NATIONAL TRANSPORT RESEARCH CENTRE



# INLAND WATER TRANSPORT IN PAKISTAN

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# 1. INTRODUCTION

## 1.1 WATER TRANSPORT:

In the interest of long term overall economy in the country, due attention has to be paid to the development of water transport. The development of water transport can supplement the present modes of moving of goods from Karachi to Inland (an average distance of more than 700 miles) by rail and road and vice-versa including local traffic along the route. During the last decade, the increasing load of traffic has been mostly handled by the Road transport. With the increasing cost of P.O.L. larger amount of money is being spent for transport of goods by road, as the cost of transportation by road is more than double thawt by rail. Transportation costs will be much less by the water transport as per the following figures:

Table 1.1
Cost of Transport by different Modes

| Mode of Transport | Multan Refinery Study | Cost per ton mile Based on US Figures Cents |
|---|---|---|
| 1. | 2. | 3. |
| 1. Road | 29.2 paisas | 3.6 cents |
| 2. Rail | 13.0 " | 1 to 1.5 cents |
| 3. Pipe line | 4.0 | - |
| 4. By Water Transport | - | 0.002 to 0025 cents |

The traffic by river, road and railways would supplement each other rather than competing, as each of them has their own sphere of interest and use. The traffic by road is the quickest though more constly. The traffic by rail is capable of handling much larger bulk. Traffic by river will be the slowest but cheapest and will also have to depend for final distribution on road transport. The same can be stated for the traffic by rial to some extent. The differences lies in the fact that routes for inland water transport by riverine traffic while roads and rails can follows the requirements/demand. Very meagre attention has been paid to development of inland navigation within Pakistan inspite of there being a huge potential in the form of a network of rivers and canals within the country for such development. Most of the work so far in Pakistan has only been paper studies and no actual efforts has been made to develop this mode of transportation. Some efforts since 1958 by Mr. Bakhteyar Hussain, Adviser Inland Water Transport, Ministry of Communications and proposals made by Mr. Mohiuddin Khan General Manager, Master Planning and Review, WAPDA in 1963 and 1975 can only be cited.

At present the construction of network of canals has produced obstacles to development of naviation as no attention at that time was paid towards the possible use of canals for navigation purposes. Also the withdrawal of water by the canals during the low supply season of winter produces stretches of river without appreciable amount of water for navigation purposes, which could have been remedied by use of canals itself for navigation. Unless the water transport becomes a feasible entity, investment for removal of obstacles in the canals cannot be taken up. This has left us, with the Indus river only which can be developed for year round navigation. The major problem in the past and which even now exists is that the Indus river outfall to sea is away from Karachi,Port, the main source destination of goods to be transported. This aspect has been further worsened by the irrigation requirements during the low season when supplies below Sukkur are nil. For using water transport as a regular mode of transportation of goods to up country and vice versa, some sort of system will have to be used from Sukkur to the Karachi Port/ alternatively Qasim Port under construction. This aspect has been a subject of desk study by M/S NESPAK (National Engineering Services, Pakistan Limited) "Reconnaissance Report - Inland Water Route Port Qasim - Sukkur".

Certain objective were set for development of Inland Navigation by Mr. Bakhteyar Hussain in 1968 and the schedule apprars in para 2.6.

## 1.2 NEED FOR ECONOMIC TRANSPORT SYSTEM:

An adequate and economic transport system is an absolute necessity for every country. In the end cost of goods of all types, a substantial component is the cost of transport involved at different stages.

The effects of an inefficient or uneconomic transport system are:

a) Domestic consumers suffers from scarcity and/or pay prices higher than reasonable, resulting in a further lowering of the already low standards of living.

b) In foreign markets, which are highly competitive, exported goods are not able to compete in prices with goods from other countries, resulting in loss of foreing earnings.

Even before the rise of oil prices in the last decade, the cost of transport by inland waterways was lowest in many cases and it has been established that this mode consumes the least amount of energy for each ton/kilometre. In the United states, waterways account for over one quarter of aggregate domestic ton/mileage, at a cost which is only one fortieth of the aggregate freight bill. According to the figures given by the European Conference of Ministers of Transport, 101,000 million tons km of freight were carried on inland waterways in Western Europe in 1973, while in 1955 the corresponding figure was 57,000 million.

In the unit cost of transport by different modes, an important component is the cost of energy or oil consumed. An idea of the prices of energy is given by the price per barrel of crude oil during the last decade.

| Year | Price of one barrel of crude oil in US dollars |
|---|---|
| 1 | 2 |
| Up to 1972 | 1.80 |
| January 1973 | 2.59 |
| December 1973 | 5.03 |
| January 1974 | 11.46 |
| January 1977 | 12.09 (Saudi Arabia and United Arab Emirates) |
| July 1977 | 13.00 (Form other than the above countries) |
| January 1979 | 12.70 |
| July 1979 | 18.00 - 23.50 |
| January 1980 | 21.43 - 34.72 |
| October 1981 | 32.00 - 41.00 |

The rapid increase in prices of energy has made inland water transport (IWT) more economical vis-a-vis other modes because of its low energy consumption.

## 1.3 NEED FOR INLAND NAVIGATION IN PAKISTAN:

Inland navigation is an effective and economical mode of transportation of goods particularly for moderate and longer haulages. Pakistan badly needs this mode of transportation to supplement the carrying capacity of the existing systems of roads and railways which are unable to transport the cargo arriving at Karachi Port regularly without causing any delay. After the construction of Port Mohammad Bin Qasim at Phitti Creek, the volume of carge traffic is expected to increase and therefore additional line of communication in the form of inland navigation becomes a must to take the best advantage of the port facilities.

A good transportation system is the basic need the development of a country. The various modes of a transportation system include Railways, Highways, Waterways, Airways, Pipelines, Conveyors etc. each having a specific field of usefulness. Water transport in the form of Inland Navigation serves as an important and effective means for transporting bulk cargo at moderate cost. In Pakistan, Inland Navigation has become a necessity as is obvious from the following facts:

a) The present Railroad and Highway Traffic System which provide the only link between the Karachi Port and the hinterland need improvements for handling the cargo load that has to be transported from Karachi to upcountry and vice versa.

b) The Government of Pakistan is developing another port namely "Port Mohammad Bin Qasim" and the work is hearing completion. The provision of this port will prove beneficial only when adequate transportation facilities are provided for carrying the cargo from the port to the hinterland. From the data collected by the Karachi Office of National Engineering Services (Pakistan) Limited for the preparation of a detailed Feasibility Report of Port Qasim Project, it is seen that during 1984-85 the imports to be handled at Karachi will be 23.1 million tons as against 14.6 million tons handled in 1969-70 allowing for the iron ore and coal to be used at the steel mill and the crude oil for use at the oil refineries and the local consumption of cargo at Karachi the cargo to be transmitted uncountry is estimated at about 13.6 million tons. This would require about 32 trains, of 60 wagons each, daily for transporting this cargo. Considering the limitations on the availability of locomotives, wagons, and other facilities the railway system is not capable of meeting this volume of traffic. On the other hand, if a combination of rail,road and water transport is used, it will have sufficient capacity to carry all the cargo load coming to the two ports. Thus the inland water route, if provided, will supplement and not supplant the carrying capacity which is available or is likely to be available on the rail and road transport systems.

# 2. STATE OF THE ART

## 2.1 EARLY HISTORY:

Travel by water was among man's earliest and best means of extending the range of his activities, broadening his horizon, and improving his living standards by securing raw materials and exchanging goods. The Egyptians used watercraft during the 4th millennuum BC. Over the centuries this mode of transport developed to meet the differing needs of fighting and trading. Whereas early war vessels were galleys carrying sails but propelled by oars, trading vessels took more generally to sail, and those of the Greeks, and Romans carried a square sail that was deep and wide in contrast to those of the narrower men-of-war. With sail-ing ships, trade routes were opended up, among the earliest known being one from Elath at the head of the Gulf of Aqaba through the Red Sea to Ophir on the Arabian Sea. Because ships were able to carry only small quantities of goods and journeys were long and slow, water transport was expensive, and only luxury goods were carried. Cargoes of precious metals were brought by water in Solomon's day, while from Palestine shipping moved by established routes to southern and western Europe.

## 2.2 FROM SAIL TO STEAM:

Technological advances in the late 18th and early 19th century, particularly the coming of steam and the building of ships of iron and, later, of steel, brought about changes in propulsion and construction that were to lead to the emergence of the world's ferries as they existed up to World War II. Early in the 19th century the successful harnessing of steam to ship propulsion was exploited by traders, who were quick to realize the advantages of speed provided by steam over sail; one trade followed the other in turning to this new power unit. Yet the advantages of sail for long voyages, on which steamships had to be able to carry large amounts of fuel, kept a considerable sailing cargo fleet alive into the 20th century. World War I was the final blow to sail. Initially, steam was used mainly for passengers and mails. One of the earliest passenger steamship services was in Russia between St. Petersburg(now Leningrad) and the Kronstadt fortress; a regular service also operated on the River Neva. In Britain steam packets were used for postal services to Ireland in the 1820s. In the United States large and speedy steamboats operated on the Hudson River; a 1,000-ton vessel accommodated 600 passengers and made 20 knots (nautical miles) per hour. The great increase in world trade contributed to the development in ship construction, design, and propulsion. Despite fears of the skeptics that iron would not float, that ships hulls would become fouled.

## 2.3 TECHNOLOGICAL PROGRESS:

Iron progressively replaced wood. Early steamboats were all paddle vessels, but the inefficient engines not only took up much space themselves but also required huge bunkers to feed their furnaces. This led to problems of payload and the operation of refuelling points. For better propulsion, screw propellers were developed to replace the paddle wheel.

