4) Proposed Public River Port in Greater Cairo

a) Site of New Public River Port

In the master plan, it is proposed that the public river port be developed at Ather El Nabi because this site has advantages in terms of access to main roads in the core of Cairo City, and ease of establishing a customs area. In addition, the site area is owned by RTA.

(Reviews for Future Development)

In the master plan, it is estimated that Ather El Nabi port could cope with the growth in cargoes until 2020. Assessing that the proper equipment is introduced and cargo handling efficiency is improved. However, this will be the first time for containers to be handled at a river port, and it is necessary to monitor actual performance of container handling when the first phase of the project commences. It is recommended that a review of river port development be conducted based on the operational performance of Ather El Nabi Port, road network planning in the Greater Cairo Region and new investment in IWT by private sector..

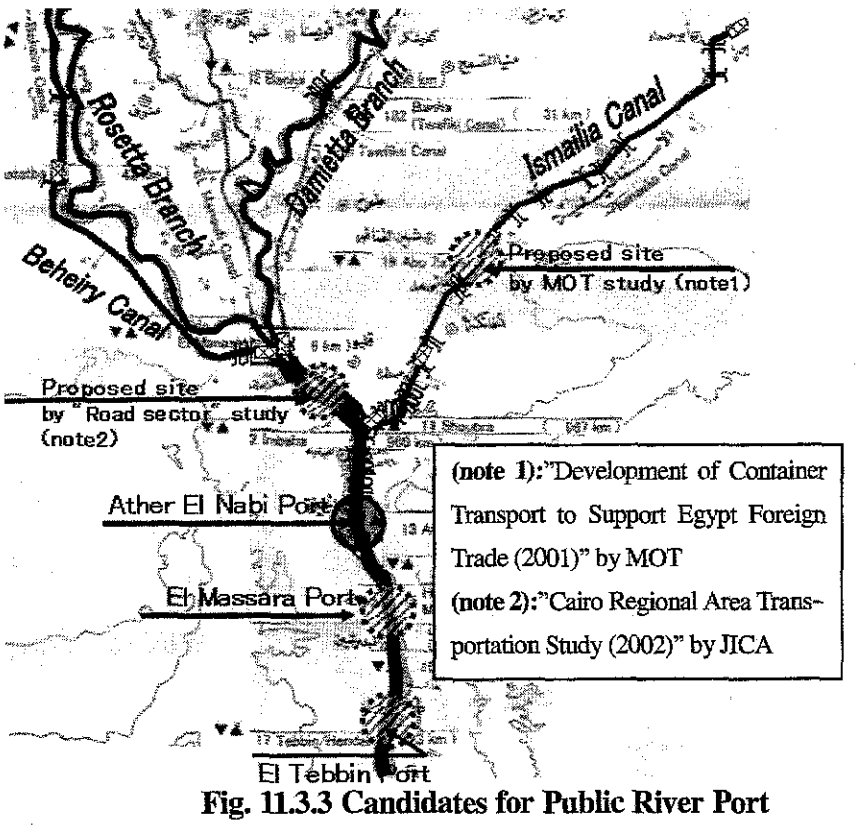


Fig. 11.3.3 Candidates for Public River Port Development by Recent Studies

As mentioned previously, three sites which are "Ather El Nabi", "El Massara" and "El Tebbin" were examined as candidates of a container river port.

Moreover, several studies suggest new sites of river container terminals on the northern area of GCR. After the first phase of the project, it is considered that above review of river port development will be conducted ranging from Tebbin to northern sites in the whole GCR as shown in the following figure.

b) Natural Conditions and Existing Facilities at Ather El Nabi

- **Branch Canal**

The Branch Canal has a length of about 1,800 m and width at mean water level of about 45 m. The canal is connected to the Nile River at almost a right angle in its northern end and at an approx. 60 degree angle in its southern end. The canal is generally relatively straight, but there is an approx. 70 degree bend in the northern part of the canal and an approx. 30 degree bend in the southern part.

The result of a bathymetric survey conducted in September 1999 indicated that the canal has insufficient water depth for the navigation of the proposed barges.

The current speed does not exceed 1 m / s (2 knots).

- **Bridges Crossing**

There are three bridges crossing over the canal. Two bridges The horizontal clearance between the bridge columns is about 27 m for the southern bridge and about 20 m for the northern bridge. The vertical clearance under the bridges is about 10.5 m for the southern bridge and about 7.5 m for the northern bridge.

The Monib Bridge of Ring Road has no columns in the Branch Canal and its vertical clearance is more than 10 m.

Therefore the clearance of the bridges is sufficient for the navigation of the proposed barges.

- **Existing Quay**

The quay, located at the northern part of the canal, was constructed as a deck founded on reinforced concrete piles in 1962. Its total length is about 450 m. It had been used for unloading of stones from barges and feluccas. At present the quay is hardly used because its backyard area is occupied by the green grocery market. The quay structure needs to be reinforced when it is transformed into container terminal facilities.

c) Basic Layout Plan

A container terminal berth should be developed at the northern side of Monib Bridge.

General cargo berths and terminal should be developed southward from the above mentioned container terminal.

d) Navigation Plan in the Branch Canal

Due to the limited width of the Branch Canal one-way traffic is inevitable. One-way traffic towards upstream (entering from the northern end and leaving from the southern end) is recommended due to the easiness of maneuvering of the barges, in particular in the north bend, and stability of mooring barges.

Water depth of the Branch Canal is not sufficient for the new barges to be introduced. Dredging work is required to secure an appropriate waterway width and depth of 1.8 m. The required width is assumed to be 24 m (barge width x 2) in a straight area and 35 m (almost 3 times of barge width) in front of the berths. However, although the proposed barge has good maneuverability, some additional dredging work for expanding the width of waterway in the north bend is required in order to facilitate maneuvering of the barges.

The proper navigation aid facilities at both ends of the canal and columns of the bridges should be installed for navigation safety. Fenders for the columns at the bridge of the northern end may be required.

(2) Sea Port Facilities

1) General Views on the Requirements for Sea Ports

The most important point for the development of the IWT is to attract as much cargo as possible. To achieve this target the transport cost and time of IW must be competitive with railways and trucks. In this regard, it is important to establish an efficient and economical transshipment system between sea-going vessels and IWT barges at seaports.

There are two methods for the transshipment between sea going vessels and IWT barges, direct transshipment and indirect transshipment (transshipment via land area). The most suitable method should be selected for each commodity based on a careful evaluation. Generally, direct transshipment does not require land stock facilities but it causes long berthing times of sea going vessels due to lower cargo transshipment productivity than that of quay side loading/unloading. Hence the transshipment via land stock facilities is generally preferable for efficient cargo transshipment if it is possible to provide required berths and stock facilities for IWT barges.

To accommodate IWT cargoes to be transshipped at sea ports (Alexandria Port, El Dekheila Port and Damietta Port), the proper port facilities, such as barge berths and basin, and cargo handling equipment should be prepared. In particular, the transship method and area for newly introduced IWT cargoes including containers, general cargoes, and maize/wheat, should be evaluated carefully. However, compared with the total cargo handling volumes at sea ports, IWT cargo handling volumes there will still be small even though they are assumed to increase significantly in the future. Therefore, the seaports basically can cater for the future IWT demand with existing equipment and facilities for the moment except for some bulk cargo loading equipment. However, from a long-term perspective, the further development of cargo handling equipment and port facilities such as barge basin will be required to accommodate future IWT cargo demand and to achieve efficient transshipment between sea and IW.

2) Alexandria Port

Alexandria Port is the sole seaport connected with IWT at present. The requirement for each cargo is as follows.

a) Coal / Coke

Two transshipment methods between sea-going vessels and IWT barges are adopted at the coal/coke terminal. One is direct transshipment in side-by-side mooring style with the rail mounted cranes and the other is transshipment via stock yard. IWT of coal/coke is forecasted not to increase in the future. Therefore the existing facilities and equipment can accommodate future demand. However the introduction of wider barges (12m width) may cause difficulty for direct transshipment due to the limitation of the outreach of the cranes.

b) Grain

IWT of grain used to be conducted between Alexandria Port and Imbaba. The loading equipment for river barges still remains at the grain terminal but is not workable due to long disuse. New loading

equipment for river barges should be installed in order to resume IWT.

c) Container

There are two options for container handling of IWT barges, gantry crane and movable crane. If the existing gantry cranes can be used for container handling of IWT barges, additional investment for cargo handling equipment is not required. However, priority to use berths with gantry cranes is given to sea going vessels. Considering berth occupancy condition, it is difficult for IWT barges to use these berths constantly. If possible, cargo handling of IWT barges should be carried out at another berth in the container terminal, such as RORO berth, to shorten the land transport distance at the port. If this would cause excessive congestion at the container terminal, the appropriate berth should be prepared near the terminal. Berth No. 44 is one of the suitable sites. A movable crane for cargo handling of IWT barges also needs to be prepared.

d) General Cargoes

There is no IWT of timber at present. However many port barges are used for unloading timber with ship gears in the port basin. The transshipment to river barges also can be conducted in the same way. Some iron/steel products are transported by river barges. Cement can be transshipped by truck crane. It is considered that a large investment is not required for IWT of general cargoes.

3) El Dekheila Port

There is no IWT at El Dekheila Port. The requirements for potential cargoes for IWT with coastal-going barge system are as follows.

a) Container

The container terminal has sufficient quay length and a mobile crane which can be used for cargo handling of river barges. The berth and cargo handling area adjacent to the terminal also can be provided for river barges.

b) Coal

All imported coals at the material quay are transported to Tebbin by rail. Since the wave condition at this quay is not calm for IWT barge mooring, another appropriate berth should be prepared for cargo handling of IWT barges. Loading equipment of the belt conveyer system from the remote stock yard is also required. A huge investment is assumed to be required for the introduction of IWT.

c) Grain

All imported grains are transported by trucks. Loading equipment from the silos is required for IWT.

4) Damietta Port

Containers, grain and timber are forecasted to be IWT cargoes. The requirements for IWT of grain and containers are as follows.

a) Grain

The river barge basin with loading equipment from the silos has been already constructed. This basin

is connected with Damietta Branch through the connecting canal. Therefore IWT can be started immediately after the completion of the Damietta Branch development project.

b) Container

The container terminal has a mobile crane which can be used for cargo handling of IWT barges. The general cargo berths adjacent to the container terminal can be used for IWT barges.

11.3.5 Barge System

(1) General

During the last 80's, new seaports have been built in El Dikheila in order to facilitate larger sea-going vessels and to allow further development. Since the new port located at 5 km west of the port of Alexandria, the port deems suitable to serve for inland water transport through Nobaria canal. However, until now the connecting waterways to this new port have not yet been provided or completed.

Based on the future demand projection formulated by JICA Study Team, the major cargo expected from Dikheila port to be transported by inland waterway in future is container cargo (and also wheat, coal is other potential cargoes, which are transported by railway from Dikheila port at present). One of alternative choices for consideration is opening of coastal connection between Alexandria and Dikheila and the transport connection by barges should be taken into consideration by introduction of newly designed coastal-inland water sailing barge.

In July 2000, MOT has made an OT basis contract with Egytrans for development of Cairo based container terminal at Ather El Nabi Port in Cairo including the exclusive right of transporting containers. This development project expects to handle 25,000 TEU containers in the first phase at the river port. The basic operation plan by Egytrans includes future additional container route from Damietta in the 2nd phase development.

(2) Existing Barge System

Since early 60's, old type of barge has been replaced by introduction of twin-ship units in combination of one pusher barge and one dumb barge. Majority of the twin-ship units are used for transport of dry bulk cargo as well as liquid cargoes. Therefore, in present river-oriented barge system, there is neither normal type of barge unit suitable for transporting container cargoes through inland waterway transport networks nor specifically designed type of barge which can safely navigable for short distance along coastal way between the ports of Alexandria and Dikheila.

