

/a Calculated using Radiation Formula (FAO Irrigation and Drainage Paper 24, Crop Water Requirements, Revised 1977).

ANNEX 2
Table 3

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Proposed Irrigation Practices

	---Normal rainfall ---		------Drought/a ------	
	Applications (no.)	Volume (cu m/ha)	Applications (no.)	Volume (cu m/ha)
Wheat	4	2,500	5-6	3,600
Spring maize	4	2,400	4	2,600
Summer maize	3	1,900	4	2,400
Rice	6	4,200	8	6,350
Sorghum/millet	1-2	950	2	1,100
Soybean	1	600	2	1,200
Peanut	1	600	1	800
Cotton	2-3	1,400	4	2,400

/a With a frequency of one in five years.

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Economic Prices of Crops and Farm Inputs, 1982 and 1986 (in 1982 Values)
($/ton or Yuan/ton)

	Wheat /a	Maize /b	Rice /c	Soy-bean /d	Peanut /d	Rape /d	Cotton-seed /d	Cotton /e	DAP /f	TSP /g
1982 Prices										
Import price ($)	229	218	429	427	844	515	367	2,388	293	225
Ocean freight ($)/h	36	36	36	19	19	19	19	19	36	36
CIF Qingdao ($)	265	254	465	446	863	534	386	2,407	329	261
CIF Qingdao (Y)	451	432	791	758	1,467	908	656	4,092	559	444
Plus:										
Port charges	25	25	25	25	25	25	25	25	25	25
Transport: port-wholesalers /i	5	5	5	5	5	5	5	5	3	3
Minus:										
Transport: farm-wholesalers /j	-10	-10	-10	-10	-10	-10	-10	-10	+10	+10
Equals:										
Price ex-mill	471	452	811	778	1,487	928	676	4,112	597	482
Times:										
Adjustment /k	-	-	0.70	-	0.65	-	-	-	-	-
Plus:										
Milling cost	-	-	29	-	24	-	-	130	-	-
Minus:										
Byproducts	-	-	9	-	24	-	-	419	-	-
Equals:										
Economic price (Y)	471	452	547	778	967	928	676	4,401	597	482
Domestic price (Y) /l	557	363	380	784	1,026	984	223	3,730	542	429
1986 Prices										
Import price ($)	237	226	458	433	719	479	345	2,831	367	256
Ocean freight ($)/h	36	36	36	19	19	19	19	19	36	36
CIF Qingdao ($)	273	262	494	452	738	498	364	2,850	403	292
CIF Qingdao (Y)	464	445	840	768	1,255	847	619	4,845	685	496
Plus:										
Port charges	25	25	25	25	25	25	25	25	25	25
Transport: port-wholesalers /i	5	5	5	5	5	5	5	5	3	3
Minus:										
Transport: farm-wholesalers /j	-10	-10	-10	-10	-10	-10	-10	-10	+10	+10
Equals:										
Price ex-mill	484	465	860	788	1,275	867	639	4,865	723	534
Times:										
Adjustment /k	-	-	0.70	-	0.65	-	-	-	-	-
Plus:										
Milling cost	-	-	29	-	24	-	-	130	-	-
Minus:										
Byproducts	-	-	9	-	24	-	-	396	-	-
Equals:										
Economic price (Y)	484	465	582	788	828	867	639	5,131	723	534
Domestic price (Y) /l	558	364	381	790	1,059	1,094	223	4,311	542	429

/a US No. 1 Soft Red Winter Wheat, FOB Gulf Ports (projected from Canadian reference wheat using equation $Y = 0.267 + 0.852X$ ($R^2 = 0.94$, 13 obs.).

/b US No. 2 Yellow, FOB Gulf Ports.

/c Thai 5% broken, FOB Bangkok, adjusted for quality assuming rice milling standards: 10% high quality (5% brokens); 60% medium grade (25-30% brokens); 30% lower quality (42% brokens). Resulting conversion factor applied to high-quality rice is 0.725. Import prices are used to estimate the economic price because local production is of a variety which is inferior to those exported by China, and is locally consumed as a substitute for other (imported) grains.

/d CIF European ports.

/e Mexican lint SM1-16", CIF Northern Europe.

/f Diammonium phosphate, bulk FOB Florida.

/g Triple superphosphate, bulk, FOB Florida.

/h Based on the following data: average freight rate of wheat, Gulf-Japan, 1979/80 = $36/ton; Gulf-Rotterdam = $17/ton; difference = $19/ton.

/i Average rail freight charge from nearest port (Qingdao, Lienyungang or Tienjin) to food-deficit municipality nearest project site, based on distance and freight rate schedule.

/j Assuming 50 km between collection or distribution point and consumer/distributor location (nearest municipality) and truck freight rates of Y 0.20/ton-km for agricultural products, Y 0.28/ton-km for inputs and Y 0.50/ton surcharge for trips over 25 km.

/k Adjustment from milled rice to paddy-equivalent price (70%); shelled to unshelled peanuts (65%).

/l For TSP (46% P_2O_5), domestic price is average of local products based on nutrient equivalence.

ANNEX 3
Table 2

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Physical Inputs

	Cultivation (% mechanical)	Seed (kg)	Fertilizer N (kg)	Fertilizer P (kg)	Pumping (cu m)
Present					
Wheat	40	170	60	28	2,000
Maize	13	47	56	8	1,500
Rice	63	163	73	30	10,700
Sweet potato	0	225	14	22	50
Other grain	0	20	11	4	300
Soybean	3	65	3	9	150
Rape	17	11	26	9	1,300
Peanut	17	215	19	19	300
Sesame	13	11	17	9	100
Cotton	32	112	58	23	1,250
Kenaf	13	23	81	0	0
Future Without Project					
Wheat	60	170	75	35	2,000
Maize	20	47	70	10	1,500
Rice	91	163	73	30	10,700
Sweet potato	5	225	14	22	50
Other grain	5	20	11	4	300
Soybean	8	65	3	18	150
Rape	25	11	26	9	1,300
Peanut	25	215	19	19	300
Sesame	20	11	17	9	100
Cotton	48	112	58	23	1,250
Kenaf	20	23	90	0	0
Future With Project					
Wheat	100	157	102	48	3,100
Maize	70	47	98	27	2,700
Rice	100	225	116	55	12,100
Sweet potato	100	225	28	31	600
Other grain	100	18	46	15	1,200
Soybean	100	65	18	33	750
Rape	100	11	38	38	2,600
Peanut	80	200	29	40	750
Sesame	100	11	24	7	750
Cotton	100	98	108	41	1,700
Kenaf	100	23	102	0	0

ANNEX 3
Table 3

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Unit Prices
(Yuan)

	Unit	Present		Future /a	
		Financial	Economic	Financial /b	Economic
Cultivation /c					
Mechanical	ha	25	24	25	30
Animal labor on:					
Wheat	ha	70	70	70	70
Rice	ha	110	115	110	110
Rape	ha	25	25	25	25
Cotton	ha	60	65	60	60
Other crops	ha	45	45	45	45
Seeds					
Wheat	ton	555	470	610	530
Maize	ton	365	450	420	535
Rice	ton	380	545	440	670
Sweet potato	ton	250	260	250	250
Other grain	ton	385	400	375	380
Soybean	ton	785	780	790	790
Rape	ton	985	930	1,095	865
Peanut	ton	1,025	965	1,155	905
Sesame	ton	1,545	1,455	1,710	1,335
Cotton	ton	240	285	265	315
Kenaf	ton	1,550	1,830	1,550	1,845
Fertilizer					
Nitrogen	ton	1,200	1,105	1,405	1,345
Phosphorus	ton	930	1,085	1,090	1,160
Pumping /d	'000 cu m	8	22	9	26

/a 1986 prices.
/b Future financial prices for seed assume increased average crop prices received and increased use of commercial seed with project; without project, financial prices of seed retained by farmers would remain unchanged.
/c Conversion factor used to estimate economic price is the unweighted average of factors for machinery, fuel and skilled labor. Future prices assume 4% annual inflation of these cost elements.
/d Conversion factor for electric power generation used to estimate economic price; inflation rate of 4% used to estimate future prices.

