HYDRAULIC DESIGN OF THE TOURISTIC BERTHING IN ASWAN CITY

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ABSTRACT

The berths on the Nile River especially in Upper Egypt need to be developed in order to increase the safety and efficiency of tourist ships. The existing Aswan berths areas on the east bank of the Nile River are chosen for development from km (6.320) to km (9.970) from Aswan Dam. The data information about the existing berth condition are collected and analyzed. The appropriate procedures for improving the hydraulic design of the berthing areas and docks are introduced to satisfy the good control and safe navigation of the ships. The proposed plan is providing the design of the infrastructure necessary to utilize the main navigation channel, including dredging of access channels and berthing areas and installation and maintenance of docks.

The results of the present research is showed that 66.70 % of the existing berths in Aswan City will be drawn under releasing the flow discharge (300 $m.m^3$/day) and more than 88.20 % of berths also will be completely drawn for flow discharge (350 $m.m^3$/day). Also it was detected the shoal area (submerged island) restrict the ships movement from berths to the navigable path of the river. So, the development plan is including the dredging the shoal areas in the east of the river to get suitable navigation depth especially in minimum water levels. The proposed hydraulic design of berths was introduced to protect it from the high water levels due to the maximum discharges in the Nile River. Also, design and installation of navigation aids are located on the boundary of the navigational path within the area of study to assist ship movement in the river.

Key Words:

Aswan City, Nile River, Berthing area, Navigation Channel, Hydrographic Survey, Docks, Dredging, and Sediment Transport

1. INTRODUCTION

The Nile River has been recognized as a navigable channel throughout the history of Egypt. Many berths are located at the Nile River, where sediment transport and deposition are major factors for maintenance of berths and approaching channels. Berths and navigation channels are designed mainly based on site conditions and specific requirements. Shoaling or sediment deposition is an unavoidable part of most of the navigation channels. In addition, maintenance dredging is also carried to improve berths, docks, basins and small boat harbors. Keeping the rate of shoaling to minimum is a major consideration for site selection and berths design

In recent years the Government of Egypt initiated the efforts towards developing the navigation in the Nile River. These efforts will increase the revenue from tourism, and reduce the cost of shipping. The berthing areas at Aswan City are chosen for developing due to its historical importance and heavy traffic and berthing of cruise ships. The city of Aswan is located at the southern of Egypt km (7.700) from Aswan High Dam. A variety of public and private organizations are involved with the operation of the development of berthing area in Aswan City. These organizations arranged into three categories: Ministry of Water Resources and Irrigation, Ministry of Tourism, and regional agencies and organizations. This berthing improvement plan involves maintenance dredging of the main ship channel, tributary channels, and associated berthing areas.

2. THE EXISTING CONDITIONS

The profile of existing conditions focuses on the existing berths and the navigable channel of the area of development. The description of the existing conditions is including the physical, hydrological and morphological conditions have to be investigated during the planning and development stages.

2.1 The Physical Conditions

The berthing area is located on the east bank of the Nile River in Aswan city from km (6.320) to km (9.970) downstream Aswan High Dam with the total length 3.650 km. The width of the river is 800m southern and decreased to 550m northern of the berths area are shown in the aerial photographic map figure (1) and the layout of the berths locations as in figure (2). The berthing area contains a variety of berths support touristic and commercial navigation as list in following table 1.

Table 1 The existing berths details

Item	Number	Description
1	33	Touristic berths with lengths from 30 m to 195 m
2	2	Docks for tourism purposes
3	4	Docks for transport purposes
4	4	Government Berths
5	7	Social Clubs
6	1	Private Berth Hotel