(3) New Barge for Possible Development

In considering present situation of barge system and potential future cargoes and transport route by inland waterway, possible development of new barge is targeted at the following type and mode of

transport:

- Barge being capable of carrying larger unit load of containers or dry bulk per barge in view of transport economy
- Coastal-going container cargo carrier barge for direct connection between Dikheila Port and Beheiry/Nobaria Canals

Among major cargo commodities which are suitable for inland waterway transport, the Study Team focuses an introduction of new barge for container and dry bulk based on the future cargo demand projected in this study. If other specific cargoes necessitate an adoption of new barge fleet, then the building of additional barges or new types of barges may be developed through in-depth study on the design and projection for future potential cargo demand.

(4) Conceptual Design of New Barge

Newly introduced barge must suit or be conditioned within allowance for various constraints, which are inevitably imposed by the present inland waterway infrastructures. Therefore, taking into account such various physical conditions of IWs as permissible water depth available along Nobaria canal, air clearance of bridges, navigable width of Nobaria canal and size of lock chamber in Alexandria/Cairo IW, the length of not less than 102m, full loaded draft of 1.6 m or less, air draft of not less than 4.4 m and beam width of not more than 12m are determined as the maximum dimensions of the new barge.

The comparative study focused on developments of container barge and bulk barge. The following table indicates the size of barge in the case study.

Cargo Type	Container	Bulk
LOA	100m	100m
Beam	12m	12m/7.5m
Draft	1.6m	1.6m

1) Coastal Sailing Container Carrier Barge

Three alternatives (5 cases) were examined for container carrier barge and single unit self-propulsive is selected as the most advantageous type.

- Total capacity of container load in combination of pusher and dumb barge (Twin Barge) will be 88 TEU's while the total loading capacity of single unit barge is 96 TEU's.
- In type of coastal sailing pusher barge and pushed dumb barge, dumb barge needs to be united with pusher barge by specially reinforced/improved couplers. It results in the most expensive due to its costly development of special coupling. In addition, this type (pusher and pushed dumb barge) apparently offers disadvantage in view of more difficulties in coastal maneuvering than other types of alternatives which are able to sail as single unit.
- Twin units (pusher and pushed dumb barge) require connecting and disconnecting each unit of barge at Alexandria Port after/before maritime lock. This will take a considerable time because dumb barge can not move individually and the pusher barge have to help her on/off berth for cargo loading/unloading. It needs cumbersome tying/untying operation to be

established in barge navigation schedule and will eventually decrease barge service level.

- There is not so much difference in barge construction cost among alternatives as well as in term of price per unit cargo load excluding coastal sailing pusher barge and pushed dumb barge which is the most expensive.
- Single unit self-propulsive does not need any time or cumbersome operation to connect/disconnect pusher together with dumb barge. In addition, this single unit type offers easier maneuverability owing to full control by single unit than other alternatives.

2) Non-Coastal Bulk Carrier Barge

Three alternatives are comparatively studied and, based on the following findings, self-propelled single unit will be considered the most advantageous in term of its price per unit cargo load.

- Load capacity of each alternative differs as follows:-

Load Capacity of Each Alternative (ton)

Alternative	Pusher	Dumb	Total
1	420	440	860
2	670	710	1,380
3	1,450	—	1,450

- The above three Alternatives (3 Cases) were compared in prices and it is found that Alternative 2 is the most expensive among alternatives.
- Alternative 3 (Self-propelled Single Unit) will be considered the most advantageous in term of its price per unit cargo load as shown. Moreover, Alternative 3 "Single unit type" does not need any time or cumbersome operation to connect/disconnect together with dumb barge and in addition can offers easier maneuvering owing to full control by single unit.

(5) Recommendation on New Barge System

The single unit type of "self-propelled barge" is the most suitable for future type of barge to transport both container and bulk cargoes. It is recommended for the future to introduce new type of barge in the following design concept:

- Deletion of twin barge unit concept
- Smaller design draft (d = 1.6 m) to suit all seasonable water draft available
- Increase the length of barge unit (100 m) in line with deletion of twin unit barge concept
- Increase the beam of barge unit (B = 12 m) within the beam allowance for two way traffics under the present 1st class waterway of 35 m width

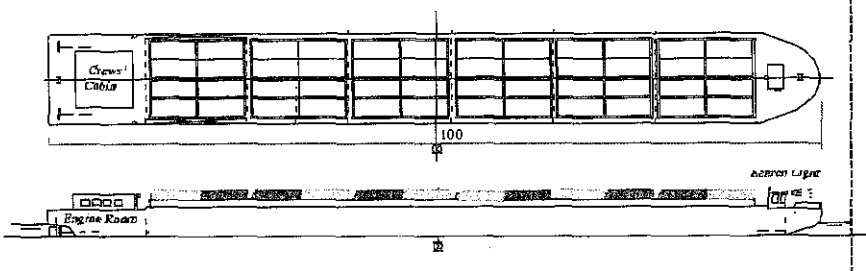
The following commentaries are also provided for possible development of new type barge recommended.

a) This twin engines system is also very helpful for maneuvering so that the turning at its position can be possible without any thrust support system.
b) From the economic (fuel oil consumption) and environmental viewpoint, the main engine power should be considered as small as possible. For this study, the 600 ps (horsepower) engine is recommended for this barge system.
c) Present Egyptian shipyard may be utilized to build the new type of barges of 100m long.
d) This study recommends that unit type of new barge of which LOA is 100m. All necessary steps for authorization of new type of barge including amendment of Ministerial Decree should be taken in due course.
e) As far as container carrier barge used to serve for transport from/to Alexandria and Dikheila ports, the rehabilitation project for extension of maritime lock at Alexandria forms one of prerequisites for possible introduction of new barge dimensioned 100 m long and 12 m wide.

Results of comparative case study are summarized as follows:

- In the study , it is proposed that a single unit of large-sized barge is the most suitable.

Container Barge



Dimensions
Length 100 m × Width 12 m × Draft 1.6 m,
Depth 2.3m (Depth 3.8 m*),
1,450 DW (1,260 DW*),
Loading Capacity is 96TEU (88 TEU*)
*Dimension/Capacity of coastal-going barge within short-range

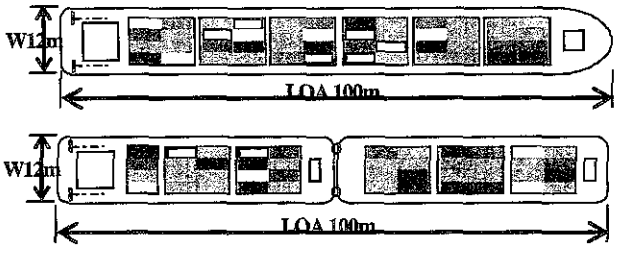
Major Advantages of New Type Barge over Existing One :

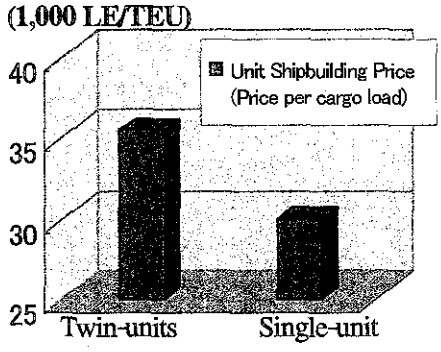
Transport efficiency & cost-competitiveness due to single unit

It is proposed that self-propelled single unit be introduced rather than conventional twin-units; a single unit offers greater efficiency and cost-competitiveness over twin-units.

Single Unit (Capacity of 96 TEU)

Twin-Units (Capacity of 88TEU)

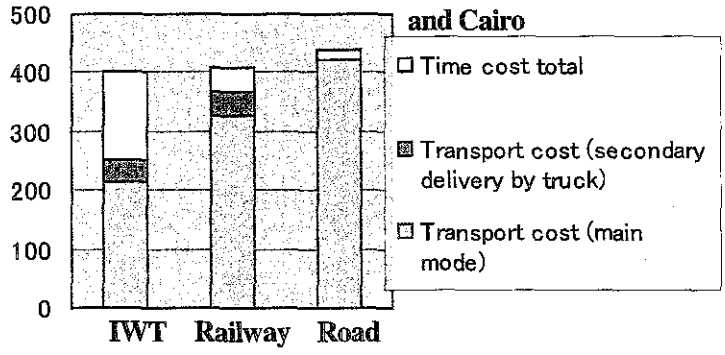




To materialize container transport:

The new barge can compete favorably with road and railway from the viewpoint of transport cost per container (see below Figure). Namely, this type enables the IWT sector to participate in the container market for the first time.

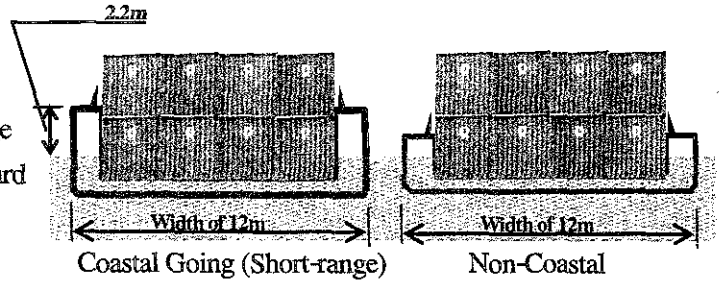
Transport cost (LE/TEU) between El Dekheila and Cairo



To navigate open-sea area between El Dekheila and Alexandria Port

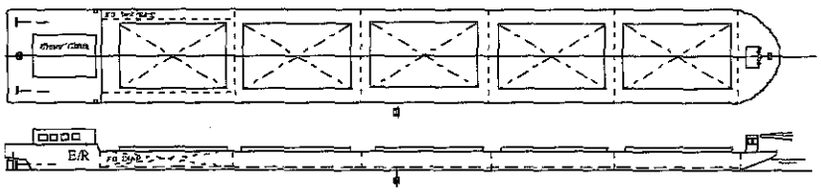
It is necessary to strengthen a hull of barge against sea waves although the distance of open sea route is only 3 miles.

It is proposed that a new coastal-going barge have a strengthened hull with 2.2 m freeboard



Sketch of Midship Section

Bulk Barge



Dimensions
Length 100 m × Width 12 m × Draft 1.6 m, Depth 2.3m, 1,450 DW

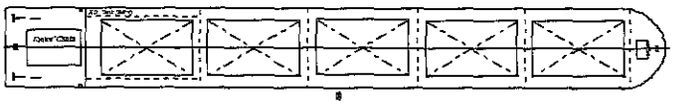
Major Advantages of New Type Barge over Existing One :

To cultivate new IWT market by improvement of cost-competitiveness:

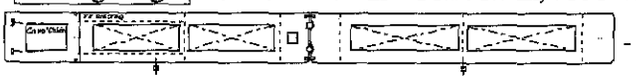
At present, existing small-sized barges seem to have some modal share in "traditional transport" such as coal/coke and molasses.

In the master plan, it is vital for bulk transportation to enlarge size of barges because Large-sized single unit enables IWT to gain new market of bulk cargoes by taking advantage of greater cost-competitiveness.

New Barge L100 m×W 12m×Draft 1.6m,1,450 DW

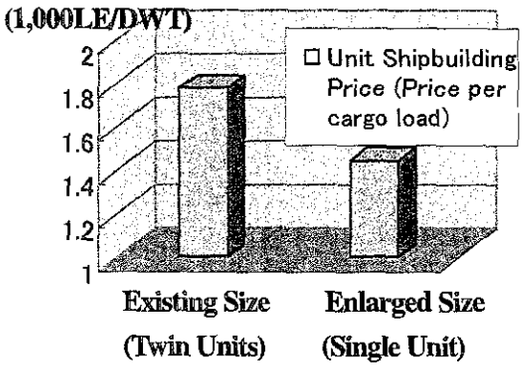


Existing Barge* L 92m×W 7.5m×Draft 1.7 m, 760 DW



*Average size of existing fleet of twin-units

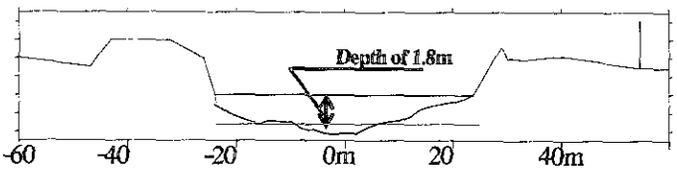
Comparing shipbuilding prices between small-sized and proposed large-sized barges, the latter is expected to bring in larger returns on investment in barge building .