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Financial Crop Budgets

	Yield (ton/ha)	Price/a (Y/ton)	Gross Value	Seed	Fertilizer	Water	Cultivation Machine	Cultivation Animal	Agro-chemicals	Other /b	Total	Net value of production
						(Y/ha)						
Present												
Wheat	1.4	557	778	95	98	16	9	41	2	57	318	460
Maize	2.1	450	946	17	75	12	3	39	3	37	185	761
Rice	2.9	380	1,120	62	116	86	14	40	30	109	457	663
Sweet potato	2.6	273	707	56	37	-	-	45	-	17	156	551
Other grain	0.9	559	510	8	17	3	-	45	4	36	113	397
Soybean	0.9	903	813	51	12	1	1	44	1	33	143	670
Rape	0.4	990	403	11	40	11	4	19	2	36	121	282
Peanut	1.1	1,116	1,194	221	40	3	4	38	8	34	347	847
Sesame	0.4	1,731	692	17	29	1	3	39	3	35	127	565
Cotton	0.5	3,868	1,963	27	91	10	7	41	30	75	282	1,681
Kenaf	1.4	955	1,332	36	97	-	3	39	8	43	226	1,106
Future Without Project												
Wheat	1.6	557	900	95	143	18	16	27	2	57	358	542
Maize	2.3	450	1,054	17	109	13	5	36	3	37	221	833
Rice	2.9	380	1,120	62	135	95	25	10	35	109	469	651
Sweet potato	2.6	273	707	56	44	-	1	43	-	17	161	545
Other grain	0.9	559	510	8	20	3	1	43	5	36	116	395
Soybean	1.1	903	949	51	24	1	2	42	1	33	154	795
Rape	0.4	990	403	11	46	12	7	17	2	36	130	273
Peanut	1.1	1,116	1,194	221	47	3	7	34	9	34	354	839
Sesame	0.4	1,731	692	17	34	1	5	36	3	35	132	560
Cotton	0.5	3,868	1,963	27	106	11	13	31	35	75	299	1,663
Kenaf	1.5	955	1,418	36	126	-	5	36	9	43	256	1,162
Future With Project												
Wheat	2.2	569	1,270	95	195	28	27	-	9	51	401	869
Maize	2.9	451	1,315	20	167	24	19	14	3	46	302	1,013
Rice	4.3	392	1,666	99	223	107	27	-	37	107	599	1,067
Sweet potato	4.4	273	1,194	56	73	1	27	-	1	40	198	996
Other grain	1.9	546	1,013	7	81	10	27	-	9	44	179	834
Soybean	1.4	910	1,244	51	61	5	27	-	7	41	192	1,051
Rape	0.8	1,101	914	12	95	23	27	-	4	46	206	708
Peanut	1.8	1,152	2,112	231	84	3	22	9	22	35	406	1,706
Sesame	0.8	1,917	1,606	19	41	3	27	-	4	40	134	1,472
Cotton	0.7	4,471	3,240	26	196	15	27	-	53	81	399	2,842
Kenaf	1.8	1,026	1,888	36	143	-	27	-	29	40	275	1,613

/a Including crop byproducts except as used for draft animal fodder or composted.
/b "Other" includes remaining expenses in cultivation as well as maintenance, tool repair, depreciation, interest, and management expense.

ANNEX 3
Table 5

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Crop Labor Requirements by Activity
(man-days/ha)

		Land preparation	Transplant /sowing	Appliation of: Manure	Fertilizer	Pesticide	Weeding /hoeing	Irrigation	Harvest /a	Other /b	Total
Wheat	P /c	19	17	32	11	3	10	8	21	11	133
	FW /d	13	17	39	14	4	10	7	25	13	142
	FW /e	7	3	61	19	11	10	11	33	13	169
Maize	P	18	4	34	18	9	21	9	33	21	167
	FW	17	5	38	23	12	21	9	35	26	184
	FW	10	4	57	35	20	21	15	45	23	232
Rice	P	29	39	39	14	12	12	29	35	4	213
	FW	20	39	47	14	13	13	29	35	4	213
	FW	25	45	77	24	23	20	33	65	5	317
Sweet potato	P	15	51	20	0	0	30	0	41	15	173
	FW	15	51	20	0	0	30	0	41	15	173
	FW	7	51	21	10	3	31	1	69	15	207
Other grain	P	18	7	25	0	8	20	2	36	17	127
	FW	18	7	25	0	8	20	2	36	17	127
	FW	3	7	34	9	11	19	8	62	19	173
Soybean	P	10	8	5	0	5	11	0	22	19	80
	FW	9	8	7	1	7	11	1	27	19	90
	FW	7	8	13	5	9	11	4	35	21	111
Rape	P	13	19	31	13	6	6	0	19	6	113
	FW	13	19	31	13	6	6	0	19	6	113
	FW	7	19	36	18	13	6	11	38	7	155
Peanut	P	13	19	24	8	8	12	2	53	9	147
	FW	13	19	24	8	8	12	2	53	9	147
	FW	10	13	31	12	22	12	2	87	11	198
Sesame	P	8	5	15	4	2	16	6	41	10	107
	FW	8	5	15	4	2	16	6	41	10	107
	FW	3	5	17	6	2	16	6	81	11	147
Cotton	P	38	29	47	13	13	40	10	69	54	313
	FW	32	29	47	13	13	39	10	69	54	307
	FW	13	29	74	25	22	39	13	97	63	376
Kenaf	P	19	2	18	5	2	10	-	48	30	133
	FW	18	2	17	10	7	9	-	51	30	145
	FW	7	2	17	13	11	9	-	62	32	154

/a Including drying, threshing, and transport.
/b Incuding managerial activities.
/c Present
/d Future without.
/e Future with.

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Monthly Labor Requirements by Crop
(man-days/ha)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat	P_	-	3	11	9	4	25	5	9	37	27	3	2	133
	FW	-	3	13	9	5	29	6	9	37	27	3	2	142
	FW	-	3	15	12	9	39	9	13	46	17	3	3	169
Maize	P_	5	5	38	10	10	28	29	26	11	-	-	5	167
	FW	5	5	39	12	11	31	34	29	13	-	-	5	184
	FW	8	8	43	16	11	44	44	34	16	-	-	8	232
Rice	P_	3	3	3	4	29	86	19	18	19	25	-	3	213
	FW	4	4	4	5	30	82	19	18	19	25	-	4	213
	FW	7	7	7	8	41	106	27	27	34	46	-	7	317
Sweet potato	P_	3	3	3	3	3	89	18	3	3	33	11	3	173
	FW	3	3	3	3	3	89	18	3	3	33	11	3	173
	FW	3	3	3	3	7	82	19	7	7	53	18	3	207
Other grain	P_	3	3	36	14	7	10	16	3	32	-	-	3	127
	FW	3	3	36	14	7	10	16	3	32	-	-	3	127
	FW	5	5	35	16	7	16	18	3	64	-	-	5	173
Soy	P_	-	-	-	-	-	22	15	10	12	20	-	-	80
	FW	-	-	-	-	-	25	15	12	14	23	-	-	89
	FW	-	-	-	-	1	31	16	17	17	29	-	-	111
Rape	P_	-	-	14	5	18	5	6	6	48	11	1	-	113
	FW	-	-	14	5	18	5	6	6	48	11	1	-	113
	FW	-	-	22	9	35	9	6	6	50	13	1	3	155
Peanuts	P_	2	2	8	41	12	12	1	9	8	48	2	2	147
	FW	2	2	8	41	12	12	1	9	8	48	2	2	147
	FW	3	3	9	39	11	14	1	23	12	77	3	3	198
Sesame	P_	-	-	-	-	-	36	16	8	25	22	-	-	107
	FW	-	-	-	-	-	36	16	8	25	22	-	-	107
	FW	-	-	-	-	-	31	18	9	48	41	-	-	147
Cotton	P_	6	7	55	43	33	15	13	12	29	49	37	14	313
	FW	6	7	51	42	33	15	13	12	29	49	37	13	307
	FW	9	10	55	49	35	17	20	17	39	67	43	12	376
Kenaf	P_	2	3	26	7	9	3	2	4	18	34	20	6	133
	FW	2	3	25	11	9	3	5	7	19	36	21	5	145
	FW	2	3	17	13	11	3	7	9	23	43	22	3	154

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Financial Budget in Tree Planting
(units/ha/year)

	Units	Forest		Orchard		Field borders		Intercropping	
Age /a	years	1-10	11-20	1-7	8-40	1-10	11-20	1-10	11-20
Production									
Lumber	m^3	-	6	-	-	-	0.6	-	0.8
Fruit	tons	-	-	-	13	-	-		
Firewood	kg	2,475	4,125	560	1,500	375	750	525	975
Gross value	Y	150	1,155	30	3,915	15	135	30	270
Lumber	Y	-	900	-	-	-	90	-	210
Fruit	Y	-	-	-	3,825	-	-	-	-
Firewood	Y	150	255	30	90	15	45	30	60
Material cost /b	Y	75	-	210	900	30	-	30	-
Depletion allowance	Y	-	105	-	15	-	-	-	15
Net value	Y	75	1,050	-180	3,000	-15	135	30	255
Labor	days	45	30	300	450	15	15	15	15

/a Following transplanting and preceding replanting.