## 2.4 IMPROVEMENTS IN RIVER PORTS:

The changing conditions in ferry operation necessitated the provision of new facilities at the World's ports and harbours to accommodate the greatly increased size and variety of shipping. Efficient services for docking, loading, discharging cargoes, warehousing, and transit of goods from river ports were developed. With increases in their draft, steamboats required deeper channesl and better, docking arrangements. The traditional quay wall berth parallel to the shore, was not easy to adapt to large vessels. The lineal quay, built perpendicular to the shore, overcame this disadvantage; additional length of quay could always be added and the berths thus adapted to accommodate larger boats. In the 19th century considerable port construction was undertaken; docks were dredged deeper, wharves extended outward, and quays lengthened. There were new developments in construction technology, often aided by new materials, such as portland cement, which replaced stone in seawalls.

## 2.5 DEVELOPMENTS AFTER WORLD WAR II:

After World War II IWT underwent several major changes resulting from rapid technological progress in construction and port handling and in the greater development of specialized ships, including the cellular vessel, built or adapted to carry cargo in standard containers. The trade expanded and with it the volume of goods and the variety shipped, accompanied by changes in their directional flow. IWT routes were improved to meet the new requirements. With competition from the air, passenger traffic declined sharply. Of all these changes, the most significant were the strides made in the construction of special purpose vessels for specialized trades to handle the widening range of commodities often carried in entire loads. The multipurpose dry bulk carrier was developed to transport new cargoes, such as iron and steel products, forest products, fertilizers, and automobiles, in addition to the traditional bulk commodities, such as grains, coal, phosphate, sugar, and timber. Specially designed combination vessels carried dry and liquid bulk cargoes in either the same or adjacent holds, the basic combinations being crude oil and mineral ores or other bulk solids. A further development in special-purpose vessels was the so-called roll-on, roll-off ship designed to carry trucks, trailers, and automobiles driven onto the ship through side or interdeck ramps in the bow or the stern. Another unit load system involved loading cargo on pallets (small, light frameworks, usually of wood), carried on deck and offloaded on the pallets at their destination. Roll-on, roll-of services were first developed in the United Kingdom for short sea routes to Ireland and nearby European ports but have become so numerous that many goods are carried overland in this way rather than being sent by sea. The economies obtainable through large scale operation also brought increases in the size of boats limited only by draft and available port facilities.

## 2.6 COASTAL SHIPPING:

Coastal shipping, the function and extent of which varies in different parts of the world according to geographical conditions and sometimes referred to as cabotage, is a separate branch of the shipping industry, generally confined to the coastal waters of a particular country. In those with continental coastlines, such as the United States, Australia, and India, coastal shipping differs little operationally from oceangoing shipping; and in the United States the term is even extended to include the inter-coastal trade between the Pacific and Atlantic coasts via the Panama Canal and the noncontiguous trade between continental Ameraca and outlying areas such as Hawaii. In Europe, where national coastlines are comparatively short, coastal shipping has a more international character.

In the United Kingdom there can be distinguished the purely coasting trade, plying among the islands and along the coast of Great Britian; the home trades,which ply between the United Kingdom and the continent of Europe within the limits of Brest, France, and Hamburg, and the short-sea trade, between the United Kingdom and Scandinavia, the Baltic Sea, and the Mediterranean. Some shipping companies operate liners, tramps, or tankers in all of these trades, while others may specialize in any one.

In the coasting and short-sea trades there are also many specialized vessels, such as cross-channel passenger ships, train ferries, ramp-loading or roll-on, roll-off motor vehicle transport ships specially designed for container traffic as well as colliers and tankers. These tend to be operated by companies specializing in particular routes over which traffic is heavy but localized. As these services often form sea links between, or extensions of railway systems, the railway companies often operate them. Indeed the coastal shipping industry may be regarded as complementary to the inland system of transport communications as well as a link with neighbouring countries; a useful characteristic of the coastal ship is its ability to load cargo directly from the oceangoing vessel for transshipment along the coast and distribution to smaller ports whose depth of water or lack of facilities precludes the direct approach of the larger ship.

Ancillary services. At the port, where the sea transport and inland transport systems meet, many ancillary services must be provided for ships. These include towage, stevedoring, warehousing, replenishment of stores, repair, and maintenance. Paractice varies widely among different ports, the various services being provided by independent contractors, by the port authority, or by the shipping companies. In many ports, particularly those in which large liner companies operate, the companies have their own subsidiary organizations to provide such services not only for their own ships but also for others. Some of the larger shipping groups operate or control fleets of tugs, loading and discharging facilities and labour, warehouses and refrigerated stores, lighterage and land transport, and even provide for the building, repairing, equipment, and maintenance of ships for themselves and for other shipowners.

## 3. ROLE OF IWT

### 3.1 General:

Waterways were the main routes of traffic in olden days and most of the old big inland cities were located along rivers. In the nineteenth century railways came into being and large railway companies started capturing most of the traffic, displacing the water transport. In colonial countries, however, big foreign railway companies were well established. In some of these areas where railway lines were difficult to construct and waterways available a few big river companies were formed which operated for a long time.

### 3.2 IWT in Developed Countries:

In developed countries, which have well-developed road and rail systems as well, inland water transport is continuing to develop fast. Huge schemes for connecting the Rhine to the Rhone and the Rhine to the Danube in Eastern Europe, developing a large network of waterways in the USSR.

Several European countries have preferred the mode of water transportation to other forms of transport for the movement of large bulk goods. In land transportation was developed by Germany and later by France,Belgium and Holland. The development in Russia are examplary, wherein such a landlocked place as Moscow has direct water links to five seas.

3.3 IWT Development in the Region:

ESCAP has been concerned about the lack of growth of IWT and sent an expert provided by the Government of the Federal Republic of Germany to visit seven countries of the region which had a potential for growth of IWT. As a result of detailed discussions with the concerned authorities and extensive touring, the expert formed the view that the lack of growth due to a number of weaknesses, which were to a large extent common to most of the countries.

The common weaknesses are:

a) Countries have no coordinated transportation policy which may ensure meeting their total transport needs at optimum cost and ensure allocation of traffic and distribution of resources on this consideration:

b) There is lack of awareness of the role which IWT can play in national, regional and rural development and in reduction of costs of handling' at ports by making use of LASH vessels, containers etc,

c) Administrative responsibility for the development of waterways is not clearly defined, e.g. between the centre and states;

d) In the systems of administration in which allocation of resources for the coming year is based on the allocations and expenditures during previous years other well established modes of transport which have a stronger say in the Governments, continue to get major shares, with the result that there is a lack of proper administrative organization and infrastructure in the field of IWT;

e) There is a scarcity of technical knowledge of the principles of waterways conservancy and maintenance, design construction, maintenance and operation of vessels and repairs to mechanized equipment. It is, noticed that the contrast between the technologies of developing and developed countries is far greater in the case of IWT than in the case of rail, road, air and sea;

f) Working or prospective working results of IWT undertakings are judged on harsher consideration than justified with no regard for the facts that they have on many occasions to compete with reailways, which indirectly subsidize the freights of bulk commodities, and that the major portion of the infrastructure of the railways and roads was setup at old and much cheaper rates than the rates on which new infrastructures of IWT would be built;

g) Waterways are not generally classified and designs of vessels and equipment are not standardized, which results in higher capital and operational costs;

h) There is a general inadequacy of operationally useful information and of those regular statistics which are required if available waterway resources are to be efficiently used and extended.

To remedy the existing situation and promote IWT. ESCAP intends to adopt a new programme. The objectives of the programme are:

a) To increase awareness of the benefits the economies of developing countries can obtain by developing IWT to the extent possible by discussions with persons at decision-making levels;

b) To assist the countries by studying in detail their problems and upgrading of skills in those areas where it is lacking so that schemes which are taken up are successful and give the maximum ton-Kilometrage at minimum cost;

c) These aims are to be achieved by undertaking studies, organizing seminars/workshops and publishing reports. The seminars/workshops may be regional in the early stages, followed by country level seminars/workshops after some nucleus has been built up within the countries.

To achieve these objectives, ESCAP has framed a long-term action programme. The long-term action programme aims to cover the following topics:

a) Administration and law;
b) Planning techniques and project evaluation;
c) Public policy and user charges;
d) Information and Statistics;
e) Development and maintenance of waterways;
f) Terminal and Landing facilities;
g) Fleet

3.3.1 <u>Work Done by ESCAP:</u>

ESCAP carried out a number of studies in the field on inland waterways transportation in the 1950s. However, because of urgent and pressing needs in the field of inland water transport in the developing countries of the region, ESCAP formulated and began to implement a new strategy of assistance. A seminar on Harbour Equipment and Inland Navigation was organized in France in 1976 with the financial support of the French Government, which provided a forum for the discussion of common problems among the developing countries.

In 1976/77, a study of why IWT had not been able to fulfil its proper role was made by an expert, whose services were made available to ESCAP by the Federal Republic of Germany and who visited seven countries of this region. From the discussions in the Seminar and from the study, it was realized that most of the countries suffered from a number of common administrative and technical problems. The action programme prepared by the ESCAP secretariat in an attempt to meet those short-comings was endorsed by the Committee on Shipping, and Transport and Communications at its first session in 1977 and by the Commission at its thirty-fourth session in 1978. The present Seminar is a part of the action programme and is the first of the two seminars which UNDP has agreed to fund.

In view of its low energy cost per unit of cargo carried, inland water transport will become increasingly competitive as the cost of energy continues to rise. Moreover, in a number of rural and deltaic areas of the region, inland waterways provide the only economic mode of transport and their development is of vital significance for the welfare of the inhabitants of the least developed among the developing countries.

Among a number of areas of major importance inlcuded in the action programme, of highest priority are matters of national policy, problems which must be solved at thenational level. There has to be also an appreciation at the highest policy-making levels of the benefits which could be derived at the national and regional levels by developing inland waterways. There has to be knowledge of the latest techniques which have been adopted by the advanced countries to assess their total requirements of transport and the optimal distribution of traffic among competing modes. The requirements of the administrative system to meet the needs of development of inland waterways and the legislation and regulatory framework required for developing navigation on international waterways have to be known.