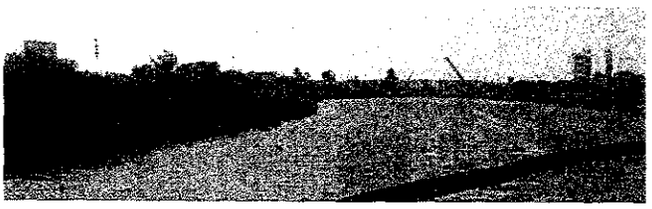
To allow navigation even during the low-discharge period

The proposed large-sized barge has shallow draft of 1.6 m despite its increased loading capacity. This new barge can navigate fully loaded even during the low-discharge period. This results in the improvement of its cost-competitiveness against trucks.

Typical cross-section in Alexandria/Cairo IW



Moreover, it is proposed to dredge Alexandria/ Cairo IW up to design depth of 2.0 m and design width of 36 m in order that both existing and new barge can safely and smoothly navigate.



Alex./Cairo IW (Upstream 23 km from Alexandria Port)

11.3.6 Barge Operation in the Delta for 2020

- There are two purposes of this sub-section, first one is summarizes barge operation when new wider barges move in opposite directions and pass each other.
- Second purpose is to estimate lock capacity and canal capacity to increase in future traffic for 2020. As well known, IWs capacity depends on lock's capacity, and the master plan reaches same conclusion.

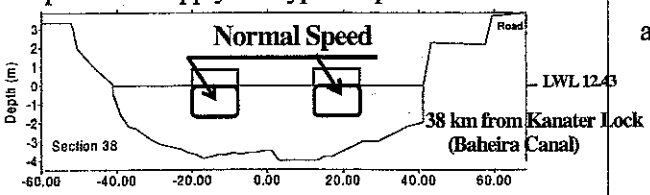
(1) Barge Operation

The master plan proposes the following operation of barges which aims at securing smooth and safe navigation when wider barge is introduced in the Delta Area (see Figure 11.3.4 below).

Figure 11.3.4 Barge Operation in 2020

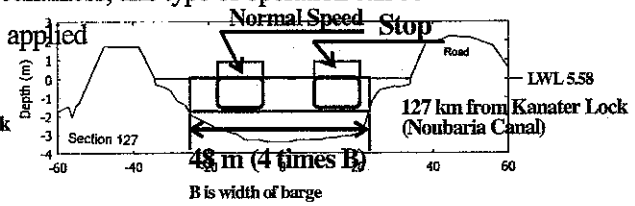
- The barges moving in opposite directions can pass each other at normal speed.

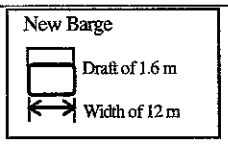
#In the full length of Baheira Canal, it is possible to apply this type of operation.



- When barges moving in opposite directions encounter each other, one barge should slow-down and stop, the other can navigate at normal speed

#In Noubaria Canal between Boulin and Janakless, this type of operation can be applied



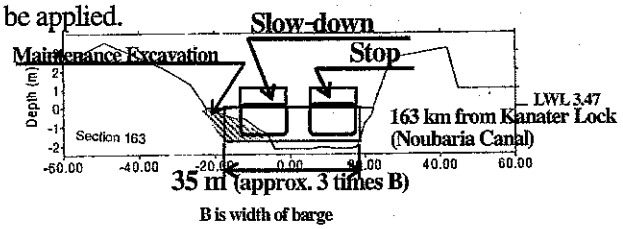


Note : the following cross-sections in Alex./Cairo IW are based on JICA's sounding survey in 2002.

- When barges moving in opposite directions encounter each other, one barge should slow-down and stop, the other can navigate at a reduced speed.

#In Noubaria Canal between Janakless to Alex., this type of operation will be applied for new wider barges.

#In Damietta Branch, this type of operation will also be applied.



Needless to say, proposed barge operation is considered taking account of the following aspects:

- To minimize dredging volume for canal widening
- To reduce adverse effect on bank erosion

(2) Capacity of Locks

Operational cycle time of lock mainly depends on needed time for water-filling/discharge into /from lock chamber.

- The locks with the longest cycle-time are shown in Table 11.3.5 below.
- **Capacities of Alex./Cairo IW, and Damietta/ Cairo IW are estimated at 32 units and 36 units per day**, respectively (see table below).

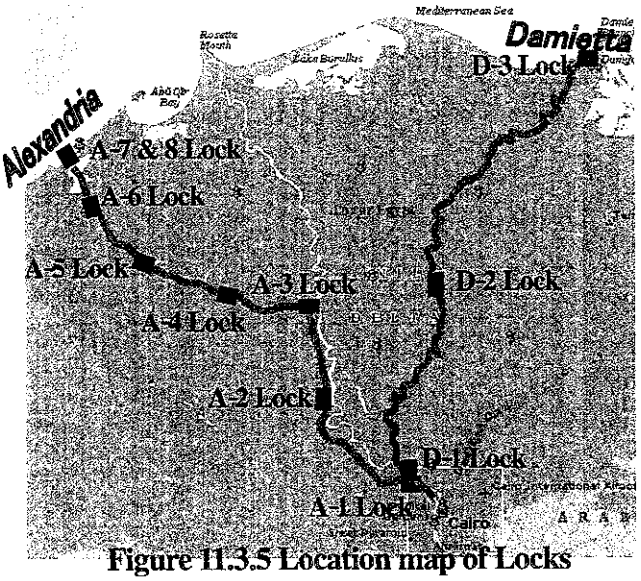


Figure 11.3.5 Location map of Locks

Table 11.3.7 Capacities of Lock

	Alex./Cairo IW	Damietta/Cairo IW
Lock with the longest cycle-time	A-6 Lock, Cycle time will be 0.75 hour	D-1 Lock, Cycle time will be 0.67 hour
Lock Capacity	32 twin-units per day	36 twin-units per day

(3) Capacity of Canal

According to the above-mentioned operations, IW capacities are likely to decrease due to stop or slow-down of barges. Therefore, capacities of canal are examined in later section.

- Capacities of IWs are indicated as follows: Alex./Cairo IW has the capacity of **210 units per day** and the capacity of Damietta/Cairo IW is estimated at **160 units per day**,.

(4) Traffic Volume Forecast

- Meanwhile, when modal-shift is realized, it is **forecasted that a max. of 32 units** will navigate Alex./Cairo IW and **a max. of 13 units** will pass through Damietta/Cairo IW. Here, a maximum number of units is computed in consideration of some congestion due to seasonal or daily fluctuations of barge traffic.

- Therefore, in terms of canals' navigation, traffic capacity can sufficiently meet increase in the traffic of barges for 2020. However, capacities of Egyptian IWT will be restricted by lock operation as shown in above-shown Table 11.3.7.

11.4 Improvements of Managerial and Operational System of IWT

11.4.1 General

To promote IWT it is essential that the managerial and operational system should be improved. Egyptian Government policy places great emphasis on environmental preservation and energy conservation. In the process of improving the IWT system, environmental issues need to be taken into consideration.

Study Team approaches these matters from the following aspects.

- Government's inducement measures on promotion of Modal-shift
- Government's program to tackle environmental issue
- Responsibility of public Sector
- Enhancement of Market Principle

11.4.2 Inducement Measures on IWT to be introduced by the Government

(1) Government initiatives to promote Modal-Shift

1) Establishment of Soft-Loan program to support IWT

Barge transport will be facilitated by private investment. Therefore, it will be important to enhance the incentives for the investment in barge transport as much as possible.

What the study team proposes as one of the effective measures for this is the establishment of a fund to provide low interest loans to private barge operators willing to build new barges. For that purpose it is recommended that MOT set up "IWT Promotion Fund". (In Japan we have a similar scheme to support operators for building ships.)

This requires a considerable sum of money at the beginning. However, loans provided from the fund will be repaid by borrowers in the long run, and the fund can be continuously operated.

It might also be possible to obtain funding from overseas countries or international aid agencies.

(2) Government program to tackle environmental issues

According to the latest Study of MOT, the fuel consumption in road transport is about three times more than that by river transport, and regarding the capital cost, the one pound productivity in IWT case is four times more than the one pound productivity in the road transport. Furthermore IWT is not only an environmental mode of transport, it also comes at a lower social cost in terms of "accidents" and preserving the environment. To further protect the environment, the government should take countermeasures to control the increasing number of vehicles. For example the

government could strengthen the current system as follows;

- Inspecting automobiles
- Certification system for garages for automobiles
- Regulations against overloading of trucks
- Prohibition of transport of dangerous cargo

Furthermore the government could introduce an environmental protection tax in future. (Tax levied on motor fuel sales, carbon and sulfur emission and so on)

11.4.3 Role-sharing between Public and Private Sectors

(1) Responsibility of Public Sector

The responsibility of the public sector is to consider development infrastructures from a national perspective and provide the private sector with a sound competitive environment without excessive interventions which are detrimental to fair competition. Furthermore the study team would like to propose that a kind of committee composed of related government agencies be established to coordinate matters regarding the use of water resources of the Nile River. It is considered reasonable to put priority of water distribution on irrigation or food production. However, from the point of view of IWT, if water distribution to IW was decreased to the extent that navigable water depth could not be maintained, IWT would be completely suspended. Since this will be the same also for sightseeing cruises, it is vital to set up a committee to discuss and pursue the optimum use of the water resources.

This committee should include the following members;

- RTA (River Transport Authority)
- MOT (Ministry of Transport)
- MWRI (Ministry of Water Resources and Irrigation)
- NWRC (National Water Research Center)
- NRI (Nile Research Institute)
- Ministry of Tourism

(2) Enhancement of Market Principal

a) Quick privatization of General Nile River Transport Company

At present, General Nile River Transport Company handles to two-thirds of all cargo transported by inland waterways. The company currently owned by the State, is now preparing to be completely privatized. As it is, they have made efforts to be attractive for investors by reducing the number of personal and clearing off idle facilities. By means of this state company's privatization, IWT markets will be more competitive. This is very

useful for the sound development of IWT markets.

b) Promotion of Market Principal

Following economic reforms, MOT has coordinated less strict competition between the three transport means (IW, railway, road) to organize the transporting of the important transported cargos as the ration commodities, fertilizers and the petroleum materials. Government has given subsidies to three transport modes respectively. But this policy might be changed to trigger competition in the market.

As the method of competition it would be useful for operator to set cheaper freight and give advantages for big clients.

In addition to fostering a competitive environment, licenses for transportation, stevedoring, warehousing as well as combined licenses should be issued to interested private companies. This will make it easier for new comers to participate in IWT businesses.

(3) Strengthening IWT Business

To date, the importance of studying the transport market, and the role of marketing has been ignored. Moreover IWT has failed to meet the needs of customers, and as a result the volume of cargo transported by IWT has gradually been decreasing. Naturally the financial state of IWT business has been adversely affected.

IWT business needs strong organized framework to attract more cargos to this sector. At present there is no IWT association established.

It is necessary that a nationwide association to strengthen IWT business in future.

Main functions of this association would be as follows;

- Adjustment issues of IWT operators
- Marketing of IWT market
- Appealing to Government
- Lobbing for IWT promotion
- PR activity for IWT

And it is important for IWT business to secure highly qualified workers to make preparations for 24-hour operation of IWT. In this respect, the conditions of barge crew should be improved. For example, it is necessary to introduce attractive salary systems, increase the level of comfort on barges and provide substantial trainings in order to attract the best workers.

