

Chapter 4 Mitigation & Recommendations

One of the key objectives of this report is to provide useful information regarding the proposed construction and operational regime impacts of the development on a number of parameters. This chapter highlights key mitigation and recommendations necessary to reduce socioeconomic and environmental consequences.

Mitigation refers to measures, which will in some way reduce or ameliorate the adverse impacts of a development on an existing environmental resource, whilst compensation refers to the provision of a replacement for the resource to be lost which will equal or exceed its original value.

There are many forms of mitigation measures available. These could include, for example:

- Minimizing the area of land-take from environment and features of value;
- Improving the quality or increasing the extent of valuable environment and features after development, through appropriate management or input of resources;
- Timing or phasing the development to avoid certain key times of year, such as breeding seasons etc;
- Maintaining or increasing the connectedness of habitats on the site, perhaps through additional planting of trees and shrubs.

There are essentially three types of compensation measures available for environment. These are: environment creation; environment re-creation; and environment enhancement.

According to the EEAA guidelines of port and marinas construction projects, the proposed project is classified as environmental category C. This implies that it wouldn't involve significant environmental problems in any phase of its construction.

Apart from this, the project and the new extension is complied with prerequisites and guidelines approved by the EEAA. This was based on the following facts:

- The proposed land-use is permissible
- The use is compatible with nearby land uses.
- Environmentally sensitive or protected areas are absent in the region

The following is an assessment for the potential adverse environmental impacts of the proposed project activities. A mitigation measure for each adverse impact has been also identified in this section. A summary table was constructed to summarize the results of this assessment along with the suggested mitigation measures for each case.

4.1. Construction phase

Although the project entails earthworks including land preparation, reclamation and dredging, appropriate measures can be taken to minimize adverse environmental impacts.

Construction impacts can result from several activities, including change in land-use, visual and acoustics disturbance, and potential damage of the environment. EEAA regulations will be followed, if available, otherwise, best environmental engineering practices such as those employed per US EPA, Canada or in similar region will be followed.

4.1.1. Land use, Topography & landscape:

The proposed project is a new development in an undeveloped area at Damietta Port far

from any urban area or public amenity. Large wetlands such as inland coastal lakes or fish farms or are not common or known at the port area or its vicinity. There are no remarkable tourist attractions, known historical sites, or archaeological assets near the port or the proposed extension.

The proposed site for the new development is infertile bare land covered with very sparse shrubs and bushes of no environmental value. There is no any land-use or public community in this site except for using its northern parts as a dumping site for pilling up of some dredged materials and solid wastes. There is also no valuable flora and fauna in or near the project area.

The project will include some contour alteration and change to the physical environment of the area of the project. This necessitates carrying out some earthworks like land clearing, reclamation and dredging the subsurface soil down to 17 m so as to make the new extension of the same width and depth as well as the neighbourhood basin (grain berth).

Contour alteration and dredging works can not be avoided at this stage. However, this is not likely to involve effective landscape change since the study area has no any prominent landform or important geomorphic feature.

Execution of excavation works of the project according to stated dimensions (300 m width x 1500 m length) will impact some activities and land covers of the project site. The affected land uses include:

- The main road of the port which runs in NE-SW route south of the project site.
- The green belts which occur alongside of the main road.
- The unpaved track which runs in NW-SE route across the project site

While there will be a need for relocating and reconstruction of the main road and the associated green belt as they will be destroyed by during construction of new extension, it might be quite enough to suggest a new route for the unpaved track to be alternative for the impacted route. Interruption of the unpaved track can be mitigated by construction another alternative track.

As for the land cover types which will be affected by the project, they include only the nabkha and embryo dunes which are located south of the project site near the green belt and also the perennial shrubs which occur sparsely and randomly throughout the project site. These habitats are of no environmental value or support any other habitat of importance; hence, there will be no need to take any mitigation measure.

No transmission line, gas or oil pipelines or utility service other than the fire station and motor-roads were noticed in the project site. The expected earthworks and other activities of the proposed project will not exert any affect on this land-use type. In fact, the fire station will remain and integrated and enhanced for the operating project.

The area of the proposed development is situated inside the existing Damietta Harbor. Loss of land is considered minimal and thus no impact.

4.1.2. Air qualities and Noise:

Temporal degradation of air quality in the working area could be due to release and dispersal of excessive amounts of dust and sediments, particularly during the dredging phase. Emissions from construction equipment, work vessels, trucks and other vehicles used in construction work could be also a source of air pollution. It is important to mention that environmental baseline survey indicated that the levels of SO_x, NO_x and other gases are less than the permissible levels published by EEAA.

In general the impact that may occur during construction is temporal impact and will be ceased with clearing of the superficial soil of the project area which is composed of loose fine- to coarse-grained sand. In contrast to the superficial layer, the subsurface soil is composed of wet mud. This implies that earthworks at this stage would not involve any significant amount of dust or residual sand either during its excavation or transportation. Nevertheless, dust emission can be reduced effectively through using appropriate methods and equipments e.g. water scattering in the construction site, use of proper transport methods, such as a conveyor belt, for excavated material. Dust from the construction activities should be swept off the main road, to prevent material being carried along this thoroughfare and causing nuisance to pedestrians or workers.

Dust being carried by the wind will cause nuisance to workers, and if in sufficient quantities may also lead to damage to sensitive ecosystems.

Roads should be properly fenced out to avoid any vehicles to move in a random fashion on unpaved roads. This is considered a mitigation measure to limit the noise and pollution due to vehicle transportation.