/b Excluding initial investment cost, which is included in project expenditure.

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Financial Benefits from Tree Planting With Project
('000 units)

	Units	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Forest														
Area /a	ha	9	13	18	18	18	18	18	18	18	18	18	18	18
Net return	Y	2,840	3,170	3,510	3,510	3,510	3,510	3,510	3,510	3,510	3,510	7,810	12,110	16,405
Labor	days	370	560	760	760	760	760	760	760	760	760	700	630	560
Orchard														
Area /a	ha	3	3	4	4	4	4	4	4	4	4	4	4	4
Net return	Y	4,200	4,070	3,950	3,950	3,950	3,950	6,180	8,420	10,660	10,660	10,660	10,660	10,660
Labor	days	980	1,190	1,400	1,400	1,400	1,400	1,510	1,610	1,720	1,720	1,720	1,720	1,720
Field borders														
Area /a	ha	77	110	150	150	150	150	150	150	150	150	150	150	150
Net return	Y	1,700	1,120	540	540	540	540	540	540	540	540	6,340	12,140	17,940
Labor	days	1,150	1,730	2,310	2,310	2,310	2,310	2,310	2,310	2,310	2,310	2,310	2,310	2,310
Intercropping														
Area /a	ha	30	45	60	60	60	60	60	60	60	60	60	60	60
Net return	Y	2,690	3,130	3,570	3,570	3,570	3,570	3,570	3,570	3,570	3,570	6,860	10,150	13,450
Labor	days	460	680	900	900	900	900	900	900	900	900	900	900	900
Totals														
Net return	Y	11,430	11,490	11,560	11,560	11,560	11,560	13,800	16,030	18,270	18,270	31,660	45,050	58,450
Increase WP	Y	63	120	190	190	190	190	2,430	4,660	6,900	6,900	20,290	33,680	47,080
Labor	days	2,950	4,160	5,370	5,370	5,370	5,370	5,480	5,580	5,690	5,690	5,620	5,550	5,490
Increase WP	days	1,210	2,420	3,630	3,630	3,630	3,630	3,730	3,840	3,940	3,940	3,880	3,810	3,750

/a At 1,500 trees/ha for forests, 300 for orchards, 75 for field borders, and 50 for intercropping.

ANNEX 3
Table 9

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Farm Budget: 0.7 ha Farm /a

	Present			Future without project			Future with project/b		
	Area (ha)	Production (kg)	Value (Y)	Area (ha)	Production (kg)	Value (Y)	Area (ha)	Production (kg)	Value (Y)
Crops									
Wheat	0.36	507	282	0.36	581	327	0.35	773	439
Maize	0.19	404	182	0.19	442	202	0.17	487	220
Rice	0.01	22	8	0.01	22	8	0.01	57	22
Sweet potato	0.09	242	66	0.09	242	66	0.06	249	68
Other grain	0.05	49	28	0.05	49	28	0.05	95	52
Soybean	0.10	85	77	0.10	105	90	0.09	127	116
Rape	0.01	4	4	0.01	4	4	0.02	14	16
Peanut	0.02	18	20	0.02	18	20	0.03	61	70
Sesame	0.01	4	7	0.01	4	7	0.01	12	22
Cotton	0.11	53	206	0.11	53	206	0.12	88	392
Kenaf	0.02	21	20	0.02	23	21	0.02	29	30
Farm Income									
Gross crop income	0.96		900	0.96		979	0.93		1,446
Production costs			230			256			325
Net Crop Income			670			724			1,122
Income from tree crops			47			41			137
Other income			101			101			101
Less taxes			15			15			15
Net Farm Income			803			851			1,345
Per capita income			173			183			290

/a For the "average" farm, a typical farm would not be as diversified as here implied. Based on Annex 3, Tables 4, 8 and 10.

/b For crop cultivation, 1991; for tree crops, the average of 1994 and 1997.

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Total Monthly Labor Requirement for Crops
('000 man-days)

		Area (ha)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wheat	P	93	-	278	1,019	833	370	2,315	463	833	3,426	2,500	278	185	12,316
	FW	93	-	278	1,204	833	463	2,685	556	833	3,426	2,500	278	185	13,149
	FW	93	-	280	1,398	1,118	839	3,635	839	1,212	4,287	1,584	280	280	15,751
Maize	P	49	245	245	1,862	490	490	1,372	1,421	1,274	539	-	-	245	8,183
	FW	49	245	245	1,911	588	539	1,519	1,666	1,421	637	-	-	245	9,016
	FW	45	360	360	1,935	720	495	1,980	1,980	1,530	720	-	-	360	10,440
Rice	P	2	6	6	6	8	55	163	36	34	36	48	-	6	405
	FW	2	8	8	8	10	57	156	36	34	36	48	-	8	405
	FW	4	25	25	25	29	148	382	97	97	122	166	-	25	1,141
Sweet potato	P	24	71	71	71	71	71	2,118	428	71	71	785	262	71	4,117
	FW	24	71	71	71	71	71	2,118	428	71	71	785	262	71	4,117
	FW	15	46	46	46	46	107	1,255	291	107	107	811	275	46	3,167
Other grain	P	14	41	41	497	193	97	138	221	41	442	-	-	41	1,753
	FW	14	41	41	497	193	97	138	221	41	442	-	-	41	1,753
	FW	14	69	69	483	221	97	221	248	41	883	-	-	69	2,387
Soy	P	24	-	-	-	-	-	530	361	241	289	482	-	-	1,928
	FW	24	-	-	-	-	-	602	361	289	337	554	-	-	2,145
	FW	25	-	-	-	-	25	778	402	427	427	728	-	-	2,786
Rape	P	3	-	-	38	14	49	14	16	16	130	30	3	-	305
	FW	3	-	-	38	14	49	14	16	16	130	30	3	-	305
	FW	5	-	-	103	42	164	42	28	28	235	61	5	14	728
Peanuts	P	4	9	9	34	176	52	52	4	39	34	206	9	9	632
	FW	4	9	9	34	176	52	52	4	39	34	206	9	9	632
	FW	9	27	27	81	351	99	126	9	207	108	693	27	27	1,782
Sesame	P	3	-	-	-	-	-	90	40	20	63	55	-	-	268
	FW	3	-	-	-	-	-	90	40	20	63	55	-	-	268
	FW	4	-	-	-	-	-	115	67	33	178	152	-	-	544
Cotton	P	27	161	188	1,474	1,152	884	402	348	322	777	1,313	992	375	8,388
	FW	27	161	188	1,367	1,126	884	402	348	322	777	1,313	992	348	8,228
	FW	33	294	327	1,799	1,602	1,145	556	654	556	1,275	2,191	1,406	392	12,295
Kenaf	P	4	8	11	99	27	34	11	8	15	68	129	76	23	505
	FW	4	8	11	95	42	34	11	19	27	72	137	80	19	551
	FW	4	8	13	71	55	46	13	29	38	97	181	92	13	647
Total	P	245	541	849	5,100	2,964	2,102	7,205	3,347	2,907	5,876	5,549	1,619	955	38,800
	FW	245	542	851	5,225	3,053	2,246	7,787	3,696	3,114	6,026	5,629	1,622	927	40,568
	FW	250	830	1,146	5,941	4,184	3,164	9,101	4,644	4,276	8,439	6,566	2,085	1,226	51,669

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Net Value of Production at Full Project Development /a

	Area ('000 ha)	Yield (ton/ha)	Production ('000 ton)	Value /b (Y/ton)	Gross value of production	production costs	Net value of production	Labor costs /c	Net value of production after labor costs
					(Y million)				
Future Without Project									
Wheat	92.6	1.6	148.2	494	73.9	33.2	40.7	21.0	19.7
Maize	49.0	2.3	112.7	576	66.1	11.3	54.8	14.4	40.7
Rice	1.9	2.9	5.6	599	3.4	1.1	2.3	0.6	1.7
Sweet potato	23.8	2.6	61.6	275	16.9	3.9	13.1	6.6	6.5
Other grain	13.8	0.9	12.6	550	6.9	1.6	5.3	2.8	2.5
Soybean	24.1	1.1	26.5	908	23.0	3.7	19.2	3.4	15.8
Rape	2.7	0.4	1.1	872	1.0	0.4	0.6	0.5	0.1
Peanut	4.3	1.1	4.6	901	4.1	1.4	2.7	1.0	1.7
Sesame	2.5	0.4	1.0	1,495	1.5	0.3	1.2	0.4	0.8
Cotton	26.8	0.5	13.6	5,321	72.4	8.3	64.1	13.2	50.9
Kenaf	3.8	1.5	5.7	1,221	6.9	1.0	5.9	0.9	5.0
Total	245.0				276.1	66.2	209.9	64.9	145.0
(Cropping intensity)	137%								
Future With Project									
Wheat	93.2	2.2	208.1	494	102.8	36.9	65.9	25.2	40.7
Maize	45.0	2.9	131.2	576	75.6	14.2	61.4	16.7	44.7
Rice	3.6	4.2	15.3	599	9.2	2.5	6.7	1.8	4.9
Sweet potato	15.3	4.4	66.9	275	18.4	3.0	15.4	5.1	10.3
Other grain	13.8	1.9	25.6	550	14.1	2.5	15.4	3.8	11.6
Soybean	25.1	1.4	34.3	908	31.1	4.9	26.3	4.5	21.8
Rape	4.7	0.8	3.9	872	3.4	1.0	2.4	1.2	1.2
Peanut	9.0	1.8	16.5	901	14.9	3.2	11.7	2.9	8.8
Sesame	3.7	0.8	3.1	1,495	4.6	0.5	4.2	0.9	3.3
Cotton	32.7	0.7	23.7	5,321	126.1	13.2	112.9	19.7	93.2
Kenaf	4.2	1.8	7.8	1,221	9.4	1.2	8.3	1.0	7.3
Total	250.4				409.6	83.0	326.6	82.7	243.9
(Cropping intensity)	133%								
Increment	5.4				133.5	16.8	116.7	17.8	98.9