11.4.4 Management & Repair for Inland Waterway Infrastructure

(1) General

Future container cargo service into IWT by new barge or new introduction of day & night operation may require suitable and upgraded transport system, otherwise future potential cargo may shift to other transport modes. IWT should offer better or improved performance of operation through the proposed improvements on inland waterway system. The likely lack of well functioned organization and properly coordinated system will impose critical constraints for further development of the sectors. The proposed improvements on infrastructures and barge transport operations of inland waterway will definitely require adequate well-trained and experienced personnel, management and organizational structures to function properly and effectively among the sector's participants, inland waterway transport barge companies, in particular.

(2) Basic Considerations and Objectives

Upper River Nile between Cairo and Asyut shows that some parts of each surveyed location are insufficient in water depth for navigation due to the delayed maintenance in past years and be needed to receive considerable extent of maintenance dredging. The extensive dredging and maintenance requires a full consideration in hydrological aspects. But, more or less, recurrent dredging and provision of navigation aids supported by a regular sounding program, can provide realistic solutions to maintain safe and easy navigation for barge transportation.

The downstream portion of Nobaria Canal, i.e. the portion from the middle section between Janaklis and Nahda locks down to the lake of Maryut, indicates a continuous shortage of water depth along the waterway for navigation due to insufficient supply of water discharge from the upstream of canal or River Nile. Besides, some parts of up- and down-stream of each lock are also revealed the need of spot dredging due to riverbed sedimentation or unevenness of bed level. Since a certain extent of siltation of canals and changes in riverbed are natural processes that could not easily be eliminated, the execution of recurrent dredging will be one of prime tasks to be carried out by RTA. However, it should be kept in mind that the whole cross sectional dredging along Beheiry/Nobaria canal, of which width is nearly in the same order as one for the required fairway channel, inevitably results in the water level reduction of the canal section with no or only a minor increase in the desired water depth for navigation afterwards. Therefore, extensive capital dredging should be succeeded with hydraulic studies with closely measured and well monitored pilot dredging in a certain reach of the waterway, otherwise the results of such dredging might well fail behind the expectations.

As the number of mechanical and electrical equipment owned by RTA is likely to increase in future owing to the increased transport cargo, there will be a growing strong need for a maintenance and repair department in technical sector of RTA. It should consist of deployment of experienced engineers, trained technicians and their supporting staffs who can do such tasks or activities as regular inspection, preventive maintenance and simple repair works on locks, recurrent sounding, survey and inspection of waterway, removal of obstacles, maintenance dredging and navigation aids, maintenance and repair of civil facilities, etc.

In line with increasing demand in future, RTA should reinforce and establish such a maintenance and repair unit of group within the organization to carry out preventive and small scale of maintenance & repair work by itself. There is an apparent need for training some group of personnel for upgraded performance of maintenance activities in future. At present, RTA may suffer from lacking technicians who can repair and maintain its locks, equipment and service vessels. As a result, even simple repairs have to be unnecessarily delayed till being carried out by contractors or maintenance and repair works is neglected.

(3) Strategic Plan for Maintenance & Repair

1) Reinforcement of RTA Technical Division & Technical Personnel

The organization structure should be subjected to adjustment in emphasizing importance of maintenance and repair for navigation waterway, lock and other facilities. Also, the number of skilled personnel should be reallocated properly to obtain a proper level of services for market expectation in continuous and higher level of transport through inland waterway.

It is observed that the sector is required to attract some types of technical personnel who are essential and most importance for upgrading future performance in possible new tasks and activities in management and repair of inland waterway infrastructure:

2) Execution Plan for Maintenance & Repair

A maintenance & repair program for inland waterway should be formulated aiming at the major pattern of maintenance dredging and repair works:

3) Close Coordination with MWRI

A close coordination between RTA and MWRI will be mandatory in programming

maintenance dredging scheme and its implementation for effective and proper maintenance of the waterway in view of both for irrigation and barge navigation.

4) Share of RTA Role

In view of skill and work experience of RTA personnel, the role of RTA for maintenance dredging should be clearly concentrated in small scale of or simple spot maintenance dredging, for which the organization and staff personnel should be reinforced to effectively carry out regular inspection, monitoring and minor or small scale of maintenance dredging. As regard maintenance & repair works for locks and equipment, all the efforts of RTA mechanical and electrical staffs should be exerted to small scale of maintenance and repair on daily or regular basis.

RTA should provide necessary inspection and monitoring of inland waterway and its infrastructure to maintain sufficient navigability and should usually prepare dredging, maintenance or repair scheme based on inspection of facilities or monitoring on hydrographic features of waterway and usability of equipment.

5) Needs for Training Technical Personnel

Maintenance Section should be reinforced in view of work force required to carried out regular inspection, periodic monitoring including surveying and minor scale of maintenance dredging and repair works. In particular, in order to improve water depth by regular maintenance dredging on the basis of regular surveys and sounding, particularly lock maintenance including immediate up- and down-stream of lock, RTA should be provided with well skilled and trained group of staff personnel in the technical field of waterway navigation and necessary equipment for swift implementation of maintenance dredging so as to reduce downtime for lock operation while maintenance dredging is done at or near the lock. In this respect, it will be appropriate and will be required to provide a regular training program for RTA technical staff aiming acquisition of higher management and efficiency in maintenance and repair works.

(4) Maintenance & Repair Program

All the regular maintenance and repair works should be implemented based on defined work program. As regards maintenance of safe waterway in particular, regular sounding programs should be set up and carried out in bottleneck sections in order to check available water depths to indicate shoals and to prepare relocation of navigation aids and dredging works. Necessary spare parts for normally used equipment and machinery should be kept in sufficient number for periodical breakdown or replacement.

11.5 Economic Analysis on Proposed Projects in Master Plan

11.5.1 Design and Cost Estimate of Project Components

The proposed improvements in the master plan will comprise of the following components for each inland waterway among Nile Delta network:

Project A: Cairo-Alexandria Waterway (Beheiry/Nobaria Canals Route)
- Component 1: Extension of Alexandria Maritime Lock
- Component 2: Dredging and Navigation Aids System along Beheiry/Nobaria Canals from Alexandria to Cairo
- Component 3: Cairo River Port at Ather El Nabi

Project B: Upper Nile-Kafr El Zayat-Alexandria Waterway
- Component 4: New Connection Canal at Bolin between Beheiry/Nobaria Canals and Rosetta Branch

(1) **Design of Each Project Component**

1) Component 1: Extension of Alexandria Maritime Lock

Possible extension of small Maleh lock will be designed under the following design criteria:

Water Level at Nobaria Canal:	HHWL+0.48m
	HWL+2.90
	MWL +0.00m
	LWL+0.27m
Water Level at Lake Maryut Side:	MWL-2.50m
Navigation Lock:	One number of Lock Chamber
Length of Lock Chamber:	116 m
Width of Lock Chamber:	16m (= present width)
Retaining Water Level:	Maximum 2.98m, Average 2.5m
Minimum Water Depth at Lock Chamber:	2.3 m
Vertical Clearance:	6.0 m above water level

2) Component 2: Dredging and Navigation Aids from Cairo to Alexandria

In order to provide sufficient keel clearance, it is recommended to dredge the waterway to have water depth of 2.0 m with necessary side slope of 1:2 though there is an argument on possible no increase or only small increase in the desired water depth for navigation after execution of dredging. At canal section where side slope of 1:2 is not possible to suitably provide for deepening dredging due to constraint of available canal sectional width, it is recommended to provide such section of waterway with bank protection in line with dredging work.

Beheiry/Nobaria Canals are deeper than normally required for navigation except for certain distance

along up- and down-stream Nahda locks where capital dredging is estimated to be required. Some extent of maintenance dredging including those at lock approaches will be necessary to be carried out under recurrent basis by years.

3) Component 3: River Port at Ather El Nabi

The likely stacking cargo in layers on existing quay should be restricted in the proposed river port operation in consideration of the restraint in load capacity of existing quay structure. Besides, new river port development at Ather El Nabi needs a provision of possible reinforcement and rehabilitation for existing quay (310m plus 150 m) together with construction of new quay (230m long) .

It is recommended that design water depth at Branch Canal should be 2.3 m which is measured from minimum water level (+15.04 m) and, therefore, capital dredging be carried out to the level of +15.04 – 2.3 = +12.7m in order for present barge convoy to be accessible during the whole year.

4) Component 4: New Connection Canal

The existing spillway has to be deepened and widened for new connection canal to have a standard dimensions for the 1st class waterway. A navigation lock has to be provided to adjust water level difference between Beheiry/Nobaria canals and Rosetta Branch, which is estimated 6.5m water head.

Maintenance dredging will not be required along new connection canal at Bolin since widening and deepening of canal is constructed with a provision of bank protection except for the likely occurrence of minor deposit at canal bottom for the portion of approach to lock head. But, maintenance dredging will be definitely required for newly dredged fairway along Rosetta Branch. The Study Team estimate that the likely annual volume of 3 % of the capital dredging will be in necessity to maintain fairway in designated width and depth.

(2) Cost Estimate for Each Component

Preliminary cost estimation for Master Plan is carried out based on preliminary engineering design. Besides, the project cost will be estimated to meet requirements in line with international standards. Project cost for constructing infrastructures includes such cost components as construction cost, procurement of equipment and machinery, engineering service, physical or price contingencies and other costs for project administration, etc. In cost estimate for projects formulated in this study, necessary cost to procure engineering services will be added at a rate of about 2.5% to 10 % against total construction cost or procurement cost of machinery and equipment. The contingencies for project consist of physical and price contingencies. Amount of Contingency is normally taken at a rate of 10 % of the total cost for construction and 3 % for procurement of equipment.

Unit costs in terms of currently prevailing costs as of February 2002 are estimated through counterchecking precedents of construction works executed in Egyptian market in recent years. The project cost will be broken down into foreign and local currency components in consideration of possible sources for necessary input materials, equipment and work forces. Exchange rate of Egyptian Pound (L.E.) against US dollars (US$) was devaluated in the last year and the current

exchange rate of L.E.4.6 against US$ as of the year 2002 is used for cost estimate. The project cost is expressed in Egyptian pound (L.E.) for foreign currency portion and local currency portion and the total amount of project cost will be also expressed in L.E. in this cost estimate.

Project Cost of Master Plan

Cost: 1,000 L.E.

Item	Description	Unit	Q'ty	Cost	Local/C	Foreign/C
Component 1: Extension of Existing Alexandria Lock (Small Lock)						
A	Civil Works	l.s	1	59,260	35,794	23,466
B	ME Equipment for Upper Head	l.s	1	8,000	2,000	6,000
C	Engineering Service Cost			3,956	1,938	2,018
D	Contingencies			6,533	3,822	2,711
	Total Cost of Component 1			77,749	43,554	34,195
Component 2: Dredging and Navigation Aids along Cairo-Alexandria Route						
A	Dredging and Bank Protection	l.s	1	28,648	25,579	3,069
B	Navigation Aids	l.s	1	15,156	3,031	12,125
C	Engineering Service Cost			3,244	1,509	1,735
D	Contingencies			3,617	2,794	823
	Total Cost of Component 2			50,665	32,913	17,752
Component 3: Cairo River Port (Ather El Nabi)						
A	Container Terminal & General Cargo Terminal (Civil Works)	l.s	1	60,913	42,630	18,283
B	Cargo Handling Equipment	l.s	1	113,500	22,700	90,800
C	Engineering Service Cost			7,711	3,979	3,732
D	Contingencies			10,068	5,302	4,766
	Total Cost of Component 3			192,192	74,611	117,581
Component 4: New Connection Canal at Bolin						
A	New Canal & Dredging along Rosetta Branch	l.s	1	56,436	38,158	18,278
B	Mechanical and Electrical Equipment	l.s	1	22,000	5,500	16,500
C	Engineering Service Cost			5,615	3,493	2,122
D	Contingencies			6,788	4,299	2,489
	Total Cost of Component 3			90,839	51,450	39,389
Total Project Component Cost				**411,445**	**202,528**	**208,917**

11.5.2 Preliminary Economic Analysis

(1) Purposes and Methodology of Economic Analysis

The purpose of this section is to appraise the economic feasibility of the projects proposed by the Master Plan for the development of the inland waterway system in Egypt from the viewpoint of the national economy.