Damping down surfaces, which are susceptible to wind blow, or the use of proprietary dust control chemicals, should control dust. Where landscape vegetation is to be planted, this should be done as soon as it is practicable to help control dusty surfaces.

Occasional incineration of solid waste may be practiced at construction sites, however given the relative locations of the proposed development, within an operating port, it is likely that any on site incineration could cause nuisance to the adjoining properties, and should not be allowed for safety reason.

Good site management practices during the construction works will help to prevent the generation of airborne dust. To ensure that atmospheric dust, contaminants or dust deposits generated by the construction works do not exceed levels which could constitute a health hazard or nuisance to those persons working on the site or living nearby, a dust monitoring programme should be carried out throughout the construction period. Materials deposited on stockpile on site should be closely monitored for any possible emission of dust and if required may damped down, covered or treated with a dust suppressant.

It is recommended that environmental monitoring programme (noise, air and water quality) be carried out at areas of excavation, the stockpiles and locations at the site boundary. Trained persons should carry out the monitoring on weekly basis. However if dry windy weather prevails then the rate of monitoring should be increased. An aerosol monitoring systems should be used. The results should check against table 4.1. The total aerosol particulates should not exceed the EEAAIWB Limit.

Table 4.1 Maximum Allowable Exposure Levels of the ambient air according to EEAA Law no. 4, 1994 and World Bank/IFC guidelines

| Dust | Exposure Period | Maximum Limits | |
|-------|-----------------|-----------------------|----------------------|
| | | EEAA | WB |
| | | Industrial area | General Applications |
| Total | 24 hrs | 230 µg/m ³ | 70 µg/m ³ |

| | | | |
|--|--------|------------------------------|-----------------------------|
| Suspended Particles (TSP) | 1 year | 90 $\mu\text{g}/\text{m}^3$ | 50 $\mu\text{g}/\text{m}^3$ |
| Respirable Particles (PM ₁₀) | 24 hrs | 70 $\mu\text{g}/\text{m}^3$ | NA |
| Suspended Particles Measured as Black Smokes | 24 hrs | 150 $\mu\text{g}/\text{m}^3$ | NA |
| | 1 year | 60 $\mu\text{g}/\text{m}^3$ | NA |

Further recommendations

- *If any finely ground materials are delivered, these should be in bag form or stockpiled in specified locations where materials can be suitably covered.*
- *All vehicles carrying bulk materials into or out of the site should be covered to prevent dust emission.*
- *Dust emission from moving construction plant and site transport will be mitigated by the use of the water which will dampen all movement areas being utilized by traffic.*

Construction works will increase noise in the surrounding area. Increased noise levels might temporarily disrupt any birds in the area. However it is anticipated that the noise levels will be minimal and localized. Noise levels in the water can result from dredging and marine construction activities (e.g. piling installation, if any).

- The maximum allowable log equivalent (hourly measurements) according to the World Bank/IFC is 70 dB during day and night. This level should not be exceeded.
- Measurement of noise level during operation should be conducted and to be compliance with EEAA levels. It is recommended to maintain noise levels during operational works below 90 dB, as practical and for 8 h shifts. In case of exceeding the level, the time of exposure should be calculated according to the equation given at Appendix 7 in the EEAA environmental Law 4 of 1994.
- The duration of dredging operation and other noise-generating processes should be kept to a minimum.
- The commencement of dredging operations should be “hiked-up” gradually to allow animals to be warned and to vacate the area. This would result in a gradual increase in noise production.

Dredging noise can extend significant distances from origin in a diametric area. However, noise contains a variety of frequencies, and particular dredgers create different noise characteristics and frequencies, some of which affect some marine species. Marine animals that are most susceptible to noise, particularly in relation to frequent visit areas (for feeding, breeding, etc) are few, however, the contractors should be aware of this impact and adjust their operations accordingly to reduce noise production.

With regards to the fact that the area is already surrounded with less development sites (cultivated land mainly), it is expected that the air quality and noise are expected to increase during construction phase and that after construction, levels

will be than the EEAA allowable levels.

The hours of building work should be controlled, and should not occur during the periods when people are most sensitive to noise nuisance. This is usually during the evening, night-time and early morning periods. Noise sources (including fixed and mobile) should be screened as far as possible to reduce the impact of noise.

It is expected that increased vehicle movements will be generated due to construction activities at the site. Due to the transport of construction materials, or the leveling works, this will lead to increased vehicle emissions (including nitrous oxides, carbon monoxide, carbon dioxide, and hydrocarbons) and dust and will also be accompanied by increased noise levels due to the traffic and excavation.

Fixed noise sources such as temporary generators should be enclosed wherever possible to reduce the noise levels they emit. All construction equipment should be operated in accordance with the manufacturers intent, and all noise reduction accessories (for example enclosures, covers, silencers, air filters, etc.) should be in place and well maintained.

4.1.3. Marine environment and water quality:

Quality of marine water in the vicinity of port's basin to be extended will be also temporally deteriorated due to turbidities which expected to evolve during the dredging works and subsequent delivery of suspend sediments to the basin's water. Diffusion from concrete work in water and overflows from landfills may be also possible sources of water pollution.

The adverse effects of construction work could be minimized by appropriate selection of equipment in pile driving or dredging, proper use of silt curtains, and suitable transport of construction materials and dredged sediments. Earthworks of the project are not likely to exert any another impact on any another water-body or wetland in the study area else than the nearby marine water.