/a Crop production only; economic analysis for animals and trees unchange of from Annex 3, Tables 8 and 10.

/b Including crop byproducts except those used as fodder for plow animals or recycled as compost.

/c Imputed at average value of distributed collective income; the commodity component adjusted to market valuation.

ANNEX 4
Table 3

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Economic Costs and Benefits
(Y million)

Year		Project cost			Incremental project benefits		
		Capital	O&M	Total	Cultivation	Tree crops	Total
1	(1982)	27.2	-	27.2	-	-	-
2	(1983)	60.9	-	60.9	13.8	-	13.8
3	(1984)	74.1	-	74.1	27.7	-	27.7
4	(1985)	68.5	-	68.5	41.5	-1.8	39.7
5	(1986)	26.4	-	26.4	55.3	-3.7	51.6
6	(1987)	-	4.3	4.3	69.2	-5.6	63.6
7	(1988)	-	4.3	4.3	76.6	-5.6	71.0
8	(1989)	-	4.3	4.3	84.0	-5.6	78.4
9	(1990)	-	4.3	4.3	91.4	-5.6	85.8
10	(1991)	-	4.3	4.3	98.9	-3.6	95.3
11	(1992)	-	4.3	4.3	98.9	-1.4	97.5
12	(1993)	-	4.3	4.3	98.9	0.7	99.6
13	(1994)	-	4.3	4.3	98.9	0.7	99.6
14	(1995)	-	4.3	4.3	98.9	14.1	113.0
15	(1996)	-	4.3	4.3	98.9	27.6	126.5
16-20	(1997-2001)	-	7.0	7.0	98.9	41.1	140.0
21-24	(2002-05)	-	4.3	4.3	98.9	41.1	140.0
25	(2006)	-	4.3	4.3	98.9	27.7	126.6
26	(2007)	-	4.3	4.3	98.9	14.3	113.2
27-30	(2008-11)	-	4.3	4.3	98.9	0.9	100.0
Economic Rate of Return							30%

ANNEX 4
Table 4

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Sensitivity Analysis

	Appraisal value	Crossover value /a	Change	Elasticity
Yields at full development (ton/ha) /c	2.5/0.7	2.1/0.6	-16	6.14
Economic crop prices (Y/ton) /d	480/5,130	240/2,570	-50	2.00
Construction costs (Y million)	262.0	733.6	180	-0.55
Development period (years)	5	8.0	160	-0.63
Incremental crop production costs (Y million)	34.6	101.0	191	-0.52

/a Value of variable tested at which net present value of project costs and benefits (discounted at 12%) is reduced to zero.

/b Percent change in net present value (discounted at 12%) due to a 1% change in the variable.

/c Average future yields of grain and cotton respectively; other yields reduced proportionately.

/d Prices for US No. 1 Soft Red Winter Wheat, FOB Gulf Ports, and Mexican lint SM1-16", CIF Norther Europe, adjusted to farm-gate equivalency; with the economic prices of all other crops reduced proportionately.

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Consulting Services

Soil and Water Studies

1. A comprehensive program of soil and water studies would be carried out in each of the project areas to guide the operation of the projects and provide a basis for the planning and design of future drainage and irrigation projects in the North China Plain. The studies would be undertaken by the technical bureaus in the counties with specialist assistance from the national and provincial agricultural research institutes. The program of studies would include:

(a) observations of changes in soil salinity, both short-term for different leaching procedures and long-term changes during project operation;

(b) observation of changes in water table levels both seasonal and long-term;

(c) maintenance of complete records of quantity and quality of all surface and groundwater use in the project areas;

(d) monitoring of tubewell performance including any changes in water quality and yield;

(e) collection and analysis of data to obtain estimates of recharge;

(f) investigations to determine crop water requirements and develop improved irrigation practices;

(g) soil surveys to supplement and upgrade existing soils maps;

(h) soil and fertility studies to identify factors limiting crop yields; and

(i) location-specific trials on improved technology.

Monitoring and Evaluation

2. A monitoring and evaluation program would be set up in each of the counties. Its purpose would be to monitor agricultural, economic and social impact of the project. Base-line studies of present yields, cropping patterns, crop budgets and farmers' incomes would be collected and changes from the base-line observed in each area following completion of project works. This program would review each year the availability of inputs and performance of supporting services with the aim of identifying problems and formulating solutions. This program would include the procurement of computers for each county and the training of project staff in their use.

Consulting Services

3. A consulting firm experienced in land and water resource development would be employed by the Government to assist the project authorities in setting up the soil and water studies and the monitoring and evaluation program, and to review periodically the findings of both programs. Specialists would visit China on short-term assignment once a year, and perhaps more frequently in the early stages. Short-term training would also be provided for project staff. Estimated inputs for the various specialists are as follows:

Specialist	Man-months
Irrigation and Drainage Engineer /a	8
Soil Scientist	6
Groundwater Engineer	6
Hydrologist	5
Agronomist	4
Agricultural Economist	6
Total	35

/a Study Coordinator.

Cost Estimates

4.

Foreign consultants	US$ 420,000
Vehicles and operating cost	80,000
Laboratory and office equipment	100,000
Overseas training	40,000
Total	640,000

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

NORTH CHINA PLAIN AGRICULTURAL STUDY

Background

1. The North China Plain encompasses an area of over 300,000 sq km covering part or all of the provinces of Hebei, Shandong, Henan, Anhui and Jiangsu. Beijing is located on the northern edge of the Plain. The Huang He (Yellow River) flows across the Plain from the southwest to northeast where it enters the Bohai Bay. Among the many other rivers traversing the Plain the best known are the Hai He in the north and the Huai He which forms the Plain's southern boundary. Except for some mountains in the center of Shandong province the Plain shows little relief and is between 20 and 100 m above sea level.

2. The Huang He has been portrayed as "China's Sorrow" because of the damage and loss of life caused by its devastating floods. Although there is a history of river control works since 200 BC, the river was not successfully controlled until 1949 and flood control works have been progressively developed since then so that some major floods have been passed without serious damage to life and property. Considerable progress has also been made in flood protection works along the many rivers crossing the Plain. In parallel with the successful flood control effort there has, in the past 30 years, been a vast expansion of irrigation both from surface water and ground water. While considerable agricultural benefits have been derived from the flood control and irrigation works, new problems have arisen and fresh opportunities have been created. Flood embankments and other infrastructure interfere with natural drainage patterns creating local drainage problems and the need for more drains and pumping stations. Introduction of canal irrigation without adequate drainage has caused water tables to rise and resulted in waterlogging and salinity, or aggravated these problems where they already existed. In other areas, remote from rivers, groundwater use has exceeded recharge and there has been excessive drawdown of water tables. On the other hand in many areas now protected from floods, droughts and other water-related constraints, conditions exist for considerable increases in crop production through the use of high-yielding varieties and modern inputs.

3. The North China Plain contains some of the best land in China for wheat, corn, cotton and oilseeds and cropping intensities of 140 to 150% are achieved in many areas. There is still potential, however, in many parts of the Plain to raise yields and production which in turn would increase farm incomes and reduce China's imports of foodgrains and cotton. The objectives of the study would be to: (a) identify the main physical, agronomic and financial constraints to higher crop production in selected areas of the North China Plain; (b) formulate agricultural development plans to overcome these constraints; and (c) identify and prepare future agricultural projects.