In this study, the Economic Internal Rate of Return (EIRR) and the benefit/cost ratio (B/C ratio) based on a cost-benefit analysis are used to appraise the feasibility.

(2) Prerequisites for the Economic Analysis

1) Base Year

   In this analysis, the year 2002 was adopted as the "Base Year" since the costs of the projects were prepared on the bases of current price as of the same year..

2) Project Life

   30 years was adopted as the "Project Life".

3) Foreign Exchange Rate

   The exchange rate adopted for this analysis is as follows US$1.00 = LE4.6

4) "With-the-project" Case and "Without-the-project" Case

   In the Master Plan, there are two projects , viz. Alexandria-Cairo IWT Project and New Bolin Canal Project.

A cost-benefit analysis was conducted on the difference between the "With-the-project" case in which an investment is made and the "Without-the-project" case in which no investment is made, that is; the benefits and costs arising from the investment for the projects were compared.

a) "With-the-project" Case

<u>Alexandria-Cairo IWT Project</u>

- Maritime Lock will be renovated.
- Navigation aids to enable night navigation between Alexandria Port and Ather El Nabi Port will be prepared.
- Dredging and bank protection works to maintain of the suitable depth and width of channels for the proposed barge types.
- Ather El Nabi Port will be developed so as to enable to provide public port services

<u>New Boulin Canal Project</u>

- New Boulin Canal will be created so as to connect Boulin and Rasheed Branch

In addition to the above investment for the two projects, it was assumed in the analysis that barges specialized for container transport will be built and be in operation by barge operators.

b)"Without-the-project" Case

- Maritime Lock will not be renovated.
- Navigation aids to enable night navigation between Alexandria Port and Ather El Nabi Port will not be prepared.

- Ather El Nabi Port will remain as it is without any development.
- Dredging and bank protection works will not be executed.
- Rasheed Branch will be left disconnected with Boulin in IWT.

(3) Benefits of the Project

As benefits to be brought about by the projects, the following items are identified:

a) Savings in inland transport costs

b) Reduction of pollution by converting road transport into IWT with less emission

In this study, items from "a)" is considered to be countable in monetary benefits, and were adopted in these cost-benefit analyses. The item "b)" is mentioned qualitatively in this study.

(4) Costs of the Projects

The initial investment costs except cargo-handling equipment at Ather El Nabi Port for Alexandria-Cairo IWT Project and New Boulin Canal Project are 201.0 and 90.8 in million LE, respectively. In the estimation of EIRR and B/C, management/operations and maintenance costs were considered as well as the initial investment costs.

(5) Results of Preliminary Economic Analysis

1) Calculation of the EIRR

The resulting EIRRs of Alexandria-Cairo IWT Project and New Boulin Canal Project are 16.6% and 12.1%, respectively.

2) Calculation of the Benefit-Cost Ratio

Assuming social discount rates of 10%, the respective Benefit-Cost ratios (B/C ratio) of the projects were computed. The resulting B/C ratios of Alexandria-Cairo IWT Project and New Boulin Canal Project are 1.60 and 1.19, respectively.

(6) Evaluation of the Projects

Considering the opportunity cost of capital in each developing country, it is generally considered that a project with an EIRR of more than 10% is economically justifiable for infrastructure or social service projects. Current interest rates on long-term credit in Egypt as of December 2001 are 9% for Treasury Bill for over one year. On the other hand, the average GDP deflator in the last three years is in the range of 3 - 4%. Thus, the opportunity cost of Egypt could be considered to be at most 6%. From the above, the figure of 10% as the EIRR criterion is considered to be reasonable.

The resulting EIRRs of both projects are 16.6% and 12.1% and exceed the above-mentioned criterion. Thus, both projects are judged economically justifiable.

Chapter 12 Initial Environmental Examination (IEE)

12.1 Introduction

The master plan (M/P) is aimed at providing the necessary facilities in the Nile Delta area so as to realize modal shift in cargo transport from road to inland waterways of the Nile River. Currently, road transport with trucks accounts for more than 90% of the cargo, the predominant mode, while water accounting for only about 1% being the least used mode. Railway mode accounts for the remainder of the cargo transport. Facilitation in modal shift of cargo transport to waterway as per this M/P is basically targeted at effectively linking the three major sea-ports of Alexandria, Damietta and Port Said, all located in the Mediterranean coast of Nile Delta, with inland population centers like Cairo using the navigation canals and river reaches of Nile River.

Inland waterway transport (IWT) of cargo is more environmentally sound in comparison to that of road transport due to its higher energy efficiency and hence reduced fuel consumption and the associated reduction in GHG (greenhouse gas) and other air pollutant emission. IWT as an environmentally sound mode for development is emphasized in two important national policy documents published by EEAA on mitigation of climate change, of which one document is for UNFCCC (United Nations Framework Convention on Climate Change). These documents are as follows:

- "Initial National Communication on Climate Change" of June 1999 prepared for UNFCCC
- "National Action Plan on Climate Change" of August 1999

The latter document has identified measures/actions to be implemented by the relevant governmental organizations of Egypt so as to mitigate climate change. Accordingly, "*Improving and Expanding River and Railway Transport*" is identified as an item of action plans to be implemented by the Ministry of Transport (MOT). This M/P could be regarded as the action plan for river transport expansion until the year 2020.

12.2 Components of the Master Plan

The IWT master plan for the Nile Delta area is composed of the development of two major waterway systems in order to link effectively only the two major seaports of Alexandria and Damietta, but not Port Said, with Cairo and further upstream Nile river reaches in Upper Egypt. Waterway link of Port Said port is assessed as economically not viable in the foreseeable future, at least until the target year of M/P of 2020, principally due to low forecast cargo demand growth for Port Said Port.

Development plan for the Alexandria Port IWT system includes improvement of the existing navigation canals of Nobaria and Beheiry, including the rehabilitation of the

Maritime Lock at the Alexandria Port to facilitate direct access by high capacity barges to the port as the most significant improvement measure, and also the development of direct link between Nobaria canal and the Rosetta branch of Nile (Rosetta-Nile) at Bolin for creating a new IWT route to serve the industrial estate at Karf El Zayet. Concerning the Damietta Port IWT system, RTA is currently executing the improvement works to facilitate navigation of high capacity barges along Damietta-Nile and hence no further improvement works are deemed necessary.

Moreover, suitable high capacity barge system is planned both for bulk cargo and containerized cargo so as to economize transport cost. The planned capacity of typical bulk cargo barge is 1,380 MT (metric tons) and that of container barge is 96 TEU.

12.3 Environmental Effects

The long-term environmental effects under the operational condition of the planned IWT system of the M/P is illustrated below, distinguished between potential beneficial effects and adverse effects, to form the IEE. This IEE of the M/P is generally referred to as SEA (strategic environmental assessment).

12.3.1 Beneficial Effects

(1) High operational energy efficiency of waterway transport

The most significant long-term environmental benefit of IWT with barges is its higher energy (fuel) efficiency associated reduction in the emission of GHG and other air pollutants. As the quantification this benefit on a comparative basis, unit emissions, defined as the quantity of GHG and other air pollutants emitted while carrying unit load of cargo to unit distance, were estimated for all of the three modes of road (trucks), railway and waterway (IWT). The estimated unit emission values of GHG (CO_2) for bulk and container cargo transports shown below illustrate in quantity terms the environmental benefit of IWT. It is noted that currently there is no IWT for containers.

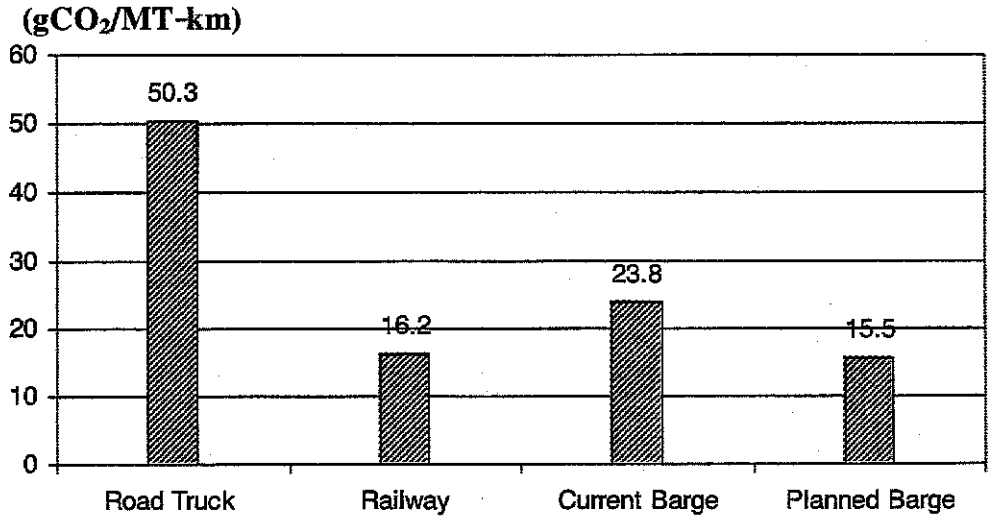


Figure 12.3.1 Unit Emissions of GHG -Bulk Cargo Transportation-

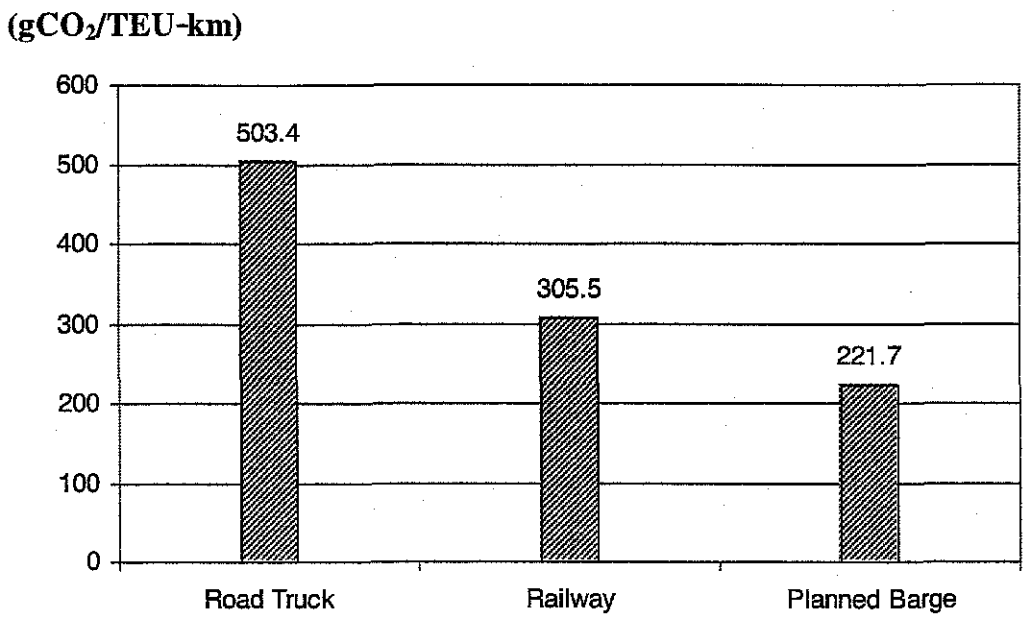


Figure 12.3.2 Unit Emissions of GHG -Container Transportation-

Based on the unit emission values the net annual reduction in the emission of GHG and other air pollutants consequent to the implementation of this M/P by the year 2020 were quantified as the difference between the cases of without and with M/P. Accordingly, in case of GHG, the annual reduction in emission is determined as 34,511 MT or 12.7%. In fact this percent-wise reduction of 12.7% is the same with respect to the air pollutants as well as fuel consumption, since all emission estimations are made based on the basic assumption of being proportional to the quantity of fuel consumption.