The extent of impact to the environment depends on the sensitivity of the environment. There are two main aspects of construction processes (e.g. dredging and reclamation / disposal processes) that could significantly reduce potential adverse impacts on the environment:

- The identification of **sensitive periods** of growth for marine flora, fauna and fish and the scheduling of construction processes to coincide outside of these periods (if necessary).
- The identification of **important locations**, which may require specific mitigation and/or relocation.

During construction, there will be also significant impacts on water quality with regard to Total Suspended Solids (TSS). Production of TSS will occur as a result of both dredging activities. Key mitigation for this parameter includes a comprehensive monitoring program and technical activities to ensure minimum sediment loading into the marine environment.

It is recommended that, during dredging, the nominated contractor should ensure that efficient dredging techniques are used. Examples of the techniques may include:

- ***Optimizing the rotation speed of the cutter-head to minimize the throw of dredged materials beyond the suction field of the intake.***
- ***Excavation production does not exceed pumping capacity to avoid the release of excess materials.***
- ***The equipment used should be routinely maintained and of sufficient quality to***

avoid unnecessary leakage/spillage (e.g. floating pipes etc. should be inspected to ensure that slurry mix is not leaking from joints etc.)

- *It is recommended that regular monitoring is undertaken to ensure that the production of TSS and eventual introduction into the marine environment is of an acceptable standard. EEAA Law No.4 for 1994, Appendix 1, states that TSS from discharges to marine should not exceed 60 mg/l. Due to the temporal and spatial variation of TSS in seawater, any monitoring program should include current background TSS values for the study area from an adjacent non-impacted control station.*
- *If TSS exceeds 50 mg/l, then the contractor will deployed silt curtains or any other means to remain the level below the 50 mg/l (World Bank/IFC/EEAA permissible level)*
- *Dredging management plan will detail the necessary processes to mitigate impacts to the acceptable levels.*

An example of a suitable monitoring program during dredging

The levels of TSS at each sampling location (sampling stations should occur 500m from the dredger within any resulting sediment plume and taken at 1m depth) should be regularly monitored by both the dredging contractors representative and by a third party (e.g. EEAA, or consultant independent). The monitoring programme should include the following KEY processes:

1. Water sample in a clear glass jar taken from the sediment plume twice daily (or as instructed by EEAA). Visual observations regarding TSS content should be made and noted in a log book. It should be noted that only experienced personnel will be able to visually inspect TSS values from this method. The format of this book may resemble the example below (Table 4.2). The log book should be available to the appropriate bodies (e.g. EEAA) upon request.
2. Water samples should be taken by a qualified technician and taken to a qualified laboratory for TSS analysis. As a recommendation, water samples from the dredge plume should be taken 500m downstream from the dredger (2 samples at each location). Samples should be taken in the centre of any sediment plumes and at a depth of 1m. Sampling to occur on a basis as set by EEAA, but should in any case be equivalent to at least three times per week by an independent consultant.

As a guide, TSS is not to exceed 10 mg/l above baseline (site specific). The average TSS concentrations according to actual field measurements at Damietta Port at a middle depth (present situation and baseline data), is 29.075 mg/l, while the maximum TSS concentrations was 36.0 mg/l and minimum 23.4 mg/l. Therefore, TSS concentrations during construction process should not routinely exceed 40 mg/l, however, in a worse case scenario, the figure of 50/60 mg/l (World Bank/IFC Guidelines and EEAA Appendix No. 1 criteria of Substance discharged to seawater). It is recommended to measure the actual TSS values of the baseline water prior to commencement of dredging operations to verify current background conditions.

Table 4.2 An Example of a Log book for TSS Monitoring during Dredging

| | Sample 1 - (00.00hrs) | Sample 2 - (12.00 hrs) |
|-----------|-------------------------|--|
| Monday | NV | HS |
| Tuesday | | |
| Wednesday | M | A |
| Thursday | | |
| Friday | | |
| Saturday | | |
| Sunday | | |
| | <i>NV – not visible</i> | <i>M – minimal</i> |
| | <i>A – acceptable</i> | <i>HS – high (action required to reduce TSS)</i> |

Construction of the new extension and other artificial structures often involves loss of natural habitat. On the other hand, the presence of a solid structure as hard substratum can be beneficial ecologically. Such structures rapidly become colonized by sponges, hydroids, bryozoans and other encrusting biota, which in turn provide food or refuges for larger organisms including fish. The assessment upon the biotic aspects is based upon an estimation of the impacts upon marine ecosystem components. A change in habitat area and/or in habitat quality will be reflected in the structure and species composition of the communities. Usually in stress situations, special and sensitive species disappear first, and stress resistant, most of the times more common species become dominant.

In general, there is no any sensitive aquatic natural habitat could be observed in the study area. Hence, probable adverse impacts of the proposed development on the marine life are considered to be minor.

A large quantity of disposing materials is expected from the dredging of the approaching channel and turning circle (about 14 million m³). The excavation and dredging of the approaching channel must be limited to the required depth. Apart from the direct and permanent loss of habitat, excavation can increase sedimentation temporary. This may limit photosynthesis of communities such as algal mats and seagarss meadows. The ecological impacts of dredging are similar to those of coastal reclamation activities, and include both direct habitat loss and various secondary effects. Although the potential impacts are of less significance since the approach channel is routinely dredged for maintance purposes.