4. The study would initially concentrate on the lands bordering the Tuhai River in Shandong Province which is parallel to and north of the Huang He. The study area (Area A) would cover about 740,000 ha, of which nearly 50% is uncultivated because of salinity and waterlogging. Techniques for resource evaluation, development planning, and project preparation would be developed in Area A for other areas to be selected in the North China Plain. The study covered by this project will probably include Area A and several other areas. It is likely that there would be some overlap in studies of selected areas, for example a study of a second area could begin before completion of Area A.

5. The study of each selected area would be in three stages. The first stage would aim at providing a broad understanding of the present situation in regard to agricultural development. The second stage would formulate an overall plan for agricultural development in the area, including priorities for development by sub-area. The third stage would include preparation of priority projects identified in the second stage.

6. Stage I would include data collection and analysis relating to:

(a) present land use, crops and crop rotations;

(b) physical constraints such as drought, waterlogging and salinity;

(c) resources available to overcome such constraints including surface and groundwater resources and access to main drains;

(d) socioeconomic factors relating to crop production such as commodity and input prices, labor availability, organization of collectives, sideline activities, etc.;

(e) agronomic factors such as availability of improved crop varieties, seed production and quality, chemical control and fertilizer needs, crop specialization with regard to soil and water regimes, etc; and

(f) other factors bearing on agricultural development such as support services, marketing, storage, processing and credit.

7. Stage II would outline a phased development plan by sub-areas together with proposals for overcoming the main physical, socioeconomic, and agronomic contraints and improving supporting services and other facilities. Criteria for ranking sub-areas in order of priority for development would be developed and then applied in selecting sub-areas for detailed preparation.

8. Stage III would include feasibility studies of several sub-areas with priority for development including designs, cost estimates, and economic and financial analyses.

9. The studies would be carried out primarily by the staff of the provincial and county agricultural bureaus with assistance from specialist institutes at the provincial and central government levels. Technical support would also be provided by local and foreign consultants. The consulting services would probably be best provided through an association between a local consulting entity (several have recently been formed) and a foreign firm. A contract with a consulting firm rather than with individual experts has the advantage that it can include, in addition to specialist services, study tours and training at the firm's offices, computer services, and procurement of instruments, vehicles, etc. needed for the study.

10. The services of the foreign consultant would not be needed on a continuous basis throughout the study, but would consist of one or two visits each year. A preliminary estimate of the man-month input for various specialties together with a cost estimate for the study is shown in Tables 6.1 and 6.2.

Table 6.1: ESTIMATED CONSULTANT INPUT

Specialty	Man-months
Team Leader	12
Hydrologists (2)	8
Water Resource Planners (2)	10
Agriculturalist	8
Economist	6
Soil Scientist	4
Groundwater Engineer	4
Total	52

Table 6.2: COST ESTIMATE

	US$
Local consultants (task force)	150,000
Foreign consultants	620,000
Vehicles and operating costs	120,000
Office equipment	40,000
Micro-computers	70,000
Overseas study tours	60,000
Total	1,060,000

ANNEX 7

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Schedule of Early Events

Activity	Target date
Appoint members of central Project Committee	May 1982
Complete designs of laterals and sublaterals	Aug 1982
Begin local training of project staff	Sep 1982
Start land leveling	Dec 1982
Start rehabilitation of main and branch drains	Oct 1982
Start construction of laterals, sublaterals and structures	Dec 1982
Start construction of tubewells	Dec 1982
Start installation of rural electrification	Dec 1982
Start construction of pumping station	Oct 1982
Start improvement of access roads to project areas	Nov 1982

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Project Progress Report

County _____ Period _____

Work completed/installed	Unit	For period			Cumulative	
		Price	Quantity	Amount	Quantity	Amount
Earthwork and Drains						
Main drain	cu m					
Branch drain	cu m					
Lateral drain	cu m					
Sublateral drain	cu m					
On-farm drain	ha					
Land levelling	ha					
Structures						
Bridge (main)	no.					
Bridge (branch)	no.					
Bridge (lateral)	no.					
Bridge (sublateral)	no.					
Culvert (lateral)	no.					
Culvert (sublateral)	no.					
On-farm culvert	ha					
Pumping station	no.					
Drying floor	sq m					
Other structure _____	no.					
Tubewell /a						
Drilled and cased	no.					
Housing	no.					
Electrification						
High voltage line	km					
Low voltage line	km					
Substations	no.					
Transformers	no.					
Roads						
Asphalt-paved	km					
Earth/crushed stone	km					

/a Costs will be shown separately for deep and shallow wells.

Work completed/installed	Unit	For period Price	For period Quantity	For period Amount	Cumulative Quantity	Cumulative Amount
Machinery and Equipment						
Irrigation machinery						
Tubewell pump	no.					
Other pump	no.					
Electric motor	no.					
Diesel engine	no.					
Construction machinery						
_____	no.					
Fertilizer/Agrochemicals						
DAP	ton					
Carbofuran	ton					
Tree Planting						
Nurseries	seedlings					
Forest	saplings					
Orchard	saplings					
Intercropping	saplings					
Shelter belt	saplings					
Research, Extension & Training						
Equipment						
_____	no.					
Seed breeding farm	ha					
Training	man-mo.					
Laboratory	sq m					
Other building	sq m					
Technical sassistance						
Consultant services	man-mo.					

Work completed/installed	Unit	For period Price	For period Quantity	For period Amount	Cumulative Quantity	Cumulative Amount
Engineering and Management						
Office construction	sq m					
Equipment						
_____	no.					
Expendables	Y'000					
Credit Extended						
Machinery purchase	Y'000					
Animal purchase	Y'000					
Tubewell install.	Y'000					
Fertilizer/chamicals	Y'000					
Seed purchase	Y'000					
Other						
_____	Y'000					

ANNEX 9

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Accounting and Disbursement Procedures for Works Executed by Force Account

1. All of the project works would be carried out by the provinces, counties, and collectives. All of these entities have established accounting systems for keeping track of expenditures on a wide range of activities in the areas for which they are responsible. These accounts are kept in considerable detail and there is believed to be a high degree of control over public funds in rural areas of China. In particular, the communes and production brigades and production teams maintain detailed accounts because of the "work points system" which is the basis for compensating their members.

2. A system to maintain separate accounts for project related construction could be devised but it would have to be instituted in three provinces, nine counties, 85 communes and over 1600 production brigades. Such a system would cover all wages paid and materials consumed and could serve as complete documentation for disbursements against force account work. It would involve, however, a vast amount of data all prepared in the Chinese language and the Chinese script. Clearly, therefore, it would have to be summarized and translated. There is the risk that the implementing agencies would encounter delays similar to those experienced in other countries where force account disbursements rely on complete documentation. This could lead to delays in disbursements and could create shortages of funds which would in turn delay the projects. Even if such a system could be made to work, the Government's auditors would face a difficult problem in relating expenditures to physical progress and this in turn would create problems for the Bank in being sure that the expenditures reported are consistent with the works constructed. This is because the documentation would be in the form of wages, material expenses etc. but there would be no link to physical quantities.

3. An alternative approach, to be implemented for this project, is to disburse on the basis of agreed unit prices for major work items. There is already a considerable amount of data underlying the unit prices which have been used in preparing the project cost estimates and these will be used in the first year of the project. However, special field studies would be undertaken in each province to update and if necessary revise the unit prices for use in subsequent disbursement applications.

4. The counties would each prepare a quarterly report on physical progress in the format shown in Annex 8. This would form the basis for the disbursement application for force account expenditures shown in Table 1. These would be consolidated by the central PMO to produce an application for the project as a whole.

ANNEX 9
Table 1

CHINA

Disbursement Application

Force Account Construction

County: _____ Period: _____

Item	Expenditures (Y)	
	To date	For Period
Earthwork		
Structures		
Well Drilling		
Totals	_____	_____
Amount Claimed	_____	_____

ANNEX 10

CHINA

NORTH CHINA PLAIN AGRICULTURE PROJECT

Related Documents and Data Available in the Project File

A. General Reports and Studies on the Agricultural Sector

A.1 IBRD, "China: Socialist Economic Development," The Main Report and Annex C: Agricultural Development, Report No. 3391-CHA, June 1, 1981.

B. General Reports and Studies Related to the Project

Reports prepared by the project county governments include:

B.1 North China Plain Project Proposal, comprising:
(a) project area description;
(b) proposed project works;
(c) detailed economic costs and benefits; and
(d) annual implementation schedule.

B.2 Supplementary Project Data, June 1981

B.3 Supplementary Project Data, September 1981

B.4 Production Team Surveys

B.5 Drainage Design Criteria

B.6 Project Management Office - Structure and Staffing
Consultant reports include:

B.7 Groundwater Development, by K. Anderson

B.8 Report on Soils, by M. Fireman

B.9 Report on Engineering Aspects and Agricultural Machinery, by J. K. Wang.