(2) Increased road traffic safety

The total annual frequency of trucks plying the principal Alexandria Port-Cairo route in the year 2020 under the condition of without M/P is estimated as 901,000 while under that of with M/P as 717,000. This accounts for a net annual reduction in truck frequency by a number of 184,000 units or about 20%, which is considered as very significant contribution to road traffic safety enhancement.

12.3.2 Adverse Effects

(1) Navigational safety concern

Increased frequency of barge traffic as well as the high capacity of barge with deep draft as per this M/P has important navigational safety concerns. Significant navigational safety risks are potential accident with another vessel and grounding of a high capacity barge due to inadequate water draft (navigation depth).

The required navigational safety enhancement measures such as navigation aids to facilitate night navigation including the barge design conforming the obtainable safe draft depth are incorporated in the M/P as in-built mitigation measures. Still, Nile River is the lifeline of Egypt providing the water for every conceivable beneficial use for virtually the entire population. Accordingly, while making every effort to mitigate

an accidental risk, it is also imperative to ensure that even in case of an inevitable accident, it would not significantly affect the lifeline beneficial water uses.

In order to ensure that an inevitable accident does not endanger the important beneficial uses, in principle, IWT of dangerous cargo is banned. Nevertheless, in case an entity is in need of IWT for dangerous cargo as with the case of transport of sulfur, a dangerous cargo, for the industrial estate of Karf El Zayet, as per this M/P, special permit for such transport shall be obtained from RTA. For the issuance of such a permit, RTA shall ensure provision of additional safety (protection) measures by barge operator depending on the perceived accidental risk of the dangerous cargo concerned. Such additional protection measure may include institution of double hull barge so as to minimize the risk of cargo spillage into waters even in the event of an inevitable accident.

In this respect the IMDG Code (International Maritime Dangerous Goods Code) of IMO (International Maritime Organization) categorizes dangerous cargo in maritime (water) transport into 9 classes that could be used for the determination of cargoes requiring special permit. The 9 classes of dangerous cargo are, Explosives, Gases compressed, liquefied or dissolved under pressure, Flammable liquids, Flammable solids or substances, Oxidizing agents and organic peroxides, Toxic and infectious substances, Radioactive materials, Corrosives and Miscellaneous dangerous substances and articles.

Finally regular conduct of bathymetric survey and the required maintenance dredging work by RTA to ensure design safe navigation depth is emphasized as the most important mitigation measure against potential grounding of a vessel.

(2) Waste management aspects of barge (vessel) operation

Increased number and frequency of barge operation as per this M/P also involves increased generation of barge operation related wastes. Bilge waste (waste oil) arising from the engine room of barge is an important oil pollutant in addition to that of solid wastes. These wastes shall be stored on-board and discharged in a port terminal. It is imperative that RTA, as the management agency responsible for IWT, ensures that all vessels, not just barges of this M/P, shall duly dispose their wastes at port terminals.

12.4. Conclusion of IEE

Implementation of the master plan has important long-term environmental benefit of reduction in emission of GHG and other air pollutants consequent to high-energy efficiency of IWT. However, mitigation of adverse effects has added significance due to the unique value of Nile River water being the lifeline of Egypt. Still, potential adverse effects are evaluated as manageable, in particular with the restriction on transport of dangerous cargo, so as not to affect the cargo transport oriented navigational use, which is also a component of multipurpose beneficial use of Nile River course.

Chapter 13 Short-term Development Plan of IWT for 2010

13.1 General

Main purpose of the short-term plan is to prepare first phase plan for the improvement of the IWT infrastructures and operational / managerial system by RTA for the target year 2010.

The short-term plan takes up the following three projects.

- Alexandria-Cairo IW improvement project:
  Improvements of canals (IWs), Installation of navigation aids and Extension of Maritime Lock
- Construction of a public river port (Ather El Nabi Port)
- New Bolin Canal project:
  Construction of new lock and barrage, Development of new canals

In the short-term plan, a new public river port is taken up as one project separately of Alexandria-Cairo IW project, for the following reason.

- Difference of project scheme: New river port is expected to be developed and operated by a concession contract scheme, while others will be developed and operated by RTA directly.

In addition, improvements of operational and managerial system will be required in order to successfully manage such projects, its improvements by RTA are also summarizes in this chapter.

13.2 Alexandria/Cairo IW Project

13.2.1 Project Components

This IW project composes of "IWs Improvement Project", "Navigation Aids Project" and "Small Maritime Lock Extension Project", and such component projects for 2010 are summarized as follows:

13.2.2 Project Description

(1) Improvements of IW

The Master Plan proposes that improvements of Inland Waterway (IW) itself should be required in order to secure safe and smooth navigation both by future large-sized barges and existing barges.
Its required minimum width is estimated at 36 m and minimum depth is determined at 2.0 m

- **Project Profiles**

As mentioned previously, improvements of this IW (Alexandria/Cairo IW) should be concentrated on the following two stretches:

- Between Janaklees Lock (61 km Lock) and Nahda Lock (100 km Lock)
- Stretch from Nahda Lock to Maritime (End) Lock in the Maryut Lake

As a result, total dredging volumes of afore-mentioned two stretches are approximately estimated at 250 thousand m3 and 95 thousand m3, respectively.

(2) Installation of Aids to Navigation in the canals

1) Identification and removal of obstacles to navigation

In addition to the hydrographic survey conducted by the study team, for the installation of aids to navigation in the short-term plan (target year 2010), RTA has to firstly carry out a detailed bathymetric survey of both canals in order to identify remaining shallow/narrow water areas, shipwrecks and other obstacles such as construction debris as well as topographically dangerous sections of the canals. The Criteria of obstacles and dangerous sections are proposed in Table 13.2.1 - Table13.2.2 in the main report.

2) Selection of prioritized sections of canals

The study team proposes that the following sections be given priority for the installation of aids to navigation: ●Sharp bends/ curving parts of the canal, ●Narrow channels of about 35 meters, ● Entrance of the locks, ●Around abutments and ●Around intakes

3) Type of aids to navigation

The study team recommends one specific type of navigation aids, a beacon" be used from the view point of durability, maintenance and fixation. The beacon is composed of three parts: top-mark, lantern and light beacon.

Beacons will be placed on the flat plate supported vertically by a steel pipe driven into the riverbed. And distance-display is to be vertically fixed to the steel pipe so that ship operators can know their position.

4) Installation interval & 5) Number of beacons to be installed

The study team recommends that in the straight sections of both canals, aids to navigation should be placed every 500 meters. If one aid to navigation is installed on the right hand side of the channel, the next one is to be placed 500m away from first one and installed on the left hand side of the channel in order to reduce the number of aids to navigation to be installed.

Table 13.2.1 Installation sections and placement intervals of aids to navigational

Section	Installation point and its interval
①Straight sections	Beacons are installed every 500m in a zigzag pattern
②Meandering sections	Beacons are basically installed every 250m Distribution and intervals vary as occasion arises.
③ Sharp bends, ④ Canal's Connecting Point and ⑤Locks	Extra beacon to be installed
⑥Bridges	Light fixture is needed

This means that the aids to navigation will be installed every 500 meters in a zigzag pattern.
Meanwhile, the beacons to be installed in curving sections are basically to be installed on both sides of the fairways approximately every 250m. The placement intervals in each section are shown in above Table 13.2.1.

6) Structure of beacons and its technical specification

Beacons consist of steel pole with a platform and access ladder to the lantern, solar panels and battery. It should be noted that aids to navigation are very intriguing for local residents. In some countries, there are often reports of theft immediately after the beacons have been installed, therefore anti-theft measures should be taken.

7) Installation of buoys

In case that there are obstacles outside the fairways, RTA has to install buoys to indicate the locations of these obstacles.

8) Installation of aids to navigation in the Nile mainstream

In this IWT project, the proposed barges will navigate on the Nile mainstream from Ather El Nabi port to downstream for about 40km before entering the canal connecting Cairo and Alexandria.
Installing aids to navigation every 500m is not necessary excluding specific areas around the connecting point to Beheiry Canal.

9) Installation of bridge lights

There are around 30 bridges crossing the Nile mainstream and two canals between Cairo and Alexandria It may not be necessary or even advisable to install bridge lights on all of these bridges. However, a lighting fixture is needed to indicate the piers of both sides of the fairway.

10) Installation of extra beacons.

At the connection point of Nobaria and Beheiry canal, one of the two canals connects with the other at an angle of around 90 degrees. Sufficient lighting fixture and beacons are needed at this and around the locks.

11) Introduction of Communication Facilities on Barges

11)-1 General

In future, container barges will frequently encounter one another as they navigate the canals. Safe navigation depends on the availability of information on other vessels in the area. In this instance, intercommunication among ships is vital.

11)-2 Crossing of two barges & 11)-3 Barge To Barge Communication

By knowing the location of approaching barges, ship operators will be able to make appropriate adjustments for crossing in a timely manner. Therefore communication devices are needed on the barges. For this IWT project, cellular phones, on the other hand, are already widely prevailing in

Egypt and can be used for communication between Cairo and Alexandria. Therefore, a cellular phone is suitable for not only barge-to-barge communication but can also be used to contact Cairo headquarters/Alexandria container terminals should a problem arise.

(3) Extension of Small Maritime Lock

This project is a comprehensive solution to existing constraint, which is an inadequacy of locks' chamber length to accommodate twin-units, due to the insufficient dimension of lock itself and due to the shortage of the air clearance under the bridge.

➢ **Necessity and Urgency of the Extension Projects**

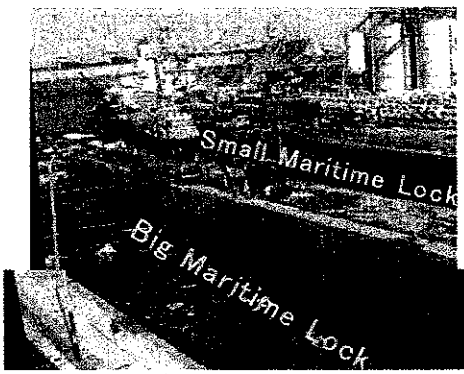
(Necessity)

The study proposed that efficient transport of target cargoes have a great importance of IWT sector. Moreover, containers cargoes are expected to be one of the majority commodities of such target cargoes and sawn timber is also chosen as target cargoes.

In addition, the study examined that such containers and bulk transportation by new-single type barge (length of 100 m, width of 12 m) will be most economical and efficient than other types.

Regarding such containers and timber transportation by barges, existing maritime locks have the following constraints:

⚓ Small Maritime Lock (existing)	:	Chamber length to accommodate barge is only 55 m. All twin-units type needs uncoupling/re-coupling operation. It is not passable for new single barge
⚓ Big Maritime Lock (existing)	:	Chamber length to accommodate laden barges with high stack is restricted to only 65 m, although its length for barge with low height is about 102 m. Twin-units type with high stack needs uncoupling/re-coupling operation. It is not passable for new single barge with high stack.



Thus, existing maritime locks have constraints on efficient operations of twin-units, and will hinder

new single barge from its passing.
It is proposed that "Small Maritime Lock" be extended offshore in order that a container barge can be free from the existing limitation of air clearance under bridge when the lock is filled with water.