## 3.4 BACKGROUND OF IWT IN PAKISTAN

### 3.4.1. General:

The idea of providing inland navigation on river indus and main canals in Pakistan has been discussed during past two decades by various Government and non-Government agencies such as Ministry of Railways and Communications, the defunct Central Engineering Authority, West Pakistan Irrigation and Power Department, Water and Power Development Authority, Messrs Tipton and Kalmbach, Harza Engineering Company and U.S. Army Corps of Engineers. Very conflicting views have been expressed by these agencies. Some agencies consider inland navigation in Pakistan as "definitely unpromising" while other vehemently support it is being the safest alternative route in case an emergency.

It was on 30th September, 1959, that a direvtive was issued by the President of Pakistan for carrying out a study to make river Indus navigable and also for studying feasibility of utilizing existing irrigation canals for navigation. Accordingly some studies were ca carried out but no definite recommendations could be made. In 1963 Mr. Mohi-ud-din Khan, then Deputy Secretary Irrigation Department, presented a paper in the West Pakistan Engineering Congress titled "Inland Navigation in West Pakistan-a few proposals". The paper outlined the possibility of avigation from Karachi to Kalabagh. Later in 1967, in pursuance of another directive issued by the President of Pakistan, the Survey and Investigation Circle, Sukkur, of the West Pakistan Irrigation Department investigated a part of Mr. Khan's proposal covering the reach from Sukkur to G.M. Barrage and put forward some possible alignments of the navigation channel in this reach. Details of these alignments have been furnished in 6 reports titled "Navigation Report" by the Irrigation Department. Even in these reports, no concrete recommendations were given about the feasibility of navigation. In view of the present inadequacy of the rail and road transportation systems to handle the ever increasing cargo load at Karachi Port and the rising prices of fuel, the Government of Pakistan once again desired to investigate the possibility of having an inland water route which could coonect Port Qasim and up-country. National Engineering Services(Pak) Limited were invited by the Government to undertake the prefeasibility study and give definite recommendations on the fruitfulness of detailed feasibility study.

### 3.4.2 River Indus:

River Indus also known as Nilab, Aba Sien, Sindhu and Mehran in the past, is one of the major rivers of the world, with a total length of nearly 2,000 miles and a catchment area of 354,760 square miles. The source of this mighty river is somewhere near lake Mansrowar, north-east of the Kailash Parbat Tibet, 17,000 ft above sea level. After running through various mountain ranges it enters the Punjab Plain near Kalabagh at an elevation of about 800 ft and about 950 miles from the sea. Various tributaries which enter the Indus upstream of Kalabagh include Gartang, Zaskar, Suru, Shyok, Shingar, Gilgit, Siran, Kabul, Haro and Soan rivers.

Below Kalabagh a number of smaller tributaries enter the river, including the Kurram, the Tochi, the Zhob and the Gomal. The last tributary of consequence is the Panjnad, or five waters, which is made up from the confluence of Jhelum, Chenab, Ravi, Beas and Sutlaj rivers. The Panjnad joins the Indus from the east above Mithankot 625 miles from the sea.

Below Mithankot, the Indus flows on an alluvial ridge to enter the Lower Indus Basin at Guddu Barrage. For the remaining 500 miles to the sea there are bunds on both sides of the river except where high land does not warrant this. The gradient from here to the sea is less than six inches per mile. Since the river is fed almost entirely from rain and snow melt in the mountains, the discharge in summer is much greater than in winter.

3.4.3. Navigation in the Past:

River Indus and its tributaries had been functioning as arteries of transport since a very long time. The earliest evidence of navigation on river Indus is provided by a seal and potsherd graffito obtained from Mohenjo Daro. One of them shows a boat with a mast and yard and the other shows a boat with a cabin and a man steering it.

The fact that Alexander crossed Pakistan in 330 B.C with the help of 200 river crafts is another proof of navigation on river Indus. Navigation must have continued during the period of Muslim rulers because the Arabs were believed to be a great maritime nation.

Navigation on rivers, canals and othe water courses (specially river Indus) had developed to a great extent by the end of 14th century. Rennell, while describing various canals and rivers in his book "Map of Hondoostan of the Moghual Empire" comments:

"The Indus and its branches admit of an uniterrupted navigation from Thatta,the capital of Sind, to Multan and Lahore,for vessels of near 200 tons and a very extensive trade was carried on between those places respectively in the time of Aurangzeb; but at present very little of this trade remains,owing to a bad government in Sind and probably to the hostile or repacious disposition of the Sikhs, the present possessers of the countries of Multan and Lahore".

Navigation on river Indus had great importance from defence point of view. While this waterway lent support to the Arab conquerors and also to the Mogals,Rennell's observation in this respect is that it opens a communication between different posts and serves in the capacity of a military way through the country and infinitely surpasses the celebrated inland navigation of North America, where the carrying places not only obstruct the progress of an army but enable the adversary to determine his place and mode of attack with certainty.

In 1835 Government of India placed its first steamer on the Lower Indus. The number of steamers was gradually increased and by 1847 the Indus flottilla, as it was called,' consisted of ten vessels and forty three barges with an aggregate capacity of 10,641 tons.

It operated between Kotri and Sukkur. Primarily, the flottilla was meant for defence purposes and during the War of Independence in 1857 the flottilla was effectively used to rush troops to the battle field. The Flottilla was also being used for commercial purposes. Table 3.1 shows that the trade was quite thriving from year to year.

Table 3.1

Imports & Exports

Pounds ( )

| Year | Export | Import | Total |
|---|---|---|---|
| 1843 | 1,010 | 121,000 | 122,010 |
| 1847 | 154,000 | 287,000 | 441,000 |
| 1851 | 604,000 | 629,000 | 1,233,000 |

The flottilla was grossly inadequate to meet the growing demands of trade, therefore, it was considered prudent to handover the flottilla to some private concern. So, Sind Railway Company who was the owner of Karachi-Kotri Railway took over the operation of the flottilla. In the beginning the government was also a share holder; but later on in 1862 the government withdrew and the flottilla became the sole property of Sind Railway Company.

Towards the end of 1862, the Punjab flottilla started to operate between Kalabagh and Mithankot. Later on the line was extended from Mithnkot to Sukkur in order to attract more trade by eliminating the difficulties of frequent transhipments and the resultant delays. Some native boats were also carrying considerable amount of traffic both up and downstream between Attock and Karachi. These boats were generally owned by boatmen who plied them on hire. The statistics of trade between Punjab and Karachi were registered at Mithankot and are furnished in table 3.2.

Table 3.2

Statistical Comparison

| Year | No.of Boats | Freight (Maunds) |
|---|---|---|
| 1855-56 | 2,771 | 853,444 |
| 56-57 | 3,340 | 1,071,907 |
| 57-58 | 3,548 | 1,199,497 |
| 58-59 | 3,965 | 1,396,397 |
| 59-60 | 3,806 | 1,485,212 |
| 60-61 | 2,945 | 1,111,824 |
| 61-62 | 2,442 | 9,229,824 |
| 62-63 | 3,185 | 1,237,264 |
| 63-64 | 3,485 | 1,265,056 |

An idea of the trade on river Indus can be had from the figure given in Table 3.3. These figures refer to the year 1875-76:

Table 3.3

GOOD TRAFFIC

| Carrier | Down Traffic | | Up Traffic | |
|---|---|---|---|---|
| | Goods | Value(Rs.) | Goods | Value (Rs.) |
| 1. Indus Flottilla | 1. Cotton | 3,723,000 | 1. Piece Goods | 7,055,000 |
| | 2. Oil seeds indigo, sugar | 453,000 | 2. Metals | 1,037,000 |
| | 3. Miscellaneous goods others | 3,587,000 | 3. Miscellaneous | 614,000 |
| | Total: | 8,823,000 | Total: | 8,706,000 |
| 2. Country Boats | Wool oil seeds, wheat | 7,633,000 | Metals, piece goods | 1,462,000 |

Navigation in Indus, however, was not a smooth sailing affairs and therefore a good deal of risk was involved in the trade. Floods, storms, banks, etc. were all parts of such navigational hazards. The goods sent to Karachi from Peshawar and vice versa had to be transhipped four times as no through service was available. The owner was considered to be responsible for all such transhipments. A piece of baggage from Peshawar to Karachi would reach its destination through following different stages:

| Stages | Mode of Shipment |
|---|---|
| Peshawar to Attock | By road |
| Attock to Kalabagh | By Country Boats |
| Kalabagh to Sukkur | By Punjab Flottilla |
| Sukkur to Kotri | By Indus Flottilla |
| Kotri to Karachi | By railway |

Besides this, entirely different freight rates were charged by country boats, Punjab Flottilla, Indus Flottilla and Sind Railways. A fair amount of good luck was required for a piece of goods to reach its destination safe and sound.

## 4. IWT POTENTIAL OF PAKISTAN

### 4.1. Kalabagh to Sukkur Survey - Scope:

On the instance of the Government of Pakistan, (Ministry of Communications), a reconnaissance survey of the Indus river was undertaken by WAPDA to determine the navigability of the Indus river from Tarbela to Sukkur. The survey was carried out as below:

i) Running survey of main creek of the Indus river from downstream of Tarbela to Sukkur was carried out by Echo Sounder. This involved establishment of a datum for the entire river. For the long term information about the depths of water available during the low flow periods staff gauges were erected as required.

ii) Cross-sections at 10 miles intervals were observed covering the entire length of the main creek.

iii) The collection of traffic data and other relevant information.

In order to determine the exact requirements, a field trip was undertaken from Chashma to Kalabagh. As a result of the trip, it was agreed that the work be undertaken by Mangla Dam Organization of WAPDA according to the following work plan:

Phase - I

i) Collection of information regarding gauges discharge observations, gauge sites togather with frequencies of observation of WAPDA and other Government agencies.

ii) Preparation of river plan from recent(November, 1973) aerial photographs, at 1/40,000 scale "of Survey of Pakistan".

iii) Reconnaissance trip by road from Chashma to Sukkur, to plan for the logistics i.e. camping, to arrange for the erection of staff gauges, to find out the access to the main channel from road and the available local facilities.

iv) Hiring arrangements of boats for the survey work.

Phase - II

Having collected the available information for the data to be analysed, a sloping datum for the entire stretch was established. This was done by correlating gauge data releases from various barrages. It was proposed to setup gauges at 15 miles interval approximately. Although quite a large number of gauge stations already existed all along the river stretch however, the gaps in the information were likely and the gauges were required to plug the gaps.