B.10 Economic Analysis of Project, by T. B. Wiens

B.11 Report on Proposed Irrigation and Drainage Systems, by C. Houston

CHINA
NORTH CHINA PLAIN AGRICULTURE PROJECT
SCHEDULE OF IMPLEMENTATION

		1982				1983				1984				1985				1986			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
LINGXIAN																					
Detailed Design																					
Construction:	Drains																				
	Structures																				
	Tubewells																				
	Power Lines																				
	Pumping Stations																				
	Buildings																				
YUCHENG																					
Detailed Design																					
Construction:	Tubewells																				
	Drains																				
	Structures																				
	On-farm Works																				
	Power Lines																				
	Buildings																				
QIHE																					
Detailed Design																					
Construction:	Tubewells																				
	Drains																				
	Structures																				
	On-farm Works																				
	Power Lines																				
	Buildings																				
MENGCHENG																					
Detailed Design																					
Construction:	Tubewells																				
	Drains																				
	Structures																				
	On-farm Works																				
	Power Lines																				
	Pumping Stations																				
	Buildings																				
	Roads																				
GUOYANG																					
Detailed Design																					
Construction:	Tubewells																				
	Drains																				
	Structures																				
	On-farm Works																				
	Power Lines																				
	Pumping Stations																				
	Roads																				
	Buildings																				

		1982				1983				1984				1985				1986			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
SUIXI																					
Detailed Design																					
Construction:	Tubewells																				
	Drains																				
	Structures																				
	On-farm Works																				
	Power Lines																				
	Roads																				
	Buildings																				
SHANGQIU																					
Detailed Design																					
Construction:	Tubewells																				
	Drains																				
	Structures																				
	On-farm Works																				
	Power Lines																				
	Buildings																				
NINGLING																					
Detailed Design																					
Construction:	Tubewells																				
	Drains																				
	Structures																				
	On-farm Works																				
	Power Lines																				
	Buildings																				
MINQUAN																					
Detailed Design																					
Construction:	Tubewells																				
	Drains																				
	Structures																				
	On-farm Works																				
	Power Lines																				
	Buildings																				

Figure 3.1

World Bank-23449

CHINA
NORTH CHINA PLAIN AGRICULTURE PROJECT
SCHEDULE OF IMPLEMENTATION

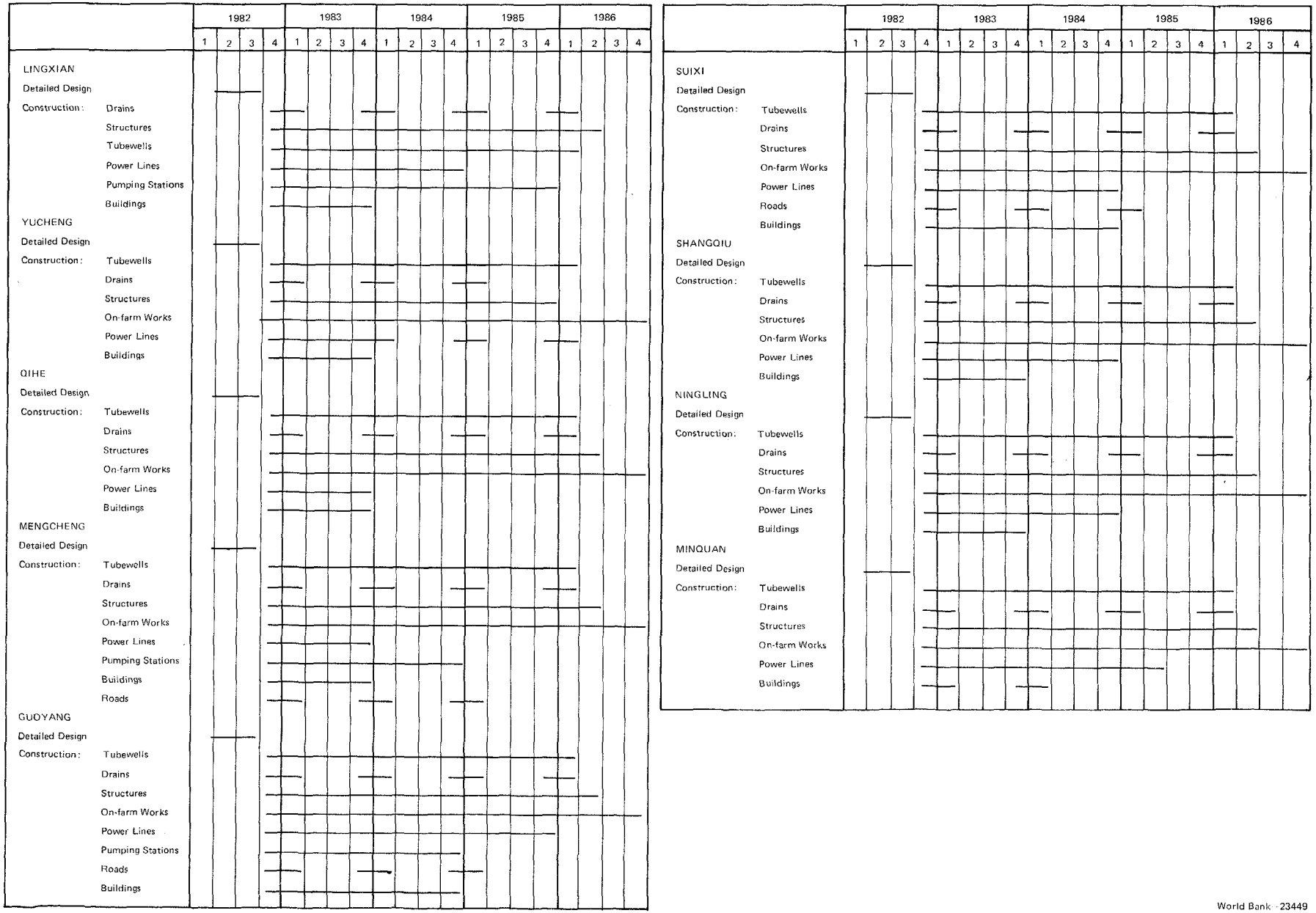
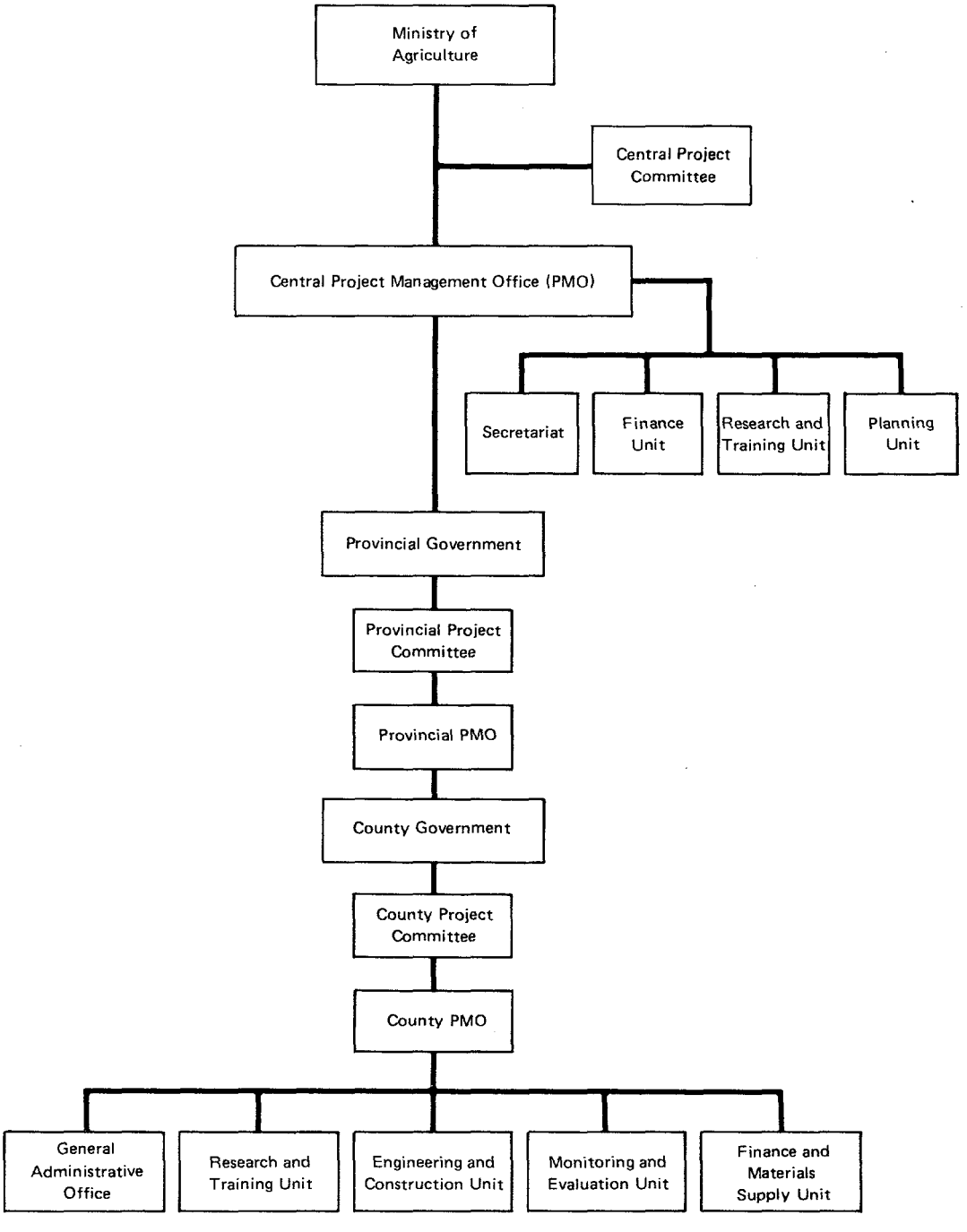