(Urgency)
The forecasted traffic volume in 2010 is annually 60 hundred units from/to the Greater Alexandria Port, and this forecast is approximately twice or three times as many as existing traffic volume through Alexandria/Cairo IW. Among others, it is estimated that the number of laden units with high stack amounts to over 14 hundred barges annually. These 14 units can enjoyed benefits of this extension project. In the light of the above aspects, it is essential to extend the small Maritime Lock immediately, in order that IWT sector can cultivate new markets such as containers and timber.

13.2.3 Lock Operation (24-hour Operation)

(1) Responsibility for Lock control from MWRI to RTA
At present there are 13 Locks (including those under construction) in Noubaria, Beheira Canal and Damietta Branch.
Among them MWRI controls 3 Locks. To control all canals in uniform manner, the 3 locks now operated by MWRI should be placed under control of RTA.
In addition, it is essential that all locks be equipped with communication systems to enable communication with passing barges.

(2) 24-hour Lock Operation
To facilitate 24-hour lock operation, RTA should organize a three-shift system.
To introduce a three-shift system, an additional 140 workers are required.
The Study Team recommends Headquarters' staff would be transferred to the lock offices of local branches.
To put it concretely it could fill up supplements for retired persons gradually within after 10 years.
(See below for further details; 13.5.2 Organizational Improvements)

13.3 Ather El Nabi Public River Port

13.3.1 Project Description

(1) Cargo Throughput and Calling Barges for Short-term Development Plan

Ather El Nabi public river port should handle all containers and general cargoes. Cargo volumes and number of calling barges to be handled at the port in 2010 are shown in Table 13.3.1-13.3.2.

Table 13.3.1 Cargo Throughput at Ather El Nabi Public Port in 2010

Unit: 000MT

		Alexandria	Dekheila	Damietta	Total
Total	General Cargo	244	—	25	269
	Containers (000 TEUs)	40	80	17	137

Table 13.3.2 Number of Calling Barges at Ather El Nabi Public Port in 2010

Cargo Item \ Sea Port		Cargo Volume per Barge	Greater Alexandria		Damietta	Total
			Alexandria	Dekheila		
Total	General Cargo	1,378 (MT/barge)	178	—	19	197
	Containers	96 (TEU/barge) (88 for Dekheila)	209	455	94	758

(2) Required Port Facilities for Short-term Development Plan

1) Container Terminal

a) Required Dimensions of Berths

The required dimensions of the container berth are 115m in length and 1.8m in depth.

b) Required Number of Berths

The required number of container berths in 2010 is calculated to be one (1)

In addition to the loading/unloading berths, a berth for a waiting barge is required for navigation safety and efficient cargo handling. Therefore 2 berths, whose total quay length is 230m, are required in 2010.

c) Required Number of Container Stacking Ground Slots

Total required number of ground slots is shown in Table 13.3.3.

Table 13.3.3 Total Required Number of Ground Slots

Container Status	Required Number of Ground Slots (TEU)
Inbound Container Stacking Slots	320
Outbound Container Stacking Slots	202
Empty Container Stacking Slots	157
Total Required Number of Ground Slots	679

d) Required Container Terminal Area

The average required terminal area for one ground slot is assumed to be 70 m2. Based on this assumption, required container terminal area for 679 TEUs ground slots is estimated to be around 5

ha.

e) Required Area of Container Freight Station (CFS)

Required area of container freight station (CFS) is calculated at 3,000 m2.

2) General Cargo Terminal

a) Required Dimensions of Berths

The required dimensions of the general cargo berth are 115m in length and 1.8m in depth.

b) Required Number of Berths

The required number of general cargo berths is calculated to be two (2) (See Appendix-XI).

Since berth occupancy ratio of general cargo berths is estimated at 45%, an additional berth for a waiting barge is not required. Therefore 2 berths, whose total quay length is 230m, are required in 2010.

c) Required Areas of Sheds and Open Yard

Required areas of sheds and open yard are calculated at 2,700 m2 and 6,000 m2 respectively.

(3) Required Cargo Handling Equipment for Short-term Development Plan

1) Container Terminal

a) Quay Side Crane

The required number of quay side movable cranes for handling containers is calculated at two (2) .

b) Rubber Tire Mounted Gantry Crane (RTG)

The required number of RTGs is calculated at 5 units on the assumption that containers loading/unloading will be stacked once in the marshalling yard (See Appendix-XI).

c) Prime Mover (Tractor / Trailer)

The required number of yard tractor-trailers is calculated at 6 units (See Appendix-XI).

2) General Cargo Terminal

a) Quay Side Crane

The required number of truck cranes in total is 4 units (2 cranes x 2 berths).

b) Forklifts

The required number of forklifts is calculated at 8 units (See Appendix-XI).

(4) Summary of Required Facilities and Equipment for Short-term Development Plan

The required facilities and equipment for a public river port in 2010 are summarized in the following table.

Table 13.3.4 Summary of Required Facilities and Equipment for Short-term Development Plan

Container Terminal (Terminal Area : 5ha)	
Berth	2 Berths (Length 230m ; Depth 1.8m)
Container Yard (TEUs)	Ground Slots 679 TEUs (Inbound / Outbound 522 ; Empty 157)
Quay Side Equipment	Movable Crane [2]
Cargo Handling Equipment	RTG [5], Tractor and Trailer [6], etc
Other Facilities	CFS (3,000m2), Administration Building, Maintenance Shop, Gate, etc.
General Cargo Terminal (Terminal Area : 1.5ha)	
Berth	2 Berths (Length 230m ; Depth 1.8m)
Storage Facilities	Shed (2,700m2), Open Yard (6,000m2)
Quay Side Equipment	Truck Crane [4]
Cargo Handling Equipment	Forklift [8] etc.

Note) [number]

(5) Layout Plan of Ather El Nabi Port

The layout plan for short-term development is shown in Fig. 13.3.1

(6) Navigation Facilities

Branch Canal should be used under one-way traffic towards upstream (entering from the northern end and leaving from the southern end).

The waterway in the canal must be dredged to maintain a depth of 1.8m under the lowest water level with 24 meters width, which is required for one-way navigation of the 12 m wide barges. In front of the berths, 35 meters width is required including the mooring barge space. At the north bend, the width of the waterway should be increased up to 35 - 40 m for smooth and safe maneuvering of the barges.

The proper navigation aid facilities at both ends of the canal and columns of the bridges should be installed for navigation safety. Fenders for the columns at the bridge of the northern end may be required.

(7) Access Road

Main roads for Ather El Nabi Port are Cornish El Nile Street and Ring Road. Since the gate of the port is planned at the north-east corner of the site, the port area would be connected with Agriculture

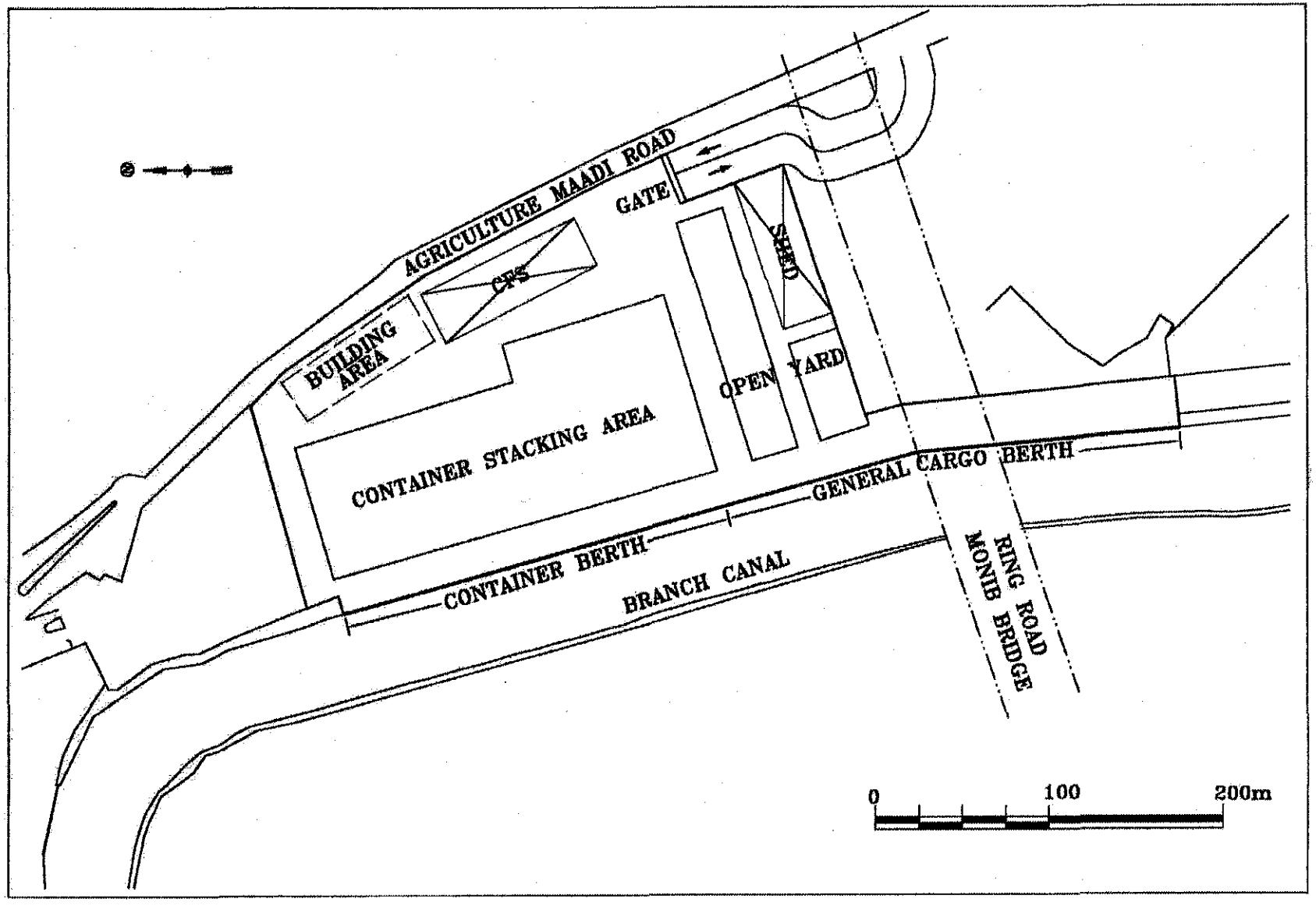


Figure13.3.1 Layout Plan of Ather El Nabi Port

Maadi Road. While the access from/to Cornish El Nile Street is basically smooth, the access from/to Ring Road is not convenient and smooth under the existing ramp location. Moreover general traffic volume in this area is already large. It is required to establish an effective road network in this area to accommodate both port related and general traffic.

In order to improve the access condition, in particular approaching Ring Road, and to separate port related and general traffic, development of direct flyover connection to Ring Road and a new access road connecting with Cornish El Nile Street near the southern end of the Branch Canal should be considered.

13.3.2 Terminal Operation

(1) Operation System

Table 13.3.5 Comparison of Operation Systems

System	Superstructure		Maintenance		Operation	
	RTA	Private	RTA	Private	RTA	Private
RTA direct Operation	*		*		*	
Entrust to Private corp.	*		*		*	
Lease to Private corp.	*		*	*		*
Concession Contract		*		*		*

In the first three operation systems (RTA direct operation, Entrust to private operator and Lease to private operator) in the above table, a severe strain would be placed on RTA's finances. Furthermore RTA does not have the know-how to effectively operate a container terminal. Therefore it is thought that the "Concession method" is the best way for terminal operations to be conducted at Ather El Nabi Port.

Under a concession contract, private companies are able to operate a terminal independently and efficiently, and as they also bear responsibility for superstructure and maintenance, the financial burden of the government would be greatly reduced.

A concession is the grant of specific privileges by RTA (Government). The concession system has been the backbone of port operations in a number of countries. Concessions have been generally successful if only because their main advantage is that governments relieve the financials of the grantor. Either the concessionaire pre-finances the whole operation, operates and maintains the facilities and recovers its investments through tariffs, or it sets asides all reserves necessary for the replacement of facilities and equipment included in the concession.