4.2. Position of the MainCreek:

The reach wise position of the main creek is described below:

(i) Mari to Kalabagh Barrage:

This portion of the river is affected by the back water from the Barrage and almost still water is met. There is enough water for navigation and depths upto 48 ft. were met with average depths of 10 ft. The L-Section was observed towards the [illegible] side which is followed by the deep creek.

(ii) Kalabagh Barrage to Chashma Barrage:

The river splits into two creeks just below the barrage. The creek on the right side is larger and deeper and this was followed for survey. The deepest channel was on the right bank near the high bank upto Syak Bund, then the creek shifts from right to left side, away from the right bank. Opposite Qamar Mashani, the creek is more or less central, than all the creeks join near Kundel on the right side close to the high bank. Below Kundel is the Chashma reservior and the deep water follows the path along the right bank from Kundel, then straight to Chashma Barrage.

(iii) Chashma to Taunsa Barrage:

Below Chashma the deep creek follows the left bank upto Kalerkot and then is centrally located right upto D.I.Khan where it goes to the right bank. Downstream of D.I.Khan the main creek follows the right side upto Ramuk. Downstream of Ramuk it goes to left upto liah and then follows, the central portion to Taunsa Sharif on the right side. From Taunsa Sharif upto Taunsa Barrage, the deep channel is on the right side.

(iv) Taunsa Barrage to Guddu Barrage:

From Taunsa Barrage to D.G. Khan, the deep creek flows along the right bank and further upto Janpur follows almost the same direction, Downstream of Janpur deep channel/river again goes to the left side upto Panjnad, from where it goes towards the right side/central portion.

(v) Guddu to Sukkur:

The main creek goes from right side to left upto Machka. Downstream of Machka it remains in the central portion upto 25 miles upstream of Sukkur, from where it follows the right side.

Meandering/Braiding of Indus river:

The present position of the river main creek in various reaches has been briefly described above. Indus river is a braided river and the main creek meanders. Only the recent history of meandering is described from local here-say as below:

(2) Kalabagh to Chashma river portion:

The river portion close to kalabagh head works depends which side gates are being operated. Over the years right side gates have been operated and the deep creek istherefore, on the right and continues so, far a few miles. However, further on, it has not acquired permanance and has been mostly central, till the hills at Kundhal where it has acquired an alignment on right side and then straight on to the barrage.

(ii) Chashma to Taunsa:

The river main creek was on the right before Chashma Barrage. Following it, the main creek has developed on left for about 20 miles from where it goes on to the right i.e. the previously established path upto D.I.Khan.

Below D.I.Khan the river established a new alignment, however, it may change its course and follow the central creek.

(iii) Taunsa to Guddu:

The main creek was previously on the left side but is now attacking the right bank near D.G.Khan River training works are being implemented and the river will revert possibly to the left. Below D.G.Khan the right side is protected by spurs and the main creek will follow the path dictated by the spurs or be centrally left.

(iv) Guddu to Sukkur:

Right side is protected by bunds and spurs. The deep creek was mainly on right for about 10-15 miles but further on has been shifting, remaining mainly on left upto Sarhad gauge. Downstream the main creek has been shifting but generally remains on right.

Central stability for Navigational Development has two aspects:-

(a) A stable channel geometry i.e. width, depth and velocity. This varies with themean annual discharge but the major factor is the longitudinal slope.

(b) The second aspect is the tendency of meandering/ braiding. Meandering occurs more at lower channel slopes than at braided or straight channels. Also channel shifting varies with discharge fluctuations and that amount of shifting in lateral directions is controlled by constructions/control points along the river.

These points have been brought up with the idea, whether we can go in for river training and the nature of problems involved. However, the prospect of river training as an aid to developing a stable navigational channel from the Indus river is too idealistic. There are certain points in favour and these are brought out:-

Due to the damages caused by river meandering, protection works have been constructed especially on the right flank of the river. These works are called river training works and are in the form of bunds along the bank, and spurs. Bunds and spurs for protection has been constructed from Chashma to D.I.Khan on right side, Liah to Taunsa on left side, Janpur to Rananpur on right side and along Chenab river to Indus river on left flank upto Chachrun. From Guddu to Sukkur Protection Bunds and spurs exist. As mentioned earlier, the purpose of these works is the protection of lands and property but these can be examined with a view to be helpful in river training for navigation.

Due to the controlled releases from Tarbela the Sailaba Area is being developed and this would involve river training for protection. These works could also be examined for their usefulness to the navigational requirements of river training, expecially at this stage when these are being designed/implemented.

(v) Ferries:

Ferries exist at all important towns with 2 or 3 boats plying at each.

## 4.3. Present Traffic:

The details of the country boats available between Kalabagh and Sukkur are as below:-

Table 4.1

Details of country boats between Kalabagh and Sukkur May to Nov 75

| S. No. | Type of Boat | Loading Capacity Mds | Size ft. | Number Available Reach I | Reach II | Reach III | Reach IV | Total | Crew on boat | Cost of new boat | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Bedghocher Large | 2500 | 80x20 | - | - | 3 | 4 | 7 | 12 | 30,000 | Freight rates/ 100 miles 1.50/assu-med on Foreys as 1.00/ cattle and as 0.25/md |
| 2. | " Small | 1600 | 70x18 | - | - | 50 | 25 | 75 | 8 | 25,000 | |
| 3. | " Dhoda | 700 | 60x12 | - | - | 50 | 50 | 100 | 8 | 20,000 | |
| 4. | Patojee Dhoda | 200 | 35x11 | 39 | 300 | 300 | 500 | 1159 | | | |
| 5. | Pandocher | 500 | 55x14 | - | 60 | 200 | 200 | 460 | 5 | 10,000 | |
| 6. | Koter | 1000 | 62x16 | - | - | 60 | 60 | 120 | 8 | 18,000 | |
| 7. | Kontol | 700 | 80x16 | - | - | - | 70 | 70 | 8 | 15,000 | |
| | | Total: | | 39 | 360 | 663 | 909 | 1991 | | | |

Time for U/S Travelling = 100 miles = 8 days) Reach I Mari Sher Chashma
" " D/S " = 100 " = 5 days) Reach II Chashma Taunsa
III Taunsa Guddu
IV Guddu Sukkur

The local names of the country boat met on the way are:

1. Beghocher - 1800 naunds - 2500 maunds
2. Kontal - easy loading
3. Kattar - easy puching
4. Dhoda - easy manufacture

It takes about 8 days to travel upstream for a distance of 100 miles while going downstream the same distance is covered in 5 days. The usual charges for goods currently are Rs. 1.50 per maund per 100 miles.

4.4 Finding of the Survey:

In general, the river Indus is nevigable from Mari Indus to Sukkur. The standard low water datum has coincided with the lowest level available during the 6 years of 1969-75. That means that the river will be navigable actually for the reach Guddu to Sukkur is the lowest for 15 years of 1960 to 1975, throughout the year. At several locations minor shoal/shallow depth area have been apparently revealed as a result of the Standard Low Water Datum position. Confirmation of these have been left to a detailed survey, however, it can condifently said that these shallow depths will not provide obstructions to the navigability of the river throughout the year with 4½ ft draft boats planned to be used. The problem of shallow depths as indicated in the various reaches by the longitudinal profiles versus the standard Low Water Datum could not be confirmed by the X-Section observed at 10 miles from Sukkur to Kalabagh. Very few section show depths of 7 to 8 feet (details in the sub paras below). The section therefore, confirm the conclusions that the main creek will be navigable throughout the year for the 4½ feet draft boats proposed to be plied.

4.5. Comments:

(i) The survey data has revealed that the river is navigable for the 4½ ft draft boats throughout the year except for the limitaions during short intervals of 10 to 30 days. These could be removed if Tarbela is operated to suit the navigational needs for the period involved.

(ii) Certain, reaches, such as Sukkur to Guddu may require detailed investigations as also some portions in the reach is from Taunsa to about 16 miles above Mithan-Kot where the Chashma joins the Indus. This reach may require some river works for proper navigation, however, this has been left to the detailed survey.

(iii) The limitation of standard low water datum in long reaches without levels available at intermediate points may be resolved in the detailed survey. This survey was for reconnaissance only.

(iv) It may be pointed out that the development of navigation will generate sufficient goods traffic. P.O.L. wheat, Soyabean and iron will be transported from Karachi right upto Kalabagh and aggregates, cement fertilizer on the way down.

(v) There is possibility for main river ports at Sukkur, Panjnad, Taunsa and Kalabagh, with intermediate (local interest) stations such as D.G.Khan and D.I.Khan. The river ports could be the terminal stations for supplying and taking goods traffic to off channel markets. This aspect needs to be covered in a more detailed study.

4.6. <u>Recommendations for Future Survey:</u>

(i) The present survey was only intended as a reconnaissance survey, however, another survey should be planned almost along the same lines, but carried out as a reconnaissance to mark out shallow reaches where the actual shoals/shallow depth may be marked. The proposed survey should be carried out in low water period of November to March to reflect the actual conditions at close to mainmum water flows.

ii) Simultaneous action is necessary for improving the approach roads to the river, at Main towns especially the main stations initially and later on to all ferry points.

(iii) A pilot scheme (with the standardized barges proposed to be run) may be initiated by Government. This would give the initial push to the development of navigation and private sector will immediately response,alternatively Private Sector may be attracted as the scheme will be economically feasible proposition.

(iv) Marking the navigable channel to facilitate movement of craft may be initiated in reach Sukkur to Guddu which has well developed river traffic.

(v) For reliable information regarding river stage, 'Servemans' meters may be installed at suitable locations initially for 3 years. Some of the staff gauge may also be supplemented by'Servemans'meters. Recommended locations are Kalorkot, D.I.Khan, Karor, D.G.Khan,Mithankot, Begar and Machka. Manometers are availabel at Mangla and SWHP(Surface Water Hydrology) Directorate, WAPDA has been asked to reconnoiter the proposed locations.