Dredging materials for maintenance may present greater disposal problems than deeper sediments during dredging/construction. Since surfacial sediments are composed of recently deposited materials that are usually contaminated, DIP will coordinate with DPA to utilize a similar dredging materials plan for subsequent DPA maintenance dredging,

On the other hand,a large quantity (An amount of 5-6 x10⁶ m³) is expected to be dredged from excavation of the basin extension project to create the proposed terminal basin. Because there is little rain along the Egyptian coast, very small amounts of the sediment released during construction will be washed into the sea.

The sedimentation process is complex and is influenced by the temporal variability in the direction and intensity of the incoming waves, and currents, and the orientation of coastline and seafloor morphology. Sediments are transported to the sink area including the navigation channel from adjacent coastal sources at Burullus and Ras El Bar as well as from the Damietta offshore shoals by several pathways comprising the opposing easterly and westerly littoral drift, north-northwest and north-northeast offshore currents as well as from onshore

sediment movement.

Beaches on both sides of the harbour are relatively still unused except the two recreation beaches at the New Damietta City about 6.7 km west of the harbour and the artificially-protected resort at Ras El Bar, 6.0 km east.

4.1.4. Terrestrial fauna and flora

Dredging operations and other activities of the project will result in destruction and abandonment all terrestrial fauna and flora which may exist in the area. However, field survey and assessment of biological communities of the project area reveal that it is very poor indeed in biogenic life and natural habitats. There is no natural vegetation or terrestrial plants of environmental importance observed in the area. This implies that impact of clearing works and other activities of the project on biodiversity will not be significant or of much concern.

The main factors affecting the distribution of terrestrial fauna are due to

Habitat Destruction: Excessive, unregulated development is one of the greatest threats to the critical natural habitats which are being degraded and destroyed by land reclamation, overgrazing, unsustainable tourism and haphazard quarrying.

Pollution: Many of Egypt's wetlands suffer from pollution, particularly in the Delta. Oil pollution, particularly in the Delta. Oil pollution is a potential threat in the marine environment, with seabird colonies most at risk. Uncontrolled solid waste dumping is likewise a threat to wildlife and their habitats.

Over Exploitation of Resources: Unregulated hunting is widespread in Egypt. One to two million birds are netted, trapped and shot every autumn along the Egyptian Mediterranean coast, including globally threatened species like the Corncrake.

The proposed port expansion will not affect the fauna and flora of the proposed area. No endangered or rare wild or domestic animals as well no species sited in IUCN book were observed.

Assessment of the impacts of development on terrestrial vegetation would then take into consideration:

- i. the extent, quality and nature of the wildlife habitats represented on the site;
- ii. the degree of habitat and species diversity;
- iii. the presence of key species;
- iv. ecological links with other habitats;

These environmental changes, intensive pressure and variation in biotic composition is always associated with change in biotic diversity and natural vegetation. Ornamental plants that might be cleared by the extension of the port is very easy to cultivated again after the construction of new levees bounded the area.

The proposed area to be used for the new extension is luckily far from the salt marsh habitat and lies in an area or sites that already destroyed, completely neglected and salt affected land where most of the natural vegetation is very poor.

The consequences of the port extension could be useful in the practical use as the new water bodies added by the extension of the port will permit the grow of free-floating, non-rooted-submerged and rooted-submerged aquatic plants (macrophytes) that have the ability

to absorb high level of heavy metals, Nitrogen and Phosphorus from polluted water under the Egyptian conditions (Ali & Soltan,1999). Serag *et al.* (1999) reported that *Potamogeton crispus* L. would be useful for absorbing Cd and Zn, *Eichhornia crassipes* for absorbing Mn, Cu, Ni and Pb, and *Ceratophyllum demersum* for absorbing Fe, Mn and Cu from nutrient-rich water such as the River Nile. High heavy metal concentrations in the River Nile aquatic system coincided with sites of heavy industrialization, dense populations, mining and sewage wastes discharge.

Assessment of biodiversity: An attempt was done to assess the biodiversity of the study area. The assessment is based on 3 viability criteria: size, condition, and landscape context. Size is a measure of the area or abundance of natural vegetation (occurrence). Condition is a measure of the composition, structure. Landscape context is a measure of two factors: the dominant environmental regimes and processes that establish and maintain the element occurrence, and connectivity.

The current biodiversity for the area is in general fair (Table 7.3), meaning at or below the desired threshold, but recoverable. Natural Plant communities are thought to be declining, may be due to changes in environmental conditions and/ or water quality, such as increased sedimentation, although the natural community composition has been significantly altered in many locations. Cropping and grazing have produced semi-permanent shifts in a few floodplain areas; because of their value as agricultural lands, these locations are unlikely to be restored in the foreseeable future. Areas that still as harbour, woody vegetation should regain their former species composition.

Table 7.3. Viability and biodiversity assessment for elements of different sampling sites.

| Site | Size | Conservation Element Viability Condition | Landscape Context |
|------|------|---|-------------------|
| 1 | Fair | Fair | Fair |
| 2 | Fair | Disturbed, dumpy place | Fair |
| 3 | Fair | Fair | Fair |
| 4 | Fair | Good | Fair |
| 5 | Fair | Sparse vegetation | Good |
| 6 | Fair | Completely disturbed | Fair |
| 7 | Good | Good | Good |
| 8 | Good | Good | Good |

In the completely distracted sites, a few plant populations remain, and many of those are small and in poor condition. Developmental consequences and the associated infrastructure (roads, utility rights of way, septic systems) invasive and exotic species will probably contribute to changes in species composition within the new systems as well and pose a significant challenge to future conservation.