A second benefit from concessions is that they establish a strong legal relation between grantor and concessionaire with candidates for concessions being carefully screened and pre-selected.

(2) Responsibility for the facilities

Sector	Classification	Facilities
RTA	Infrastructure	Quay, Yard Pavement, Dredging Canal, Access Road, Utility Supply, Navigation Aids
Private Operator	Superstructure	Terminal Buildings, Fence and Gate, Cargo Handling Equipment

(3) Operation time 24 hours

(4) Operator

It is desirable that a single operator should manage both the Container Terminal and General Cargo Terminal from the point of view of efficient land use.

However plural operators may be acceptable provided conditions are profitable.

13.4 New Bolin Canal Project

13.4.1 Project Components

In the master plan, it is proposed that this project should include construction works of a new lock and a barrage, excavation of existing spillway from Beheiry canal to Rosetta Branch and other required works.

13.4.2 Project Description

Cargo volumes and barges (units) to be passed through proposed new Bolin lock in 2010 are estimated at 489 thousand MT, approx, 2,300 barges, respectively.

➢ **New Canal**

Requirements of proposed facilities are as follows:

- Depth and Width; Water Depth is designed at 2.3 m under LWL on the basis of required keel clearance (KC) = 50 cm.
  Fairway width is designed at 35 m corresponding to larger-sized new barge (beam of 12 m) beyond 2010.
- Width of bend; Fairway width of the bends at junction of Beheiry and new Bolin canals and at junction of Rosseta branch side are more than 60 m.
- Waiting (berthing) spaces: Waiting spaces are provided at the upper and lower stream of the new lock. The length of its spaces is 150 m to accommodate one twin-unit or one larger-sized new barge

- **New Lock**

In the short-term plan, it is proposed that designed chamber length to accommodate barges is more than 102 m, and its width is 17 m.

- **Dredging of Rosetta Branch**

  - Depth and Width; Water Depth is designed at 2.3 m under LWL on the basis of required keel clearance (KC) = 50 cm.
    Fairway width is designed at 25 m corresponding to existing barge with width of 7.5 m.

Here, the short-term plan proposes that first stage should carried out initial dredging in order to secure IW width of 25 m, and its width is approximately corresponding to 3 times B (Beam of existing barges). Future widening along Rosetta IW will be examined or determined taking account of sedimentation records and users needs in future.

13.5 Basic Design and Cost Estimate for Short Term development Plan

13.5.1 Basic Design of Each Project Components

In designing facilities for each project component, the same criteria determined in the master plan will be equally applicable to this basic design for IW facilities proposed in the short term development plan.

Among others factors related to design of facilities are the service life of construction component and works, for which the following service life in common practice will be taken into account for designing the project components:

Work Categories	Service Life (Years)
Civil Works	
- Irrigation Facility:	75
- Navigation Lock:	50
- Navigation Aids Facility:	30
- Port Facility	50
ME Equipment for Lock & Barrage:	30
Cargo Handling Equipment	
- Major Equipment	20
- Minor Equipment	10

(1) Project Component A: Alexandria/Cairo IW Project

Proposed dimensions of Nobaria canal dredging are 35m wide at level of canal bottom, 2.0m water draft under minimum water level with side slope for dredging of 1 vertical to 2 horizontal. Where the canal section indicates physical constraints in suitably providing the above side slope for dredging in the water area due to narrowness of the existing canal width, a provision of bank protection is carried out in line with the dredging work. The bank protection is recommended to extend to the bottom level of navigable water depth 2 m measured from minimum water level along the canal so as to preclude future possible undermining. The proposed type of bank protection is a wall in slope 1: 0.5 protected by grouted stones placed upon bedding stone layer.

In the implementation stage, the following hydraulic studies or sounding survey will be conducted and should be implemented in close concern with the MWRI.

- Survey and Sounding for at least 30 km long upstream section of Nahda Lock
- Hydrological and Hydraulic Studies of Nobaria Canal
- Study and Detailed Design for Dredging & Bank Protection
- Tender Documents for Dredging and Bank Protection

The small Maritime lock is extended offshore to provide sufficient length of 116 m for lock chamber. The present type of lock structures and gate operation system will be applied for offshore extension

work. New lock head will be constructed at the offshore tip of lock extension. The existing lock bed and the half of side vertical wall is demolished while the remaining side wall could function as a part of temporary shielded wall during construction and, after completion, is united as a part of the new concrete.

Subsoil investigation, which was carried out by the Study Team, shows that the subsoil at and around the existing lock consists of sand pieces formation of about 3 m thick from the elevation of about MSL–4 m till the depth -7m where very hard sandstone layer having more than 100 N value is encountered. Although the site subsoil condition raises no serious problem for foundation of lock, the site excavation work required under the proposed lock and the piling construction for temporary shield wall for dewatering during lock construction must be carefully schemed.

(2) Project Component B: Ather El Nabi Public River Port Project

It is proposed that the existing quay be reinforced to sustain possible loads applying during port operation by renewing deck slabs and girders of reinforced concrete. The portion of existing slab deck concrete will be demolished and the supplementary piles will be installed at possible 3 rows for reinforcing the existing quay at the front row, at the center position between the 2nd and 3rd existing pile rows and the rear of the deck, respectively. The supplementary piles will be constructed using steel pipe piles of about 800 to 1,000 mm diameter. These supplementary piles are spaced at 7.0 m interval for the longitudinal direction of the quay. Some girder and slab concrete will be provided upon the supplementary piles to form rigid structure united with the existing remaining quay deck concrete.

The present auxiliary equipment such as docking fenders, bollards, ladders is recommended to be replaced so as to suit the likely accommodation for the objective type of barge convoy in terms of design water level and alignment of berths.

(3) Project Components C: New Bolin Canal Project

The existing spillway will be deepened to have 2.3 m water draft under minimum water level for the whole year and widened to 35 m for new connection canal so as to have a standard dimensions for the 1st class waterway with provision of bank protection of 1 to 1 slope.

The subsoil conditions outlined at the site will not represent any serious technical issues on the bearing capability for supporting anticipated dead loads by newly constructed navigation lock or irrigation barrage structure. The navigation lock is reinforced concrete structure with impermeable concrete walls instead of applying sheet piled solution. Mean water level difference at both heads for the proposed lock will be 6.5m and therefore the type of miter gates which is normally recommended for locks with lifts of less than 10 meters is adopted for up- and down-stream lock gates. The water requirement for lock operation is quite low as compared with the present level of water discharge in the existing spillway and there will be expected no conflict between navigation and irrigation requirements.

The existing barrage has to be replaced by newly constructed barrage and regulator to be provided

beside the new navigation lock. Crest height will be at +8.90 m, which is equivalent to minimum water level at Bolin lock of Nobaria canal. Water discharge through regulator will be controlled to maintain the present level of discharge.

The Study Team evaluates that the fairway width of 3B (B= width of barge) deems sufficient for two ways navigational traffic, newly developed fairway along the Rosetta Branch in the short term development plan will be deepened to have 2.3 m water draft under minimum water level for the whole year but be widened to 25 m (=approx 3B) so that the capital cost investment could be minimized.

13.5.2 Implementation Program of Each Project

(1) Construction Materials

Approximate quantity of major permanent construction materials (excluding ME and Cargo Handling Equipment) required for each project component is summarized as follows:

Approx Quantity of Major Permanent Construction Materials

Major Construction Material	Unit	Approx. Total	Major Construction Material	Unit	Approx. Total
Fill Sand	cu.m	71,900	Gravel	cu.m	53,450
Concrete (Plain)	cu.m	21,660	Armor Stones	cu.m	60,960
Concrete (RC)	cu.m	61,700	Steel Pipe Pile	ton	680
Reinforcing Steel Bar	ton	5,800	H-shaped Steel Pile	ton	70
Asphalt Concrete	cu.m	4,180	Others for Building, etc.	l.s	1

(2) Method of Construction

1) Dredging Works

The quantity of subsoil to be dredged from the projects is roughly estimated as follows:

Estimated Volume of Dredging & Excavation required by the Project

Project Component	Soil Character	Quantity (m3)	Remarks
A. Alexandria/Cairo IW Project			
Improvement of IW by Dredging	Canal-Bed	355,000	
Navigation Aid System		Nil	
Extension of Alexandria Maritime Lock	Seabed	9,900	Contaminated by heavy metals
B. Ather El Nabi Public River Port Project	Canal Bed	120,000	Widening and Deepening
C. New Bolin Canal Project			
New Bolin Canal	River Bed	229,000	Widening and Deepening
Improvement of IW of Rosetta Branch	River Bed	480,000	
Total	Approx	1,212,000	

Dredged bed soils will be dumped at specific onshore spots along the canal or river which is located within maximum 2 km distance, but the dredged river bed soil along the Rosetta branch will be dumped into river water area beside the dredging spot. In case of Alexandria Maritime lock extension work, the subsoil excavated at the extension area for maritime lock will be transported to outside the city of Alexandria for possible disposal at site suitable for receiving such soils as contaminated by heavy metals.

2) Construction of Alexandria Maritime Lock

All the site works for extension of lock will be done within dry-up area by temporary shield wall. Site construction work will decisively hamper the barge navigation at the adjacent Big Maleh lock and therefore due traffic control must be exercised during construction activities. A fast tracking method of construction is preferable to shorten the construction period as much as possible but it is estimated that one year period will be required to complete the lock extension work.

3) Ather El Nabi Public River Port Project

Once site clearance shall be completed, the temporary yard will be developed within the site area. The existing quay structures inclusive of container and general cargo terminal will be rehabilitated for the whole length by the use of steel pipe pile construction. Since the existing quay deck has been located upon the sloped canal bed along the existing branch canal bank, any driving work may be suitable to be carried out as offshore work using pile driving barge.

4) Construction of New Bolin Canal Project

To be firstly constructed will be the new barrage. After completion of new barrage, existing spillway facilities will be demolished and the present spillway will be diverted into new waterway for the use of new barrage. New navigation lock construction will succeed after completion of new barrage and will be carried out under dry-up condition. Dry up work is also applied to construction of bank protection and canal excavation as well. The existing water discharge will be maintained during whole construction work period. A series of construction works will be required two years period for its completion.

(3) Construction Time Schedule of Short-term Development Plan

Overall construction for projects in the short-term development plan is evaluated to take 5 years duration from commencement of engineering services for study or detailed design till completion of construction or procurement of equipment including maintenance period. Overall time schedule for construction works and equipment procurement is shown in the following construction time schedule of the short-term development plan.

Overall Project Implementation Time Schedule

Project Components	Year	1				2				3				4				5			
	Quarter	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
A Alexandria/Cairo IW Project																					
A1 Dredging and Bank Protection																					
1 Dredging/Bank Protection Construction																					
2 Engineering Services																					
Hydrological/Hydraulic Study																					
Detailed Design & Construction Supervision																					
A2 Procurement of Navigation Aids																					
1 Procurement of Equipment																					
2 Engineering Services																					
A3 Alexandria Maritime Lock Extention																					
1 Lock Construction																					
2 Engineering Services																					
B Ather El Nabi Public River Port Project																					
B1 River Port Terminal Construction																					
1 Civil Work Construction																					
2 Engineering Services																					
B2 Procurement of Cargo Handling Equipment																					
1 Procurement of Equipment																					
2 Engineering Services																					
C New Bolin Connection Canal Project																					
1 New Connection Canal Construction																					
2 Dredging of Rosetta Branch																					
3 Engineering Services																					
Expected Completion of Alexandira/Cairo Route																					
Expected Completion of New Connection Canal at Bolin																					

Remarks
- · Engineering Services for Technical Study, Detailed Design & Bid Documents Preparation
- · Bid Assistance for Pre-qualification & Evaluation of Bids for Contract
- · Construction or Equipment Procurement
- · Maintenance of Works done by the Contractor