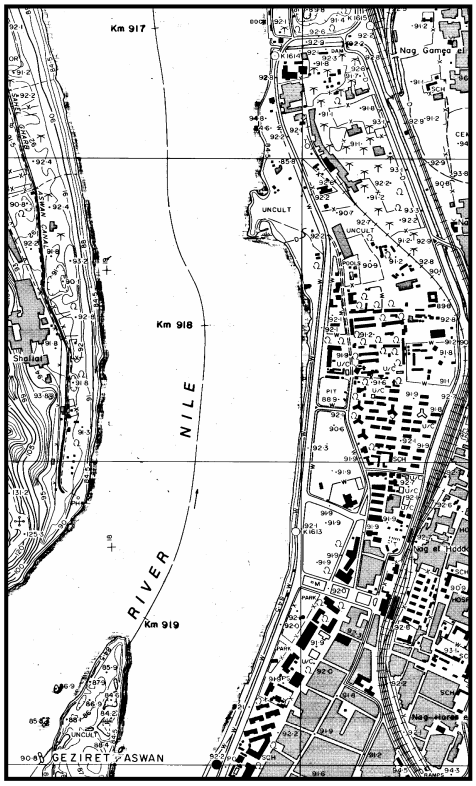

Fig 1 Aerial Map of the Berthing Area

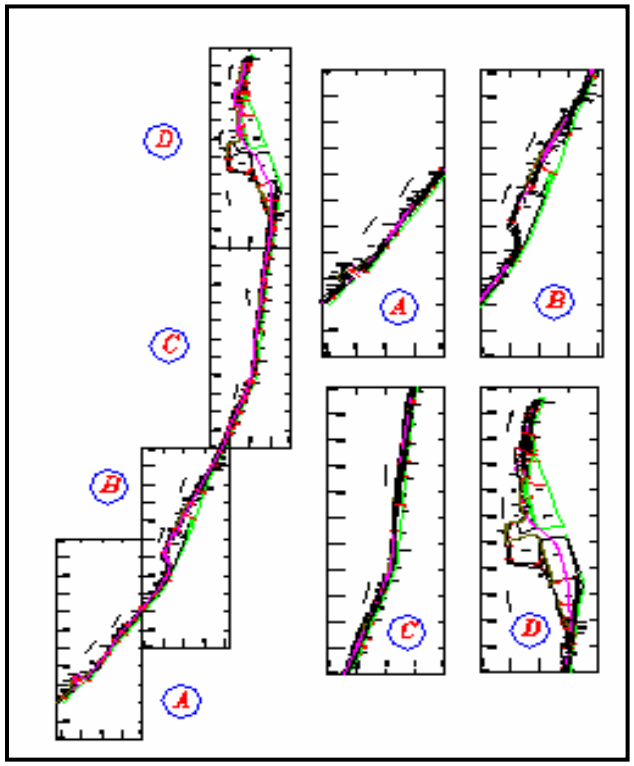

Fig 2 Layout of Berths Locations

2.2 The Hydrological Conditions

The required data for the present studies are deduced from the analysis of measured hydrologic data at Aswan Gauge Station km(6.340) and El-Gaafrra Gauge Station km(33.750) for the past 10 years. It was found that the minimum water level in the berthing area range from (81.56) m to (81.71) m at minimum discharge (60 m.m^3/day) and the maximum water level range from (85.55) m to (85.70) m at maximum discharge (270 m.m^3/day) as described in table 2. The purposes of evaluation of the maximum and minimum water level are for design the berth levels and determine the dredged level for the shoal areas to get sufficient water depths required for the safe navigation.

As shown in figure 3, during the period from July and August, the water levels are high due to irrigation water requirements. While in December and January, the water requirements are low. As a result, water level in the Nile River during December and January is the lowest throughout the year. It may be concluded that the navigation faces real problems during this period unless additional water is released from Aswan High Dam. This period matches the low discharge period, the issue, which is considered a real throat to the tourism industry.

2.3 The Morphological Conditions

The details of the berths were surveyed by taking more than 70 cross sections to determine the slope and elevation of each one. Hydrographic survey was carried to get the bed elevations for the Nile River in adjacent of berthing area. The contour map of the bathymetric data was plotted to determine the shoaling areas, which obstruct the navigation. The alignment of the riverbank was determined to improve training lines of the berthing area.

The hydrographic survey of the river shows that there are water depths sufficient for navigation in the middle of the river and also beside the berthing area for waiting the ships. But it was found the shoal area (submerged island) restrict the ships movement from berths to the navigable path of the river.