Generally, the investigation indicated that the new proposed port area is considered moderate or less important areas as it contains few fauna and flora that are found elsewhere in Egypt and are affected with the landscape due to rapid urbanization.

Additional wildlife surveys should be undertaken at the site during autumn, winter and spring, including nocturnal surveys so as to properly determine the full fauna

component at the site and cooperating into the operating programme of the terminal to minimize significant adverse impact.

4.1.5. Social environment and public community

Impact on social environment and community will be very minor as it is not likely that any of natural resources or amenities used by public community in the vicinity area will be affected by any activity of the proposed project. It is of note also that land clearing and dredging will not lead to relocation of any public community or amenity as the extension site is located in an isolated area and was allocated since long time for development.

The project activities are not expected to impose any health threat or need relocation or displacement for any community. As for increase of truck traffic, it can be properly managed so that it avoids the residential and commercial areas. If land disposing is selected, the suggested track for transportation of the dredged material from the work area to the dumping sites can be selected to avoid passing through or cross major residential, commercial or heritage sites of importance.

It is foreseen that the social impacts whether positive or negative will come directly from the development of the extension as whole. Positive social environmental impacts may be associated with development due to:

- Indirect and direct employment opportunities, income generation and flows,
- Benefits from improved service and infrastructure provision,
- Positive changes in the value system and cultural characteristics.

However, negative impacts are also possible. These may include:

- Negative changes in the value system.
- Exaggerated feelings of social disparity due to differences in life patterns
- Adverse social change,
- Increased land values commodity and service prices pushing them beyond the reach of locals.

Employment expectations not being matched by demand for local labors force. Positive impacts of the new extension development are summarized as:

- The phased construction duration that extends for more than 2-3 years, is considered as a positive impact due to the provision of local construction jobs.
- The proximity of the project location to Damietta City amplifies its potential beneficial direct and indirect economic and social impact on the local community due to the size of touristic flows in the area.
- Estimated number of permanent employment opportunities.
- However, the eventual socioeconomic impact on the local community will be tied to the percentage of local opportunities created. This represents one of the problems that diminish the overall socio-economic benefits of industrial development projects (due to the limited qualification of the local labor pool).
- Construction works that will extend along many phases in sequence, will contribute to generate temporary work opportunities. It is expected that the large scale of the development will induce multiplier effects on the local economy that are related to activities and services that may be located in the proximity of the development.

4.1.6. Other Issues:

Archaeology and Cultural Heritage: As there is no archaeological sites in the development there will be no impact relating to this aspect.

Traffic and transport issues: The traffic will be increased considerably in the working area,

as tens of dredgers, bulldozers, trucks and loaders will be needed and utilized for importing embankment and infill material as well as for lodging of the dredged sediments resulted from excavation of the extension site. There is no need for establishment of new roads or tracks for accommodating the project activities as the existing road network is quite enough and of good state.

Dredging Methodology

Dredging practice and equipment has evolved considerably in recent years to increase dredging efficiency and to minimize the potential adverse effects on the environment (Bates, 1998). To some extent the environmental effects due to the re-suspension and settlement of sediments during the excavation process can be minimized by selecting the most appropriate method of dredging.

The new terminal will require dredging of the inland area up to 17 m deep. A Cutter Suction Dredger (CSD) can be used in its construction. CSDs are common types of dredging equipment and comprise the following key components (Fig4.1):

- Pontoon and control bridge;
- Cutter ladder with suction pipe and submersible pump;
- Inboard pumps;
- Discharge pipe;
- Spud legs; side wires;
- Ladder hoist wire; floating pipeline; and (occasionally); and
- A barge loading system.

It is not anticipated that a barge loading system will be employed on this project.



Fig. 4.1 An Example of a Cutter Suction Dredger (CSD)

When dredging, the back end of the dredger is anchored using one or more stern spuds which are arranged to allow the dredger to advance in steps up to 2m in length towards the dredging face. The dredger rotates in an arc around the back spud, which is controlled using the side wires connected to anchors, positioned either side of the dredger. A rotating cutter-head is mounted at the end of a ladder that extends from the dredger to the seabed, and supports the suction pipe. The dredging process involves cutting the sediment and pumping it through the dredger's suction pipe as slurry. The slurry is predominantly seawater with a potential dredged solids content of up to 20%. The dredged material is then transported from

the dredger to the dumping areas via pumping and discharge through a floating pipeline (Fig 4.2).



Fig. 4.2. Floating Pipelines used to Transport Dredged Materials from a CSD

Environmental Performance of Cutter Suction Dredgers

In terms of environmental performance related to sediment excavation, all dredgers, including CSD, have a direct impact on the seabed. In terms of the creation of sediment plumes, different dredging plant re-suspends dredged material for different reasons. CSD do not employ overflow systems (e.g. as in Trailer Suction Hopper Dredgers - TSHD) and, assuming that the pipeline or barge system transporting the dredged material to the disposal site does not leak, the main source of sediment re-suspension is limited to the material disturbed around the cutter-head or at the disposal dumping site.

Initially, the high-energy cutting and sweeping rotation actions during cutter suction dredging might not appear to be an efficient method for avoiding sediment re-suspension. However, field studies indicate that only relatively small amounts of re-suspended sediment are transported beyond the immediate vicinity of the dredger when compared to other dredging equipment US Army Engineers Waterways Experiment Station, 1986 (PHE Gulf personal communication).