(vi) Studies may be carried out at an early date with a view to consider if the present system of protection works along the Indus reiver can be adopted to suit the need of a stable navigational waterway and if it is so it may be possible to assess the additional works involved to modify these works for navigational needs.

(vii) The portion of Chenab River downstream of Taunsa Panjnad link may also be surveyed for its navigability.

4.7. Conclusions:

The reconnaissance of the Indus river from Sukkur to Kalabagh has revealed that no major obstructions exist and the Indus river is navigable throughout the year from Sukkur to Kalabagh for 4½ ft barges proposed to be used. Larger crafts could be plied for more than 9 months in a year. This view has been confidently stated in view of the changed/controlled releases from Tarbela Dam which will enhance the low season supplies, so that the river will remain navigable throughout the year.

The survey methods followed and the results have been discussed in detail and also the present traffic on the river was determined from local hear say and data for the same has been included in the report. The limitations of this type of survey has been fully explained and it has been recommended that another survey should be planned as soon as possible to investigate shallow depth areas more throughly on the basis of this report. The Standard Low Water Datum in long reaches without any intermediate gauging stations has not been determined precisely and it has been recommended that steps may be taken as soon as possible to observe river stage during the low supply period for several years.

The reach from Taunsa to the confluence of Chenab river with Indus river may present a problem and a more through investigation of this reach may be carried out so that action can be planned that this does not become a bottle-neck however, it may be stated that without any works forimproving the navigability of Indus river in this reach, the recommended size of barges can be plied for more than 10 months in a year.

The above recommendations have been given regarding the further investigations required to confirm the navigability of the Indus river from Sukkur to Kalabagh. Other recommendations regarding the development of navigation have also been suggested. The major ones are:

i) A pilot scheme may be initiated preferably in the most promising reach of Sukkur to Guddu to ply the barges proposed to be used for transportation in the Indus river,However, to review the economic side of the scheme was beyond the scope of this report and this may be examined by the economic experts.

ii) The traffic data for the present river transport was collected but it cannot be projected viz-a-viz the development of navigation in the river. Hence it has been suggested that examination of the possible haulage of fertilizer/ballast,road matal and the grains may be examined in detail.

The feasibility of modifying the presently instituted/ under construction works for protection from the floods on Indus River may be examined so as they can be used as river training for navigability of the various reaches.

4.8 Port Qasim to Sukkur reconnaissance survey:

A reconnaissance survey was carried out from Port Qasim to Sukkur Barrage following routes along various creeks, canals, drains, etc. The purpose of this survey was to get the first hand information about these water courses and to assess the difficulties and problems to be faced on various possible alignments of the navigation channel. The following canals, drains, creeks, etc. were included in the reconnaissance survey:

i. Creeks - Phitti Creek, Gharo Creek, Rahu Creek

ii. Drains - Khui Gharo Drain, Jam Sakro Drain

iii. Canals - KB Feeder Upper, Rohri Canal, Nara Canal, Jamrao Canal, Oderolal Escape

iv. Lakes - Kalri Lake

v. Barrages-Sukkur Barrage, G.M. Barrage

The reconnaissance survey revealed that while K.B. Feeder Upper, Kalri Lake and head reaches of Rohri Canal can be easily used for navigation without any remodelling of their sections. Jamrao Canal and Gharo Creek can be rendered navigable by minor remodelling or dredging. Remodelling or reconstruction of some structures shall, of course, be necessary for using above canals for navigation.

## 4.9 Collection of Data:

Various Government and Non-Government agencies were contacted both personally and through correspondence for the supply of data; Discussions were held at various places and with various people and views of important personnel were obtained regarding the feasibility of inland navigation in Pakistan particularly from Port Qasim to Sukkur. Special emphasis was given to the collection of following data:

i. Previous studies on the feasibility of "Inland Navigation" in Pakistan

ii. Hydraulic data of river Indus and various canals, drains, lakes, creeks, etc. located in the area.

iii. Present position of roads and railways and their fututr extension for handling cargo traffic.

iv. Data on inland cargo crafts commonly used on various waterways of the world.

v. Subsoil strata, water-table depths etc.

vi. Topography of the area in which the probable alignments of the navigation channel would lie.

## 4.10 Navigation Studies:

Inland Cargo Craft: The size and shape of the inland craft vary considerably, but the modern trend in various countries is to standarize on a few sizes. Two of the standard river barges used in USA have dimensions of 195 x 35 ft and 175 x 26 ft. Their depth varies from 10 to 12 ft and the draft has been limited to 9 ft. Almost all the European countries have adopted 1,000 ton and 2,000 ton barges as the standard sizes.

Based on the practice in various countries and keeping the peculiar conditions of Pakistan in view, the following vessel is recommended:

| | |
|---|---|
| Draft | = 6 ft |
| Free board | = 2 ft |
| Depth of vessel | = 8 ft |
| Beam width | =28 ft |
| Length of vessel | =240 ft |
| Carrying capacity | =800 |

Main commodities which can easily be transported by water-ways include the following:-

i. Dry Bulk:

Wheat, coarse rice, coal and coke, fertilizer, gravel and stone ballast, rock salt, ores and minerals, etc.

ii. Semi-bulk:

Cement, fine rice, iron and steel, cotton etc.

iii. Liquid Bulk:

Crude oil, oil products, molasses etc.

iv. General Cargo:

It is assumed that at least 25 to 75% of railroad traffic will be diverted to waterway transport and about 10% of the diverted traffic will be newly generated. In other words, as a first approximation about 9 million tons of cargo will be handled by waterways. However, the estimated traffic is very rough and needs to be firmed up by detailed studies while preparing feasibility report.

4.11 Navigation Channel Proposals:

Previous studies and investigations by various quarters on the subject have resulted in the following "Navigation channel proposals".

1. Feeder-cum-navigation channel from Sukkur to G.M Barrage via Nara Canal.
2. Navigation along Nara Canal-cum-new link upto Hala.
3. Navigation along Rohri canal-cum-new link upto Hala.

4. Navigation along RohriCanal

5. Navigation through river Indus

6. Navigation link from river to Nara and Rohri Canals upstream of Sukkur Barrage.

7. Navigation link from Hala to river upstream of G.M. Barrage.

8. Navigation link from G.M Barrage to sea via Pinyari Canal and river Indus.

Previous studies are confined to navigation from Sukkur to G.M. Barrage and not a single proposal has been advanced for navigation from G.M. Barrage to Port Qasim. NESPAK has forwarded a new proposal consisting of two parts:

i. Navigation from Sukkur to G.M. Barrage via Nara Canal, Jamrao Canal and new link.

ii. Navigation from G.M. Barrage to Port Qasim.

The position of all the proposals has been summarized in Table 4.2.

Table 4.2

Navigation Channel Proposals

| Proposal | Forwarded by | Total Length of the channel (Miles) | Length of new link (Miles) | Merits | Demerits | Comments |
|---|---|---|---|---|---|---|
| 1. | 2. | 3. | 4. | 5. | 6. | 7. |
| 1. Feeder-cum-Navigation Channel from Sukkur to G.M. Barrage via Nara Canal. | Mr.Mohiud-Din Khan. | 190 | 76 | i) Utilization of 106 mile length of Nara Canal<br>ii) Minimum Number of locks. | i) Maximum water requirement (Q-4700 cfs)<br>ii) Upto 22 ft. raising of rail and road embankments.<br>iii) Serious problem of waterlogging and stability of slopes<br>iv) High and costly banks<br>v) Maximum railway crossings. | The proposals is infeasible both technicall and economically. |
| 2. Navigation along Nara Canal-cum-new link upto Hala. | Irrigation and Power Deptt: Survey and Investigation Circle, Sukkur | 171.25 | 65.25 | i) Utilization of 106 mile length of Nara Canal | i) Considerable water requirement (Q-326 cfs)<br>ii) No. of locks-13<br>iii) Excessive raising of rails and roads<br>iv) Serious problem of waterlogging<br>v) Fairly large earth work and land acquisition. | The proposal is economical infeasible. |
| 3. Navigation along Rohri Canal-cum-new link upto Hala | Irrigation and Power Deptt: Survey and Investigation Circle, Sukkur. | 162 | 113 | i) No railway crossing<br>ii) Practically problem of water logging or stability of slopes | i) Maximum earth work and land acquisition. | The proposal appears quite promising, but economic aspect may render if infeasible. |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4. Navigation along Roni Canal | -do- | 157 | 33 | i) Utilization of 124 miles length of Rohri Canal<br>ii) Least problem of waterlogging or stability of slopes<br>iii) Only 33 mile long new channel<br>iv) Only 165 cfs replenishment water requirement. | i) Maximum number of structures.<br>ii) No time available for remodelling of structures<br>iii) Maximum number of locks(16 nos) | Technically, the proposal is feasible but exorbitrate cost of remodelling structure and practical problems make it infeasible. |
| 5. Navigation through river Indus | -do- | 160 | | i) No water requirement.<br>ii) No excavation of new channel and acquisition of land.<br>iii) Only one structure (a lock at Sukkur Barrage) | i) Navigation possible only for 6 months.<br>ii) Costly training works. | Proposal is feasible. |
| 6. Navigation link from river to Nara and Rohri Canal). | -do- | | | ½ | | |
| i. Through old Nara | | 4.5 | 1.0 | i) Utilization of old Nara Canal.<br>ii) Only two bridges and two locks. | | Old Nara presents natural connection with Nara Canal, not suitable for connecting Rohri Canal. |

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| | | | | | | |
|---|---|---|---|---|---|---|
| ii. Through new link South of Rohi Town | | 3.[illegible] | 0.2 | i) Utilization of New Nara and abondoned Rohri Canal<br>ii) Only 3 structures (two locks and a syphon). | | Suitable for connecting Rohri Canal with river Indus, but infeasible for Nara-Indus connection. |
| 7. Navigation Link from Hala to river upstream G.M.Barrage. | Irrigation & Power Dept: Survey & Investigation Circle, Sukkur. | | 36.5 | No new channel excavation. | i) Additional discharge requirement of 707 cfs<br>ii) Ponding effect available only upto 15 miles u/s of Barrage.<br>iii) Extensive dredging is involved for navigation upto Hala. | Navigation is possible only upto 15 miles u/s of G.M.Barrage and not upto Hala. |
| 8. Navigation from G.M. Barrage to Sea Via Pinyari Canal. | Mr.Moin Uddin Khan | 165 | 10 | i) Minimum earth work and land acquisition. | i) Additional discharge requirement of ± 10,000 cfs.<br>ii) Connection with Port Qasim not possible.<br>iii) Extensive remodelling of large number of major structures.<br>iv) Very costly training works. | The proposal is infeasible. |