Table 2 The minimum and maximum Water Levels and Discharges at Aswan City

Year	Flow Discharge (m.m3/day)		Water Levels (m)	
	Min	Max	Min	Max
1993	75.00	240.00	82.07	85.27
1994	60.00	240.00	81.71	85.27
1995	60.00	250.00	81.71	85.42
1996	60.00	250.00	81.71	85.42
1997	60.00	270.00	81.71	85.70
1998	60.00	250.00	81.71	85.42
1999	95.00	260.00	82.67	85.63
2000	100.00	270.00	82.78	85.77
2001	90.00	270.00	82.55	85.77
2002	75.00	275.00	82.20	85.83

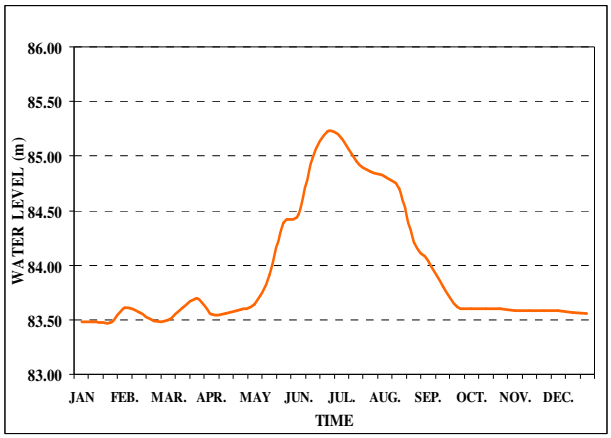

Fig 3 Typical Water Level Hydrograph at Aswan Station

3. HYDRAULIC PERFORMANCE OF BERTHING AREA

The developments of berthing area have to be investigated for its operational performance. The important impact of design and operate berths is the water levels. Due to the water policy on the Ministry of Water Resources and Irrigation in Egypt, it was expected to release the future discharges (300, 350 m.m^3/day) downstream Aswan High Dam in future. Numerical modeling has been carried by applying the surface water model HEC- RAS in the determination of the water surface elevations due to the expected future flow discharges based on inputs describing the channel shape, hydraulic parameters, and flow discharges.

Table 3 The Percentage of submerged berths

The berths which submerged due to high discharges					
Type	Total	300 m.m3/day		350 m.m3/day	
	Number	Number	Percentage (%)	Number	Percentage (%)
Touristic Berths	35	25	71.40%	32	92.50%
Docks	7	4	57.10%	5	71.40%
Social Clubs	9	5	55.60%	8	88.90%
Sum	51	34	66.70%	45	88.20%

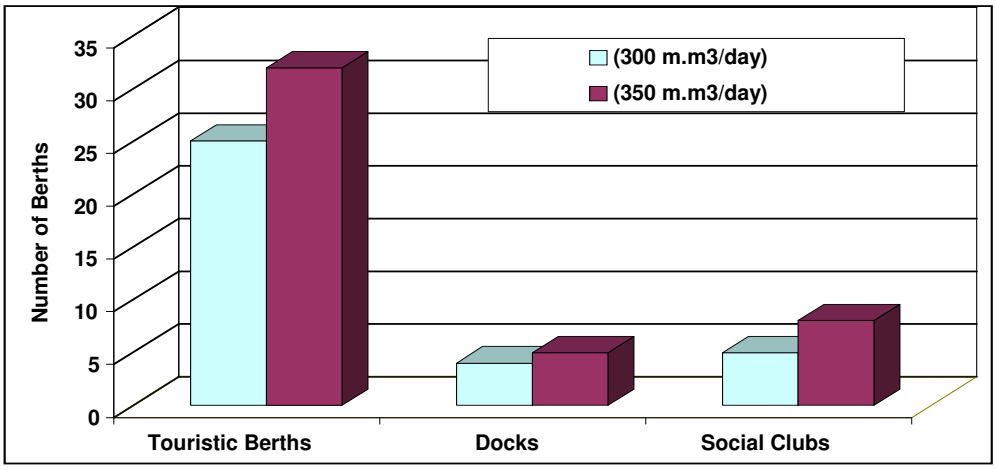

Fig 4 The numbers of drawn berths at high flow discharges

The results of the numerical model show that the predicted water levels are (86.65) m and (86.85) m for releasing the future flow discharges in the Nile River. By comparison the predicted water levels and the levels of the existing berths in Aswan City, it is found that the 66.70 % of the existing berths in Aswan City will be drawn due to releasing the discharge (300 m.m^3/day) with water level (86.65) m and more than 88.20 % also will be completely drawn for discharge (350 m.m^3/day) as shown in figure (4). The details of the submerged berths under maximum discharges are listed in table 3.