Solid and Liquid Waste

Earthworks of the projects such as land clearing, excavation and reclamation will involve huge amounts of dredged sediments/material. These materials must be cleared away and dumped in suitable sites. According to available information, quantity of dredged and excavated sediments that will result from the terminal earthworks will be not less than 5 - 5 million m³. This estimate was based on excavation an area of 1500 m by 300 m down to depth of about 18 m.

Based on EBS study of the port and surrounding areas, we recommend sea-dumping due to soil characteristics. The sea-dumping site is the one already used for maintenance purposes. In addition to the sea dumping three alternatives on-land sites to be used for dumping and accommodating such huge quantity of dredge material.

If land dumping is utilized, then the leachate from the dredging waste will comply with the world bank/IFC guidelines and Dutch standards (VROM). Additional mitigation measures

(such as providing liners, stabilising agents, etc.) will be included to ensure compliance with World Bank/IFC or Dutch (VROM) standards.

Where there is a leachate from disposal waste site, the toxic metals contained in the leachate should not exceed the World Bank/IFC levels as shown in the following table for pollutant in liquid effluents.

Table 7.3. Limits for process wastewater Domestic sewage, and contaminated stormwater discharged to surface waters, for general application.

| Pollutant or parameter | Limit |
|-------------------------------|-----------------------------------|
| pH | 6 – 0 |
| BOD | 50 mg/l |
| Metals | |
| Heavy metals (total) | 10 mg/l |
| Arsenic | 0.1 mg/l |
| Cd | 0.1 mg/l |
| Cr6 | 0.1 mg/l |
| Cu | 0.5 mg/l |
| Fe | 3.5 mg/l |
| Pb | 0.1 mg/l |
| Mercury | 0.01 mg/l |
| Ni | 0.5 mg/l |
| Zn | 2.0 mg/l |
| Coliform bacteria | 400 (Mean Probable Number/100 ml) |

The first on land dump site (DS-1 in Figure 4.3) It covers an extensive area (one million m²) outside the port SE of the excavation site. This site is composed of abandoned land that has already been used for accommodating the dredged material resulted from excavation of the navigation canal. The dredged material shall be transported from the excavation sites by trucks following certain path until it reaches its final destination. The total distance need to be crossed away by trucks from the exaction site to the destination is about 6 km.

The dredged material can be also dumped in another substitute site (DS-8 in Figure 4.3) located inside the port at its western part. This site is currently being used for dumping debris and demolition stones and therefore it can be exploited for accommodating part of the excavated material. The total distance need to be crossed away by trucks from the exaction site to the destination at this dumping site is about 2 km. However, we don't recommend using this site because of its limited size (210 000 m²) comparing to the first and because it is located inside the port area and hence, introduction of dredging material and dumping wastes will hamper any future plan for development or exploitation of this area.

The 3rd on land site is controlled by the Damietta New City municipality which is approximately 11 km to the west of the project site and can accommodated up to 2 million m³.

Based on the above, the DIP agrees to develop and submit a dredging material management plan.

Disposing sediment dredged from the extension basin and channel

According to the feasibility study, the new developments will need some modifications in the approaching and navigational channels. This is due to the increase of the capacity of the port as well as types and size of ships.

Previous studies have indicated that basin-dredged material has been wrongly called "spoil" for years and they commonly carried to dumping or disposing sites. In few cases worldwide, dredged material is practically used for many beneficial inland and coastal uses mostly landfill of wetlands and low-relief areas (EPA, 1992). Beneficial uses of dredged material as borrow sediment for landfill are widely applied worldwide (Jackson and Nordstrom, 1994; Wang and Gerritsen, 1995; Wagner, 2000). In few cases, they are used to manufacture bricks, glass containers and cement.

According to the EEAA guidelines (1996), engineering structures built on the coastline that may significantly change the beach morphology must require environmental impact analysis and mitigation. In our case study, the inland dredging of the new harbour basin would not impact the adjacent coastline as indicated in the wave analysis model and thus no environmental impact analysis is required as shown in the numerical modeling. The only impact may be resulted from the improper management of the dredged sediment resulted from dredging activities. Therefore, dredged sediment must be managed in economically and environmentally sustainable disposing sites. It has been estimated that a total of $5-6 \times 10^6 \text{ m}^3$ sediment volume is expected to be dredged from the extension basin project. This sediment volume is yielded by multiplying surface area by the dredged basin depth (18 m). Therefore it is necessary to assure suitable area to place dredged material resulted from excavation of the project site.

A dredging management plan will be developed by DIP in accordance with international standards. The management plan will include a sediment sampling plan. From the baseline study, we anticipate that the upper 20 cm of the dredging materials from the channel is likely to be contaminated with heavy metals such as Cu, Ni and Pb. According to the master plan, about 14 million m^3 will be dredging from the Deepings of the approaching channel and turning basin in order to go from -15 to -18 m depth. The upper 20 cm contaminated sediments will account for an amount about 500,000 m^3 from the dredging materials. If testing indicates that contaminants are higher than the World Bank/IFC guidelines, as showed in the previous page, DIP will utilize stabilizing agent to render contaminants immobile,

From our field observations and the land use analysis, the only identified low-relief area is located in the northwest of the harbor basin (Fig. 4.3). On average this area (Site #1) is approximately ~1m below mean sea-level and has an average surface area of about 745062 m^2 . To avoid any possible wave overtopping, it require maintaining a landfill elevation of ~3 m above mean sea-level. This landfill elevation together with its adjacent accretionary coastline provides extensive sheltering or a buffer from offshore wave conditions. Land filling of this particular area would maximize the use of sediments dredged from harbor basin and also increase the economic value of the low-lying area by providing suitable area for future beach development. An amount of $2.98 \text{ m}^3 \times 10^6$ is estimated to landfill this low-lying area up to 3 m elevation. This amount is yielded by multiplying the surface area (745062 m^2) by the vertical elevation from bottom (4m). Sediment can be delivered to this low-lying area mechanically using trucks or as slurry via a pipeline during wet excavation of the extended basin (see pipeline route in figure 4.3).