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| | | | | | | |
|---|---|---|---|---|---|---|
| 9. Navigation from Sukkur to G.M. Barrage via Nara Canal, Jamrao Canal. | National Engg: Services(Pak.) Ltd. | 194 | 30 | i) Utilization of 149 miles length of Nara and Jamrao Canals.<br>ii) Minimum replenishment water requirement.<br>iii) Practically no problem of water-logging or stability of slopes.<br>iv) Minimum earth work and land acquisition. | i) Remodelling and Construction of a fairly large number of structures.<br>ii) No.of locks-11 | The proposal is feasible both technically and economically. |
| 10. Navigation from G.M. Barrage to Port Qasim. | -do- | 109 | 33 | i) Utilization of 75 mile length of K.B Feeder, Kalri Lake & Gharo Creek.<br>ii) Only 110 cfs replenishment water requirement.<br>iii) No problem of water-logging. | i) Problem of stability of slopes.<br>ii) Remodelling and construction of large number of structures. | The proposal is feasible technically as well as economically. |

4.12 Dimensions of proposed vessel:

Taking into consideration the available depth of water in the channel(Rohri, Jamrao and Nara) and the shallow winter river channels, the draft of the vessel shall be limited to 6 ft. The dimensions work out to be:

Draft = 6.0 ft
Free board = 2.0 ft
Depth of vessel = T = 6.0 + 2.0 = 8.0 ft
Adopting ratios = T:B:L = 1:3.5:30
Beam of vessel = 3.5 x 8 = 28 ft
Length of vessel= 30 x 8 = 240 ft

Assuming a volumatic efficiency of 0.9, the water displacement for a vessel size 240 ft length, 28 ft breadth, 8 ft depth and 6 ft. draft shall be = 0.9 x 240 x 6 = 36300 cft

The total capacity of the vessel, therefore, is=36300 x 62.4/2240 = 1000 tons.

Assuming dead weight of the vessel including equipment to be 20% of total capacity, carrying capacity = 0.8 x 1000 = 800 tons.

4.13 Comments:

The development of inland waterway will form an integral part of the transport complex of the country. In order to appraise the inland waterway proposals in their right perspective it is necessary to have an idea of the existing inland cargo transport pattern the projected freight transport demand and the role of inland waterways in meeting the future traffic demands of the country. The appraisal of the proposals also demands the economic comparison of water transport with other transport modes.

For projecting traffic demands of the country, nine out of thirteen divisions of Pakistan have been considered as traffic generating areas for the proposed waterway. The origin and destination traffic zones have been classified as A, B, C, D, etc. in order of potential of each zone for generating traffic.

4.14. Classification of Commodities:

Only those commodities are suited for waterway transportation which can be economically moved in bulk and do no not requirerapid transit. Main commodities which can easily be transported by water transport are listed below:

a. Dry Bulk:

i) Wheat
ii) Rice (Coarse)
iii) Coal and coke
iv) Fertilizer
v) Gravel, Stone Ballast, sand, etc.
vi) Rock salt
vii) Ores and Minerals

b. Semi Bulk:

i) Cement
ii) Rice (Fine)
iii) Iron and Steel
iv) Cotton

c. Liquid Bulk:

i) Crude
ii) Oil products
iii) Molasses

d. General Cargo:

The above list includes the commodities arriving at Karachi Port and Port Qasim as well as those picked and dropped at intermediate points. The classification of commodities listed above conforms to the International Standard Trade Classification.

4.15 Existing Cargo Transport Pattern:

The entire inland cargo transport of the country is being handled by a Railroad and highways. A partial analysis of the data given in Transport Coordination Project (TRACO), reports was carried out to determine the composition, seasonal variation, origin and destination of cargo handled by rail-road and highways.

Table 4.3 Traffic Projections of Pakistan

| Commodities | 1980 | 1985 | 1990 | 1995 | 2000 |
|---|---|---|---|---|---|
| DRY BULK (IMPORTS): | | | | | |
| Fertilizer(Finished) | 0.40 | 0.79 | 0.79 | 0.77 | 0.80 |
| Iron Ore' Coal | 3.23 | 6.72 | 6.72 | 13.44 | 20.16 |
| Phosphate Rock Sulpher | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 |
| Sub-Total: | 4.23 | 8.11 | 8.21 | 14.81 | 21.56 |
| DRY BULK (EXPORTS): | | | | | |
| Wheat | 0.75 | 2.04 | 2.06 | 2.00 | 1.50 |
| Rice | 1.30 | 1.75 | 1.85 | 2.00 | 2.20 |
| Cement | - | 1.68 | 2.54 | 2.75 | 3.00 |
| Fertilizers | 0.78 | 0.74 | 1.05 | 1.25 | 1.25 |
| Sub-Total: | 2.83 | 6.21 | 7.50 | 8.00 | 7.95 |
| LIQUID BULK (IMPORTS): | | | | | |
| Crude Oil | 6.70 | 8.70 | 10.70 | 12.70 | 14.70 |
| Sub-Total: | 6.70 | 8.70 | 10.70 | 12.70 | 14.70 |
| GRAND TOTAL (ALL CARGO): | 13.86 | 23.02 | 26.26 | 35.51 | 44.21 |
| Dry bulk imports as percent of total cargo handled (excluding Iron Ore and Coals). | 28.0 | 18.3 | 15.2 | 15.0 | 15.0 |
| Dry bulk exports as percent of total cargo handled. | 20.42 | 26.98 | 28.56 | 22.53 | 17.99 |

Port Qasim projections are quite detailed in respect of commodity composition. NESPAK traffic projections have been furnished in Table 4.3.

Table 4.3 indicates that the share of the dry bulk imports in the total cargo handled will go down from 28% in 1979-80 to 15% in 1999-2000. However, the share of dry bulk exports in the total cargo handled will go up from 20.42% in 1979-80 to 28.56 in 1999-2000. This excludes the cargo which will be handled in the port area by belt conveyors and shipped by pipeline i.e. iron ore, coal and cruide oil.

b. Traffic Allocation:

Figures in table 4.3 show that the country's cargo traffic will get almost doubled by 1985 and by the year 2000, it will increase to about four times the present freight traffic. The important implication of this project is that the existing transportation facilities will soon be taxed to the limit and a large increase in their capacity will be required to keep pace with the demand. This increase in capacity of transportation system can be achieved by:

i. Extension of railroad transportation facilities.

ii. Extension of highway transportation with construction of Indus Super Highway.

iii. Providing pipelines for transporting POL from Port Qasim to Multan, and

iv. Developing Inland Waterway transportation.

Allocation of traffic to various modes of transport is a very complex problem and cannot be attempted at this stage. However, the decisions which will establish this distribution will have to be made progressively as the need for the additional capacity develops. The particular transport media to meet a specific need will also depend upon the type source and destination of the cargo to be handled.

## 5. OBSTACLES TO DEVELOPMENT OF IWT IN PAKISTAN

There are a number of obstacles which hinder the development of IWT in Pakistan. One of major problem is some the railway and roads structures which cross the rivers and canals. There structures were designed without taking Navigation into consideration and pose a major problem for the passage of waterway craft. Extensive remodelling of canals is required for navigation purposes. There is also non-available of sufficient water depth during the Rabi season and in some canals Navigation is possible for six months of the year only. In water logged areas, stability of slopes presents a serious problem. Remodelling and construction of large number of structures has made the Navigation schemes very expensive and uneconomical. Very costly River training works are required which cannot be built with the present resource constraint.

## 6. DEVELOPMENT OF ALTERNATIVE MODES OTHER THAN IWT

IWT is the cheapest mode of transport. Several developed countries have preferred the water Transportation to other forms of transport for the movement of large bulk goods. With the development of pipeline transport, liquid bulk commodities like crude and refined oil products can be conveniently transported at economical costs. IWT mode is not developed or planned to be developed to any significant role in the near future due to various reasons outlined in the previous chapter. Instead of spending on major IWT projects, it would be worthwhile to develop the pipeline transport for POL from Multan to upcountry points and improve the existing road and railway transport network. A combination of rail, road and pipeline transport is the answer to present needs of the country. However, necessary initiative should be taken to investigate and introduce IWT in Pakistan. Pilot projects in Navigable reaches of the Indus should be taken on experimental basis.

## 7. RECOMMENDATIONS

Recommendations for development of Navigation are as below:

i) WAPDA may be assigned the responsibility of providing navigation conservancy services on the Indus from Sukkur to Kalabagh. This would involve erecting of simple channel markers for the guidance of navigating boats and launches. Starting from Sukkur or Guddu it can be gradually extended to the whole navigable reach.

ii) Once the channel is marked, the turn around time of boats would be reduced and their through put enlarged. Assurance of a waterway being available would encourage private launch and barge owners to start operations on the river. Meantime WAPDA can demonstrate the usability of water transport by introducing a small tug and barge flotilla in a reach where traffic potential is highest. Rented towing service for boats would also encourage mechanisation.

iii) Improvement of landing points and inland ports would facilitate movement of cargo and passengers and improve water front and bank environment of the towns, barrages and headworks.

iv) A traffic potential survey would be required to estimate the quantum of various cargos which may be expected to move on the river. Requirements of various types of craft in different areas of the river and port and storage facilities required ashore will have to be based on the results of this survey and traffic estimates.

v) Feasibility studies of the IWT connection between Sukkur and Port Muhammad Bin Qasim should be progressed further in detail and the economic feasibility, based by NESPAK on arbitrarily assumed figures, should be studied in depth.

vi) For river navigation, the standard low water level for all rivers of Pakistan has to be defined. River Indus has to be given first priority and then soundings of channels be performed with accuracy.

vii) For canal Navigation, openings at control works on the rivers have to be known in width, depth and overhead clearances together with full supplly level and [illegible] frequency. In other words, a standard low water level has to be defined for the Irrigation canals.