Figure 3.1

World Bank - 23449

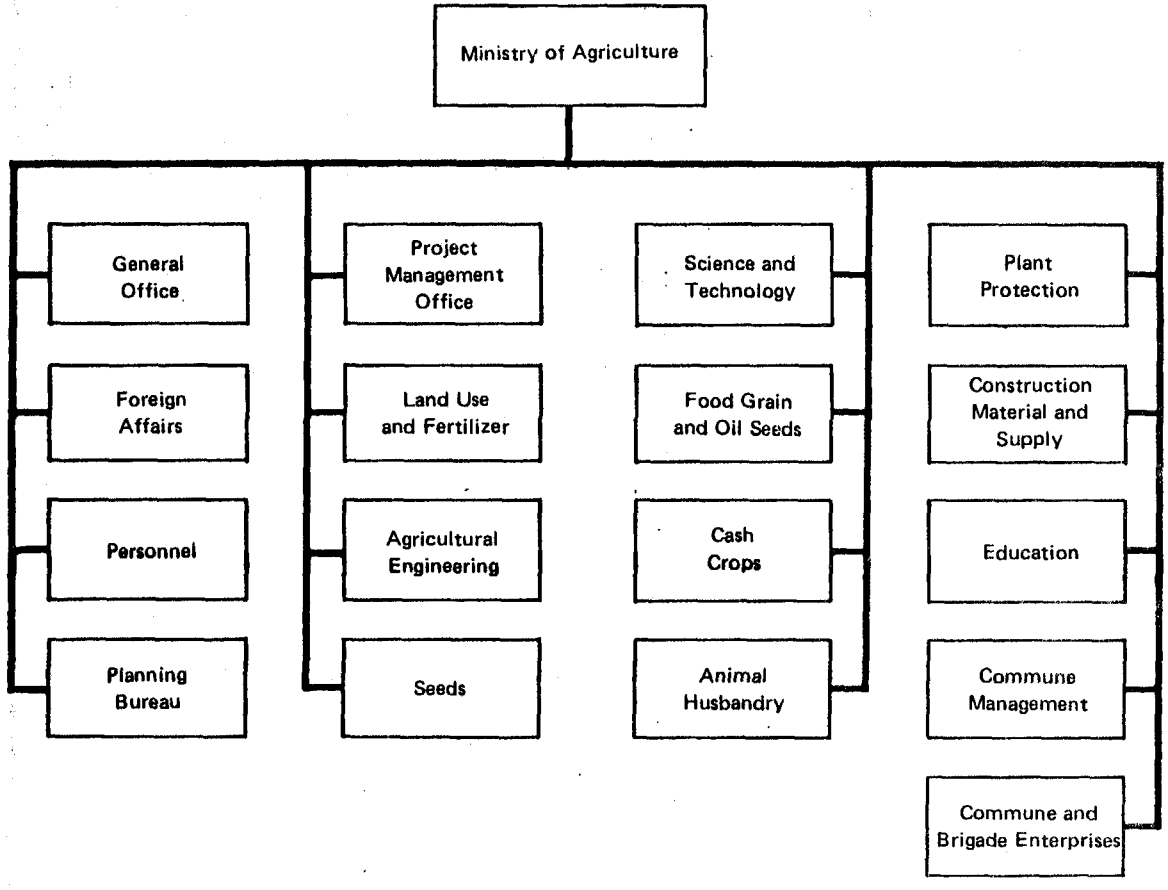
Figure 4.1

CHINA
NORTH CHINA PLAIN AGRICULTURE PROJECT
PROJECT ORGANIZATION



World Bank – 23404

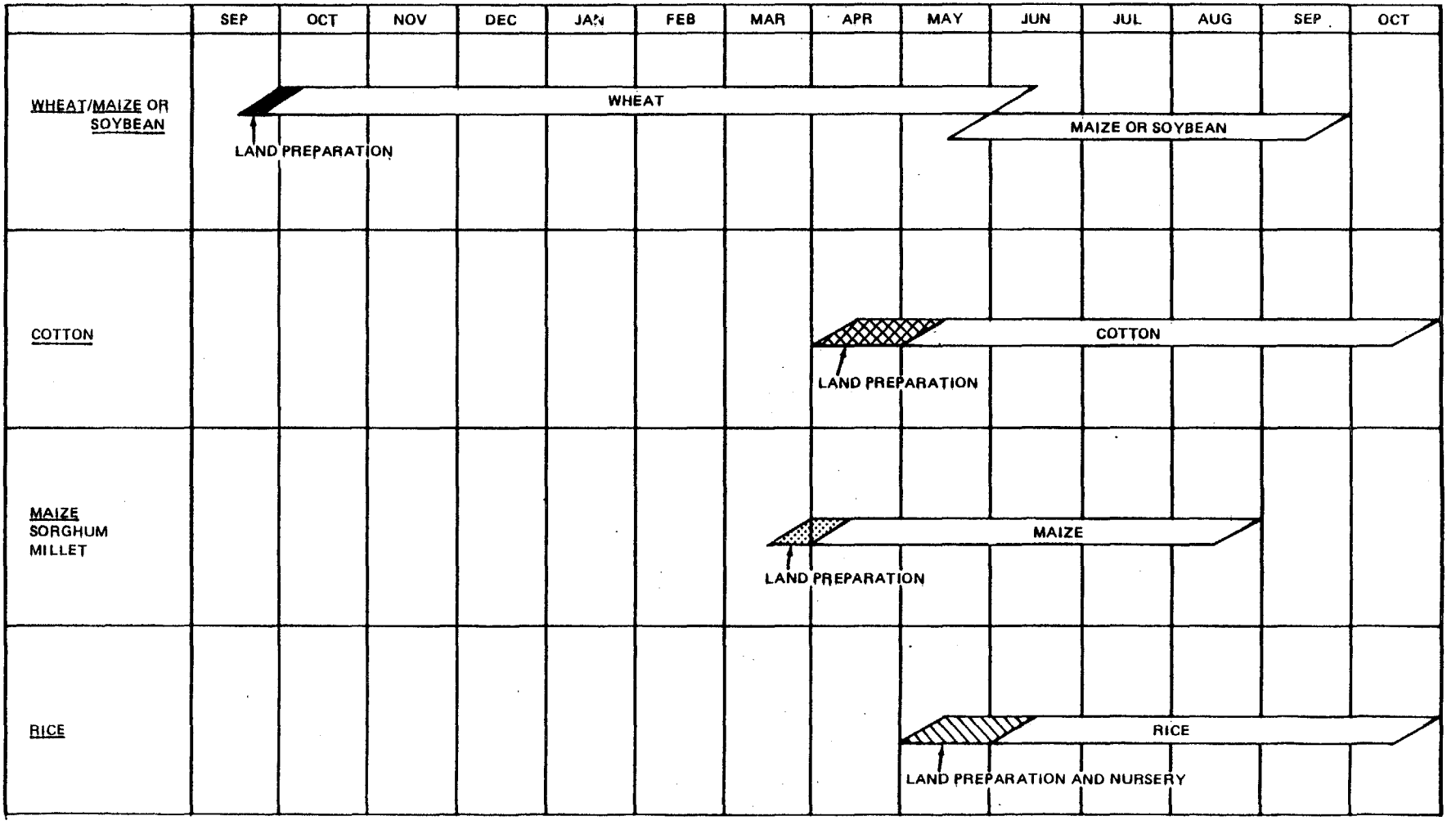
CHINA
NORTH CHINA PLAIN AGRICULTURE PROJECT
ORGANIZATION OF THE MINISTRY OF AGRICULTURE