The remaining dredged material ($9.65 \times 10^6 \text{ m}^3$) can be trucked and stockpiled in the old disposing site northeast of the proposing project (Fig. 7.3). This disposing site (Site #2) has enough space to accommodate this amount (~ $1.5 \times 10^6 \text{ m}^2$). In view of economic considerations, the distance between the project site and this dumping is approximately 2 km (Fig. 7.3).

Solid and liquid waste in the new development are not expected to have impacts on the area and low impacts other wise due to the systems adopted in the design. Solid and liquid waste will be managed in accordance with the well-established principles used by an international management company and in accordance with standard DPA operation.

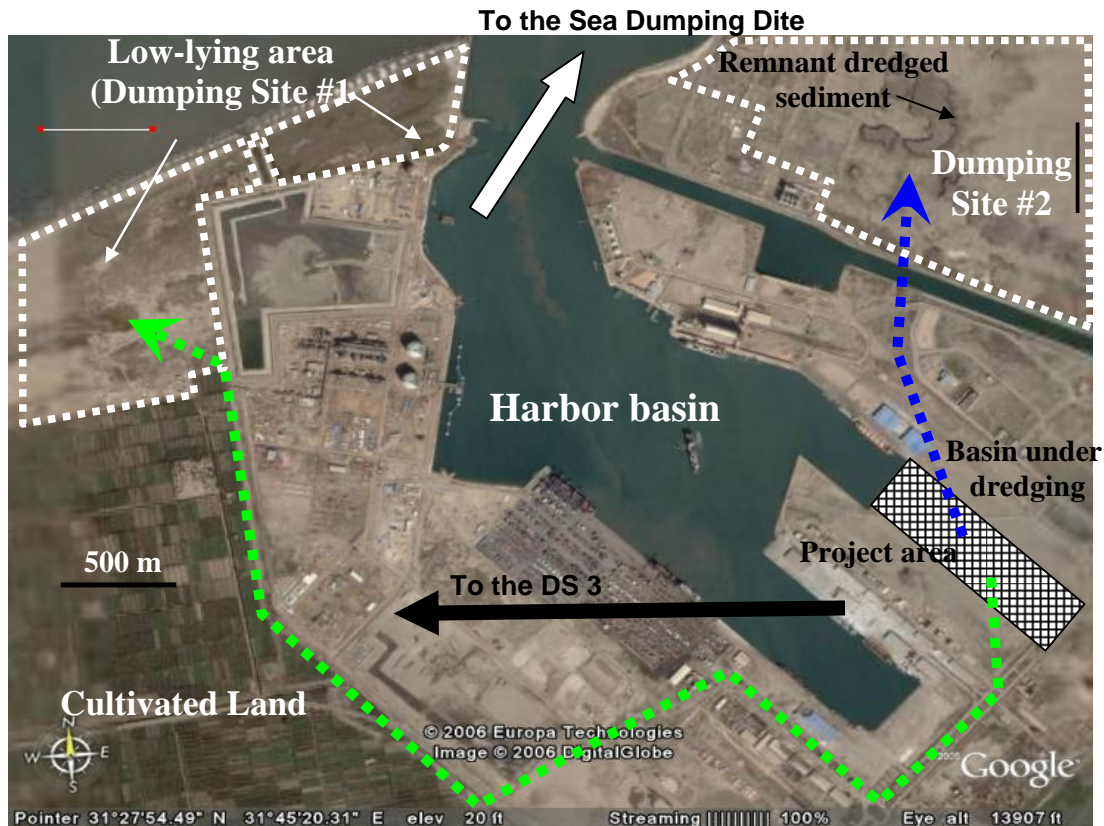


Fig. 7.3 The sites proposed for on-land dispose sediment dredged from the extension harbor basin (project area). Site #1 is identified in this study as a low-lying area suitable for land filling whereas Site #2 has been previously used for dumping sediment excavated from the navigation canal connecting between the main basin and the Damietta Nile branch whereas. General pathways connecting between the proposed dumping sites and the excavated basin are also denoted as dashed lines. Site 3 is proposed by the New Damietta City Municipality. Offshore site is roughly 11 km offshore. The dredge management plan will detail procedures to be implemented.

During the construction phase of several months, a significant number of workmen will be present at the site. Eutrophication might be expected during construction unless sewage treatment plants are used in designated sites. Pollution by other substances is also negative in the sense that the presence of tens of workers for months will lead to pollution of various substances (oil, fuel, chemicals, and solid waste).

During operation the negative impacts increases as pollution level might increase due to the ships (oil, paint, chemicals, effluent and solid waste). Very strict measures to control pollution sources should be taken as discussed later in chapter 5 (HS &E).