4. PLANNING AND DESIGN OF BERTHING AREA

The plans of developing the berthing area of Aswan City includes many components such as proposed new hydraulic design of existing berths and evaluated the amount of cut and fill for each berth cross sections. Also, the alignment was improved for the riverbank. The study involves dredging of the main ship channel, and associated berthing areas to make the navigation more save and efficient in the berthing area of Aswan City.

4.1 Hydraulic Design of Berthing Area

The development of the berths should be taken into account many requirements such as: minimum and maximum water levels, amount of fill and cut which will be carried for each berth, the slope of the bank, side slope and dimensions of the design retaining walls. For improvement the berths, it was determined the amount of cut and fill for each cross section due to the minimum and maximum water level in berthing area as shown in figure (5). Also, it was designed retaining walls with top level (87.20) m and (83.60) m for lower level which will built on stone toe as described in figure (6).

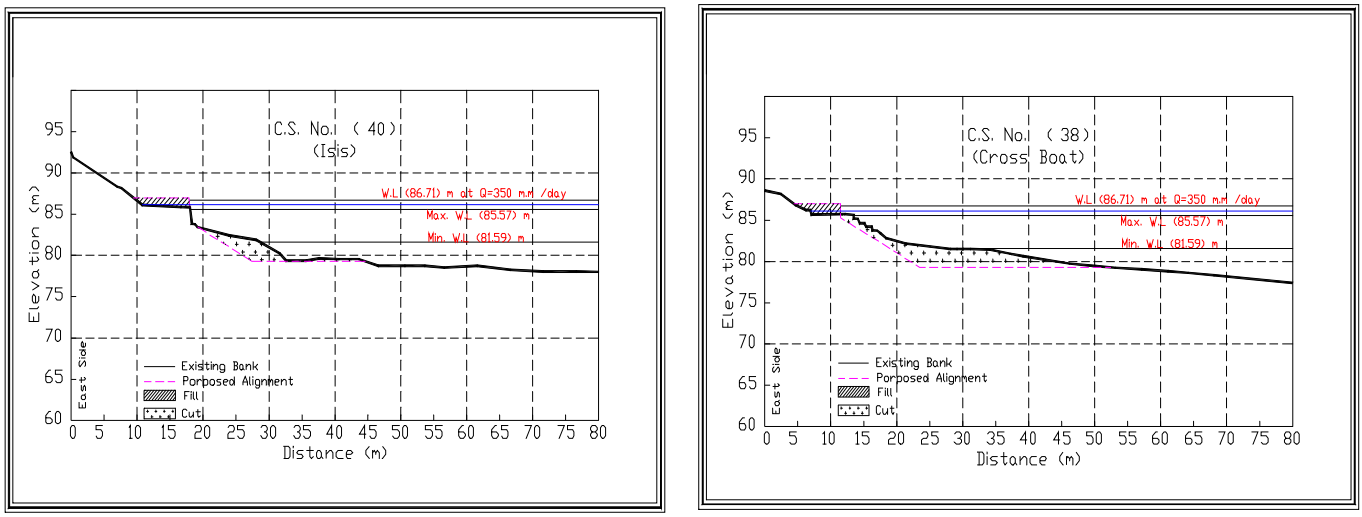

Fig 5 Proposed Modification of the Berths Cross Sections

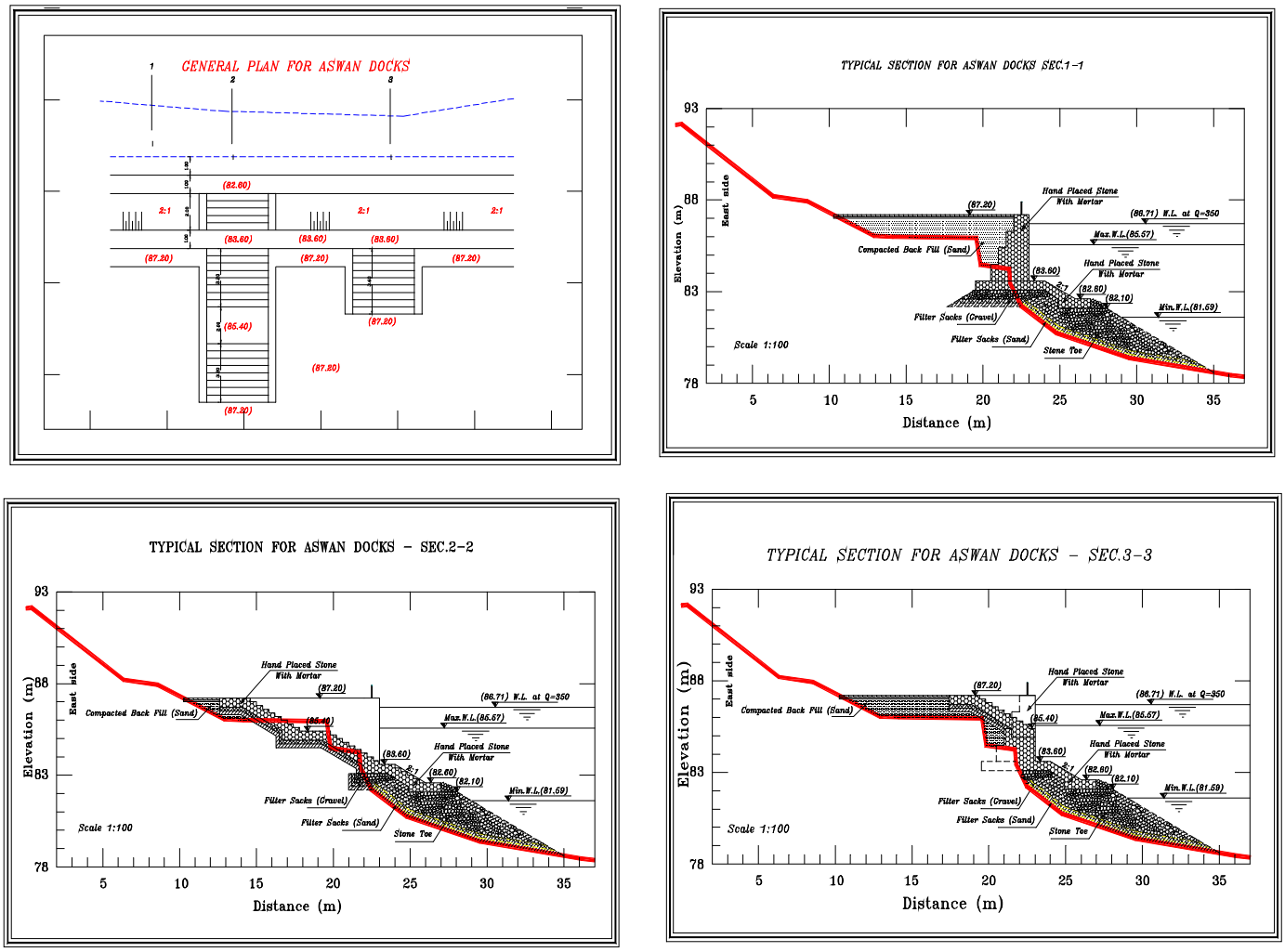

Fig 6 Typical New Proposed Berths Design

4.2 Alignment Improvement

It was determined the training line for the berthing area from km (6.320) to km (9.970) downstream Aswan Dam in the east bank of the Nile River. It was taking into account the boundaries of existing berths and another structures and gives the optimum flow path into river under the different of water discharges. The trigging line for discharge (300 and 350 m.m^3/day) was determined to the berthing area.

4.3 Dredging the Shoal Areas

From the hydrographic survey of the river shows the shoal area (submerged island) in front of the berthing area of Aswan City restrict the ships movement from berths to the navigable path of the river as shown in figure 7. The level of dredging was determined as (79.30) m for the navigation channel in order to keep 2.30 m water depth lowering than the minimum water level for safe navigation.