World Bank -- 23405

Figure 4.2

CHINA
NORTH CHINA PLAIN AGRICULTURE PROJECT
Proposed Cropping Calendar

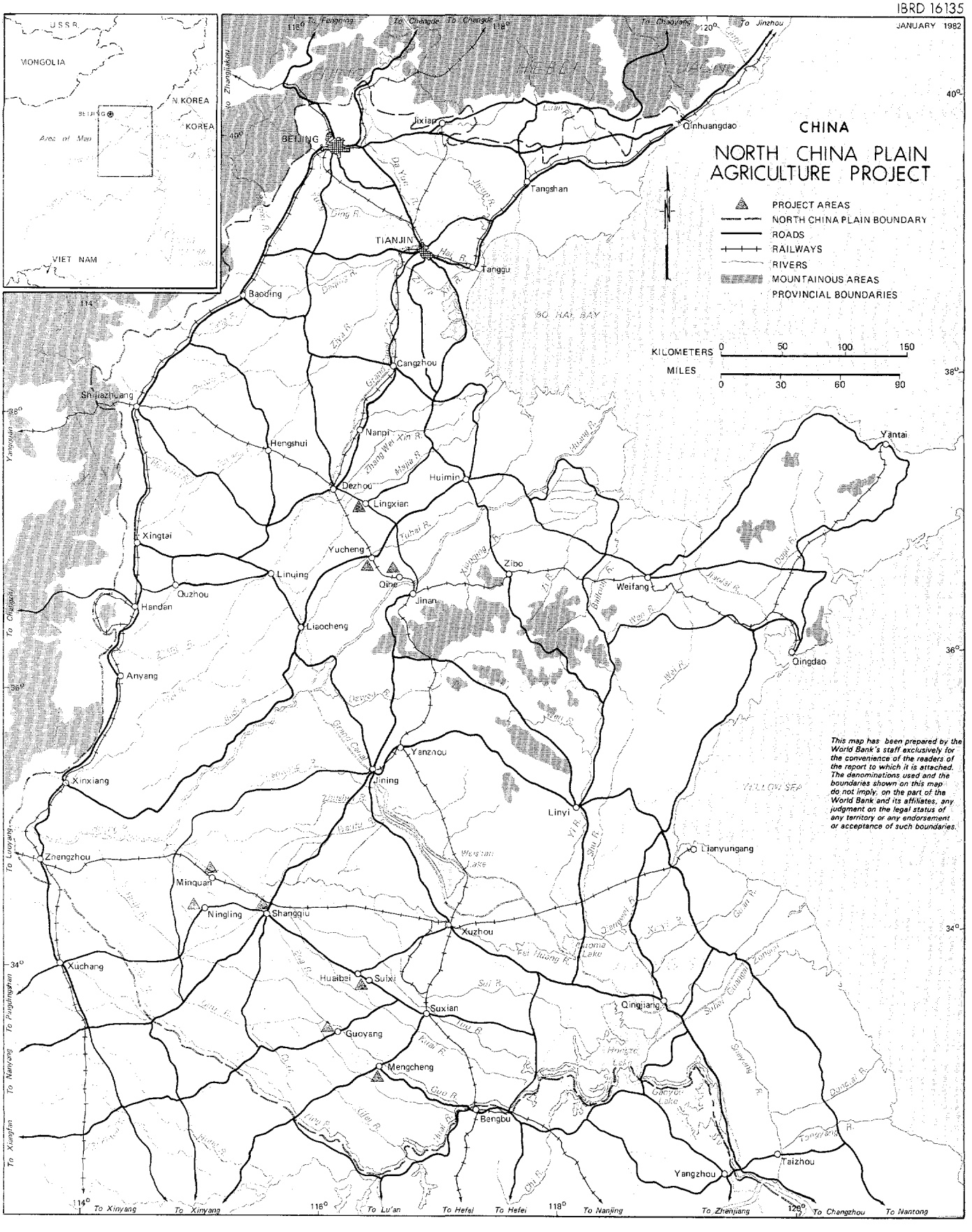


World Bank--23377

Figure 5.1

IBRD 16135

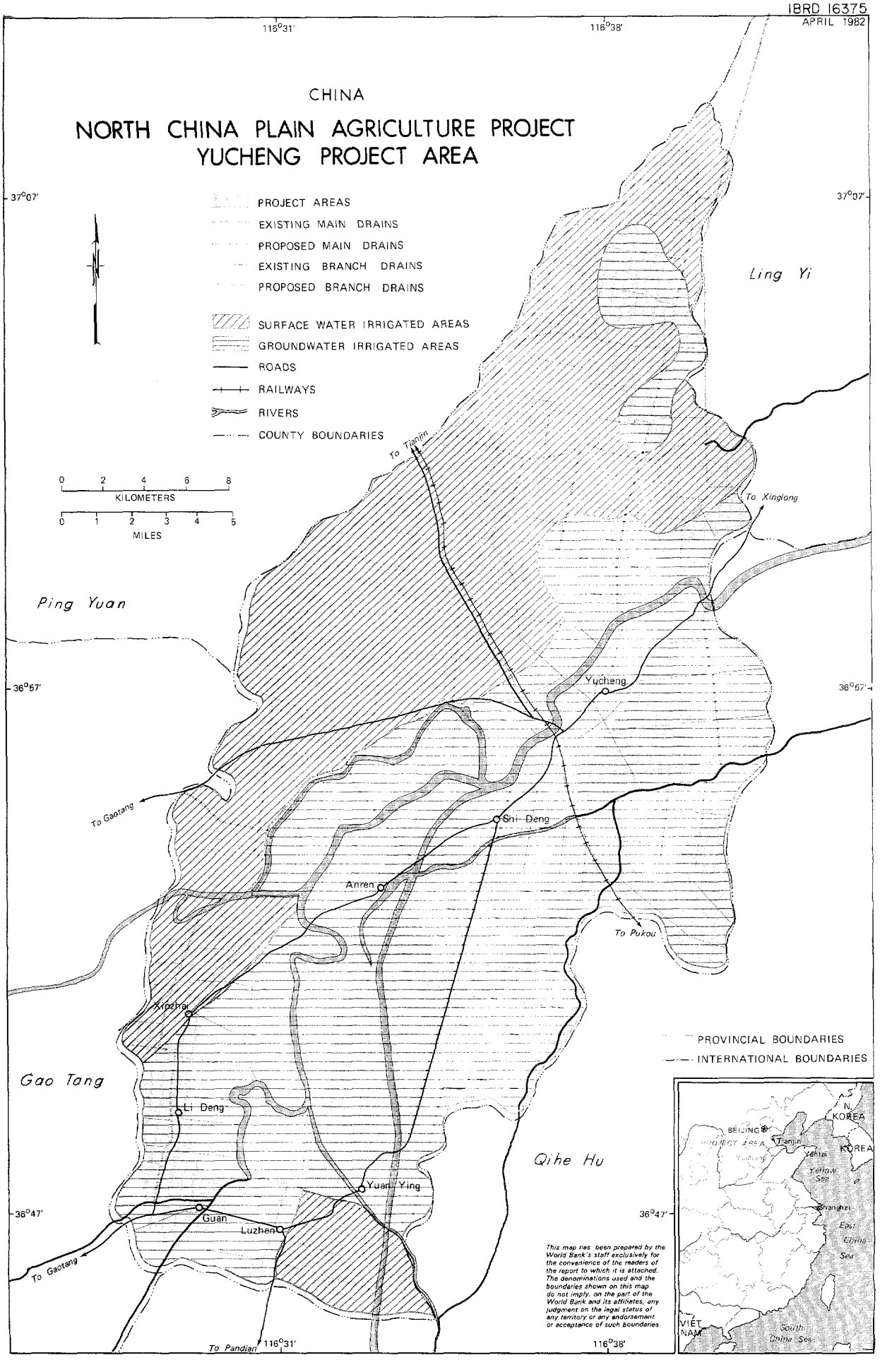
JANUARY 1982



This map has been prepared by the World Bank's staff exclusively for the convenience of the readers of the report to which it is attached. The denominations used and the boundaries shown on this map do not imply, on the part of the World Bank and its affiliates, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.

IBRD 16375
APRIL 1982

CHINA
NORTH CHINA PLAIN AGRICULTURE PROJECT
YUCHENG PROJECT AREA



This map has been prepared by the World Bank's staff exclusively for the convenience of the readers of the report to which it is attached. The denominations used and the boundaries shown on this map do not imply, on the part of the World Bank and its affiliates, any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.