Providing the scale of the development is matched by corresponding developments in

waste management and treatment practices adverse impacts are not considered to be significant.

The terminal design will include the utility services. These services will match the demand of the growing development, and work plans will reflect this requirement. DIP will address this issue. This problem must be addressed to prevent nuisance and water pollution.

It is essential that the chosen Contractor comply with the relevant EEAA, WB/IFC, and DPA requirements, and take the appropriate measures, to the satisfaction of the DIP, to ensure minimum disturbance of the surrounding environment. DIP will include these requirements within the appropriate construction contracts.

Operation activities are often carried out using temporary sand bunds along the boundaries of the site wherever necessary to prevent outflow or infiltration of water from the reclamation/deposition area to adjoining land or sea areas.

An appropriate methodology would include during the initial stage, the construction of permanent or temporary bunds (usually from clean sand) and a water box arrangement to prevent the uncontrolled dispersal of silt during dewatering operations. The reclamation works shall be undertaken in such a way that dispersal of silt over the adjacent seabed is kept to a minimum and there is no significant damage to adjacent sensitive habitats.

The water box arrangement (Fig. 4.4) should be designed such that the retention time of silt laden water within the containment bund is increased. This will allow for finer particles of sand/silt/mud to fall out of suspension within the bounded area prior to the water being discharged into the marine environment. Accumulated silt/fines not suitable for reclamation purposes should be appropriately disposed of (e.g. in approved landfill sites).



Fig. 7.4 A Water Box Arrangement as used on a Reclamation Project in Bahrain.

7.2. After completing the project

It is important to mention that there will be an increase in the capacity of the port as the size of the containers handling will reach about 1.5 million TEU / year during 2008 and 2.5 million TEU/year during 2009. This increase in the navigational activities will increase the level of pollution such as

- Solid and liquid waste from ships
- Emission from ship
- Hydrocarbon in the water
- Uncertain event from accident

The main environmental impacts which may be involved in operation of the new extension after its completing may include increase of coastal pollution such as hydrocarbon and metals pollution. This is mainly due to the increase capacity of the port for berthing and mooring of the commercial ships. Increase of the traffic and cargo handling in the port and subsequent usage of port facilities and release of pollutants such as sewage, bilge water, spilt fuel and lubricants, antifouling agents, etc would likely affect quality of water and air in the port area. However, the pollution impacts would be of minor effect since the proposed development represents not more than 2% of pollution associated with the current activity of the port operations. This is very minor percentage and any adverse impact will be minimized by proper management of the port activities and by following the national and international standards and regulations e.g establishment of reception facilities, handling of liquid and solid wastes to third party, handling the sewage through the main sewer systems. These pollutants will increase the environmental stress on the port and nearby areas.

Afterwards, all dredging and excavation operations will cease with completing the project and establishment of the new extension. All other subsequent activities will be limited to berthing of commercial ships and relevant shipping and exportation operations. Such activities will be managed and operated by the DIP following certain standards and regulations and hence, they are not likely to produce any significant environmental impact.

Table 7.4 summarize the impacts from different sectors during the project life cycle.

Table 7.4. List of potential adverse environmental impacts of the proposed project activities and suggested mitigation measures.

| Phase | Issue | Potential Adverse Impact | Impact Severity | Mitigation |
|---------------------------|---------------------------------------|---|---|---|
| During construction | Topography | Contour alteration | High, short-term | The study area has no any prominent landform or important geomorphic feature. Meantime, excavation and contour alteration is an essential step for construction of the new extension |
| | | Landscape change | Moderate, short-term | |
| | Coverage pattern & land uses | Risk to utility services & transmission lines & pipelines | Negligible | |
| | | Risk to commercial & Industrial units | Negligible | |
| | | Risk to agricultural land or natural cover | Insignificant | Rehabilitation of vegetation covers along existing roads of importance again. |
| | | Risk to road network | High | Relocation an shift of the impacted roads southwards |
| | | Wastes & dredged materials | High, short-term | Appropriate sea and land dumping site as identified and preparing for accommodating the dredged materials |
| | Air quality | Emission of dust | Moderate, short-term | Use of appropriate methods and equipments to minimize the expected emission. Pollution such as toxic organics and metals should not exceed risk-specific levels or reference air concentration at the receptor end as indicated by the World Bank/IFC. The annual arithmetic mean for particulate matter should not exceed 50 µg/m ³ |
| | Water quality | Turbidity and increase suspended sediments in water | Moderate, short-term | Use of appropriate methods and equipments and use of proper transport methods. TSS should be less than 50 mg/l (World Bank/IFC Guidelines) |
| | | Pollution from wastewater, diesel spills from site compound and machinery | Moderate, short-term | Process wastewater, domestic sewage, and contaminated stormwater and runoff must meet the World Bank/IFC and EEAA limits (Table 7.3) |
| | Traffic & transport | Increase of traffic | Insignificant | Management of traffic and transportation facilities. |
| | Social environment & public community | Relocation of public communities/amenities | Negligible | |
| | | Noise Nuisance | Negligible | |
| | | Threat to public health and safety | Negligible | |
| Coastal hydrodynamics | Change of coastline | Negligible | | |
| | Interruption of water regime | Negligible | | |
| Aquatic habitats | Migration/loss of habitats | Insignificant | Project will generate a net benefit by creating a new base area | |
| Terrestrial fauna & flora | Migration/loss of habitats | Insignificant | Existing infertile base land has very limited habitat | |