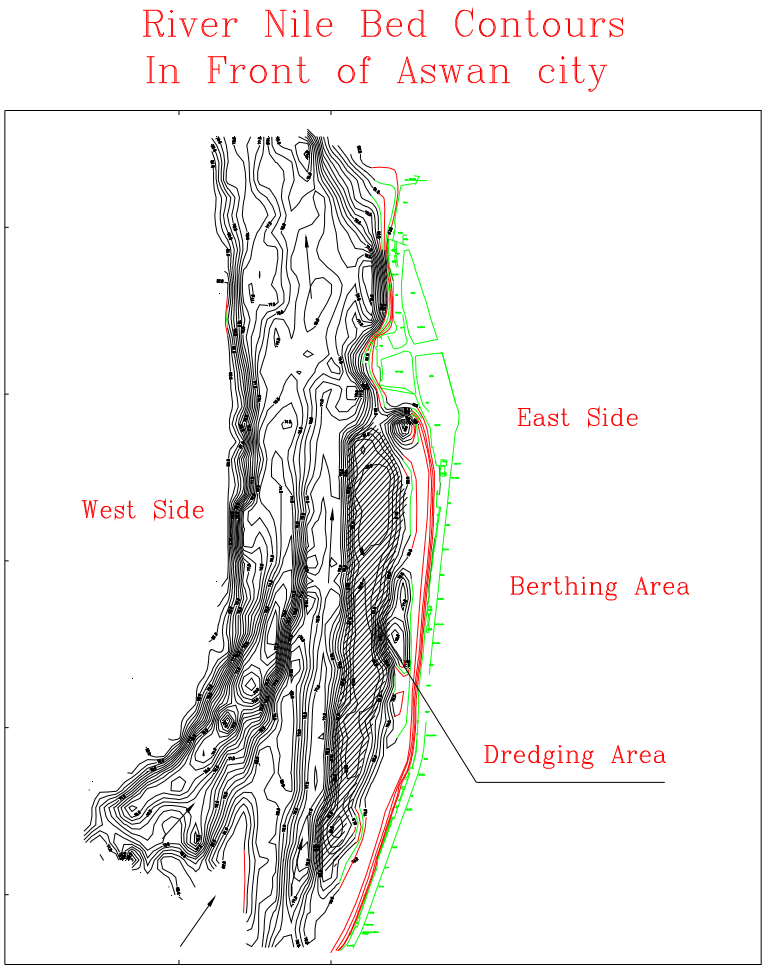

Fig 7 Contour Map of the Berthing Area of Aswan City

The level of the submerged island ranged (79.00) m to (82.00) m with total length 1500 m. It was recommended that this shoal area will be dredged at level (79.30) m to improve the navigation in this area. Also, it will increase the water flow adjacent the berthing area and then will reduce the sediment deposition. Removal of the sediment material from the navigation channels and berths by dredging allows more fully loaded ships safe passage into and out of berthing facilities.

4.4 Determination of Navigation Aids

Generally, the river navigable channel needs to be identified by special boys. Using the hydrographic survey for the berthing area to locate the navigation aids to assist ship movement in the river. A basic waypoint navigation system (navigation aids) was located on the boundary of the navigational path within the area of study. In this study, it was determined the locations of the navigation aids with the global referenced coordinates (Easting, Northing,) and the numbered which will be used to located it in the right places in the field.

5. CONCLUSIONS

The present paper describe the methodology used in conducting the proposed plans for improvement the existing berths on the east side of the Nile River in Aswan City. It is taking into account the future water management policy for helping in the strategic planning and operation control of existing berths under different scenarios of flow discharges. The evaluation of the existing conditions were showed that that the 66.70 % of the existing berths in Aswan City will be drawn due to releasing the discharge (300 $m.m^3$/day) with water level (86.65) m and more than 88.20 % also will be completely drawn for discharge (350 $m.m^3$/day). The new hydraulic design of berths was introduced to the existing berths to be safe under passing the maximum discharges in the River Nile. Also, the shoal areas were located and the dredged level was determined at level (79.30) m is to maintain safe navigation depths. Also, the navigation aids were located within the area of berths. The economic benefits of the berthing improvement will be high due to increasing of the number and loading of boats in the Nile River.

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