## III.6. B I B L I O G R A P H Y


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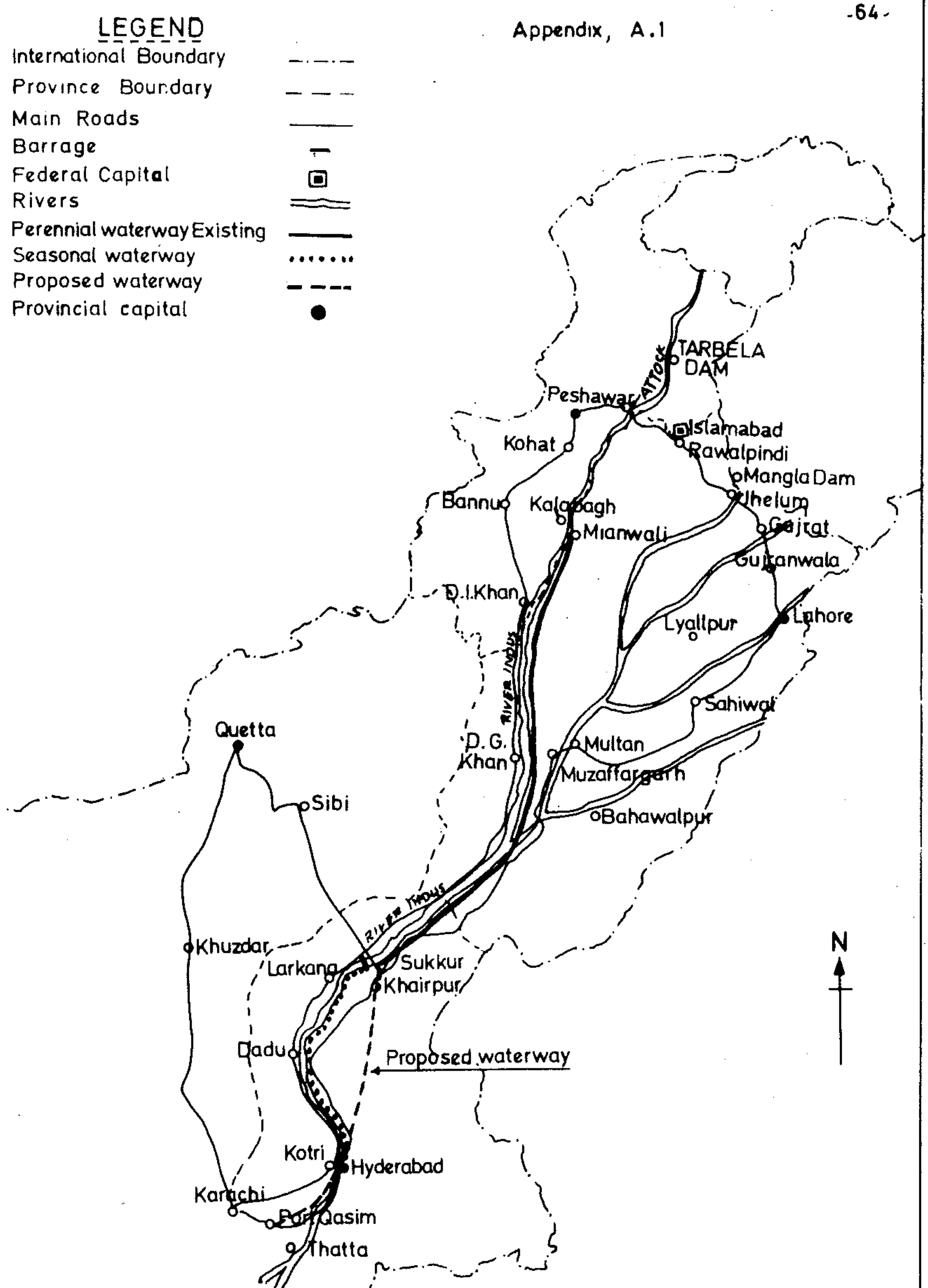
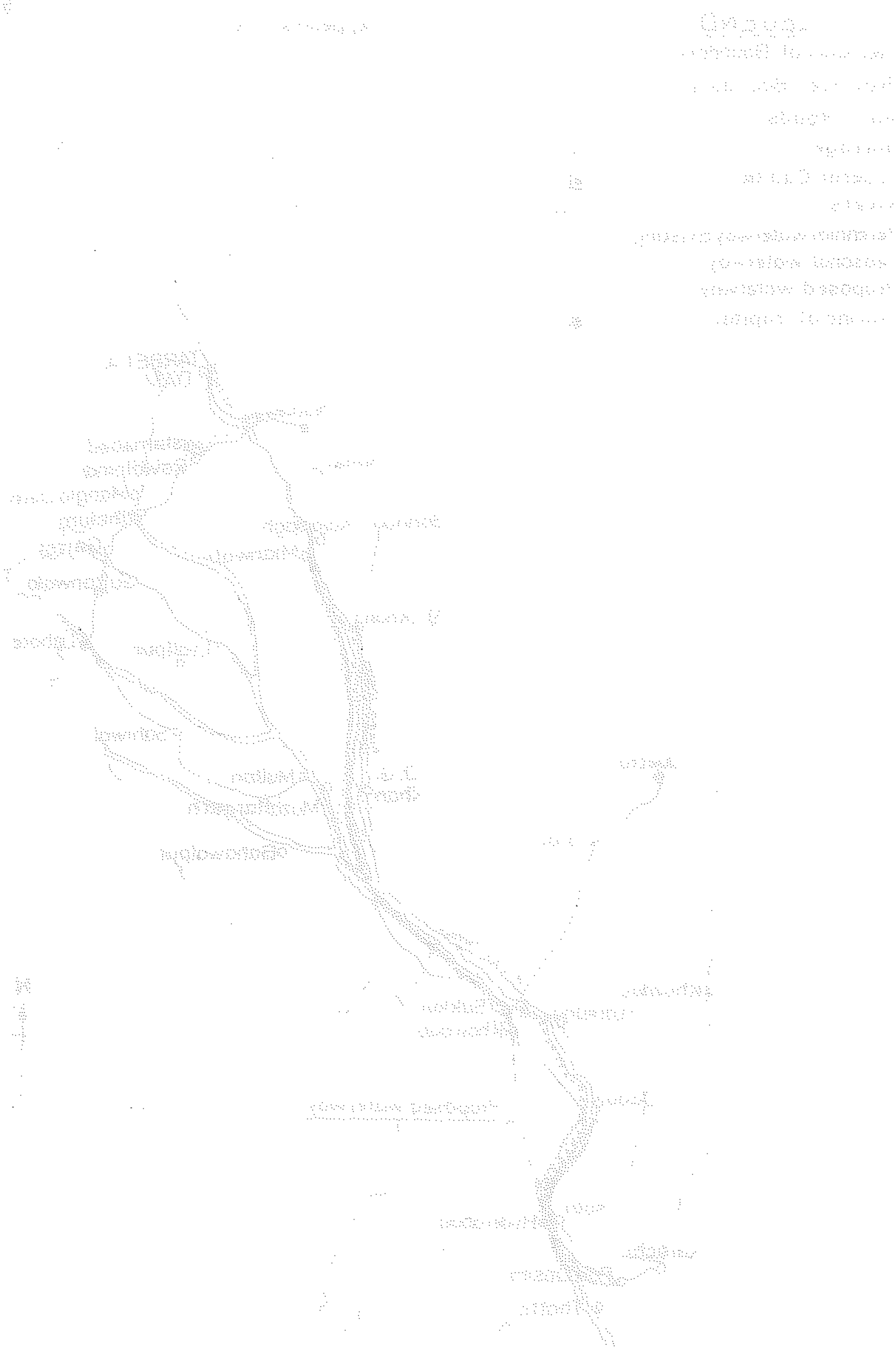
Appendix, A.1



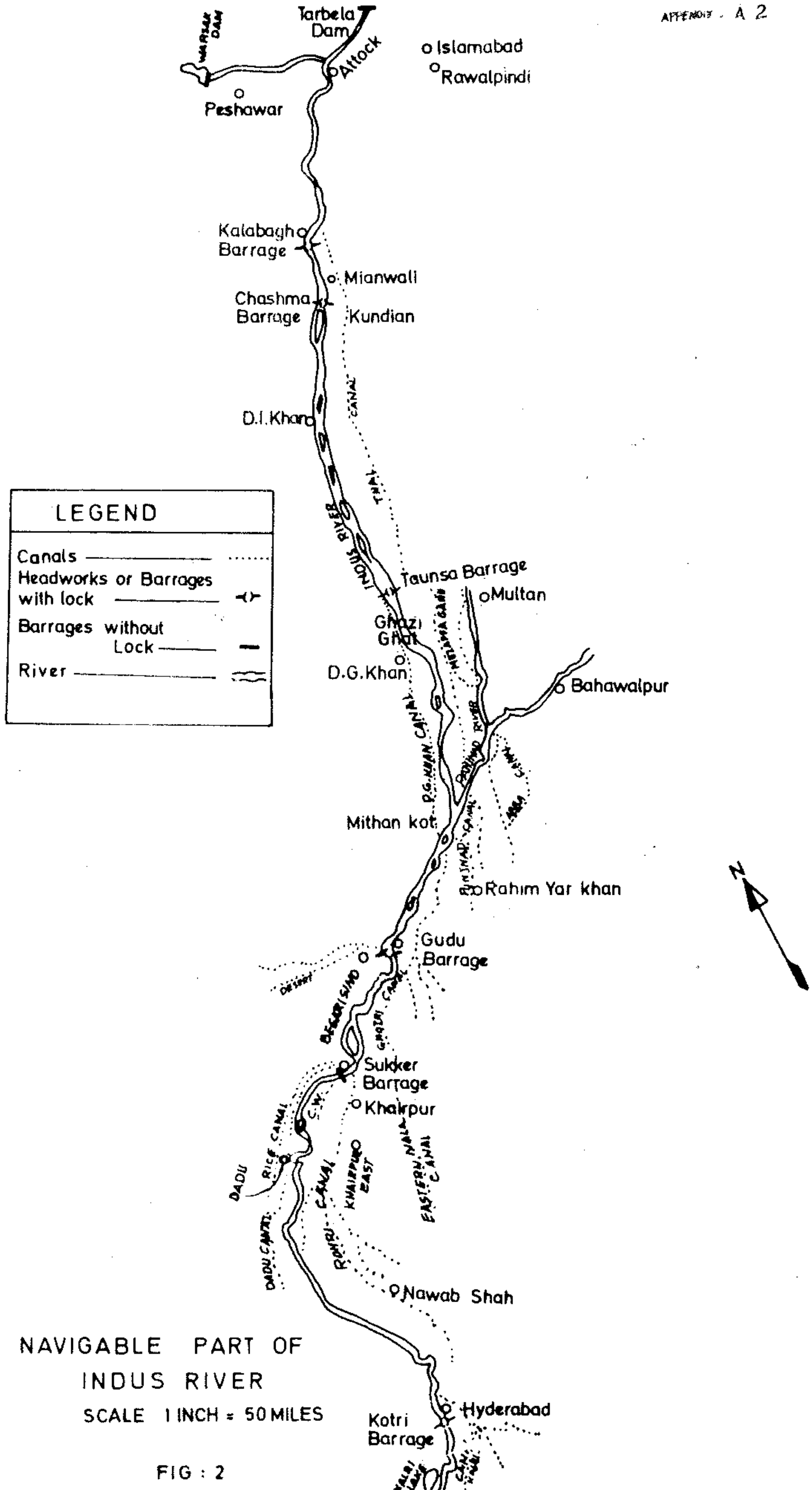

WATERWAYS OF PAKISTAN

FIG : 1

SCALE, 1" = 100 MILES.



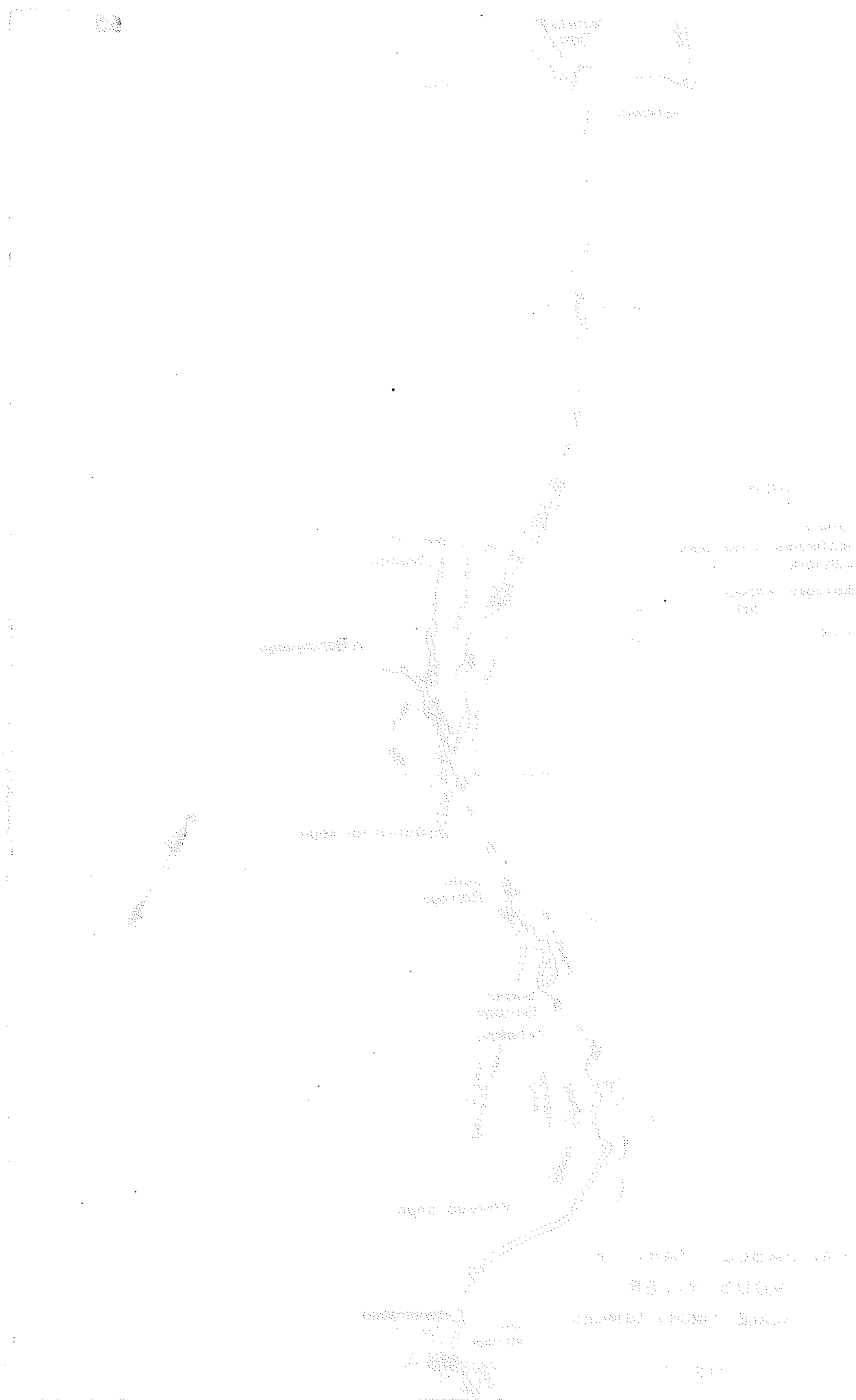
WATERWAYS OF PAKISTAN

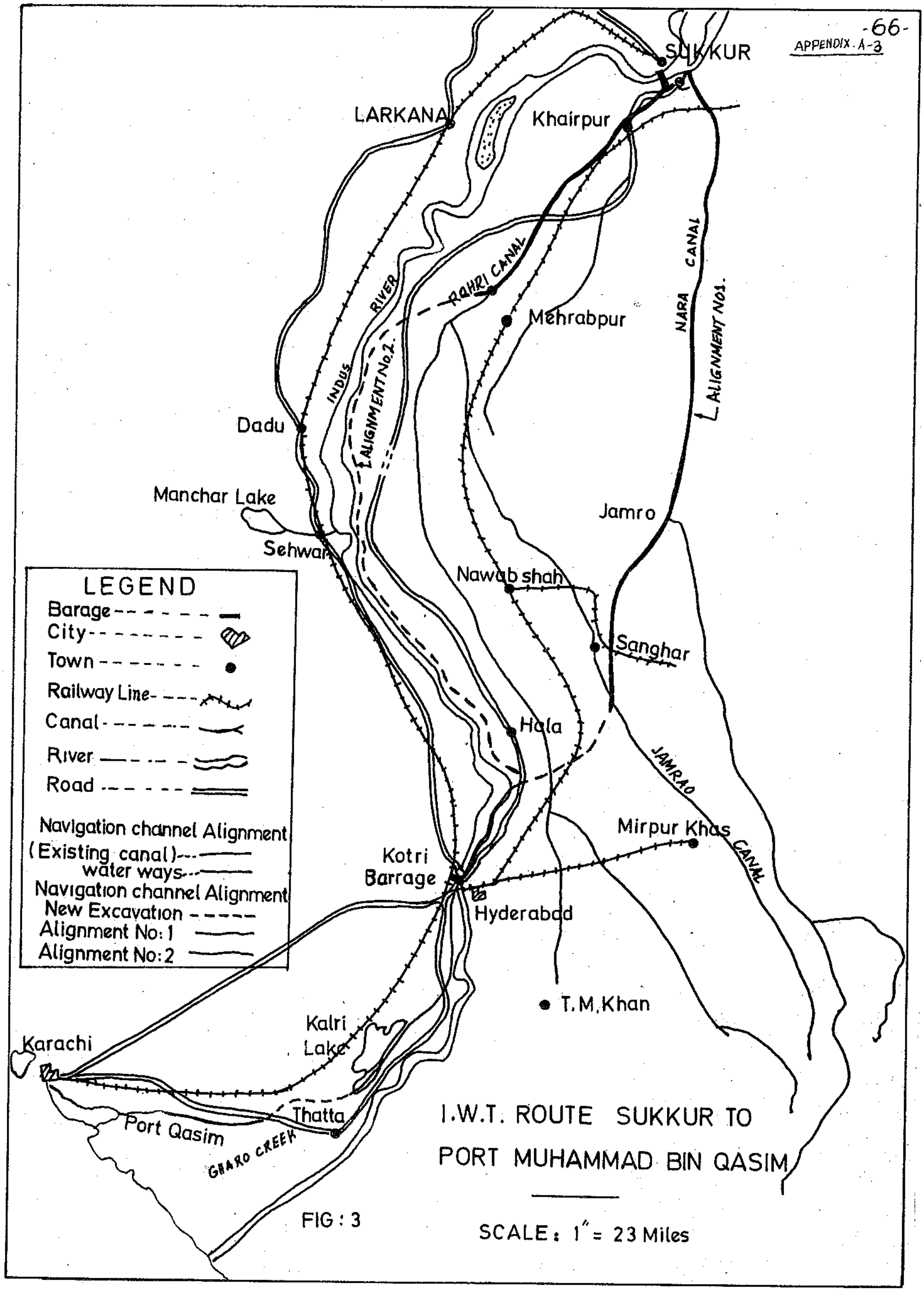



NAVIGABLE PART OF INDUS RIVER

SCALE 1 INCH = 50 MILES

FIG : 2






I.W.T. ROUTE SUKKUR TO PORT MUHAMMAD BIN QASIM

FIG : 3

SCALE: 1" = 23 Miles