KLAAIPEDA STATE SEAPORT AUTHORITY

KLAAIPEDA PORT ENTRANCE REHABILITATION PROJECT
ENVIRONMENTAL IMPACT ASSESSMENT
EXECUTIVE SUMMARY
EXECUTIVE SUMMARY

The Klaipeda Harbour entrance will be improved by the construction of two new breakwaters to extend the existing breakwaters, by the rehabilitation of the two existing breakwaters and by deepening and widening the entrance channel and a part of the harbour basin to -14 meters.

The sediments to be dredged under this project comprise various types of soils of which a part is contaminated. Of these sediments, all clean sands will be beneficially used. The contaminated sediments would need to be dredged separately and stored in a confined disposal facility. However, no such facility yet exists. The remaining clean glacial till and silty sediments will be dumped at a designated disposal site about 20 kilometres offshore from Klaipeda. The project and its impacts on the environment are extensively described in the Environment Impact Assessment Report of the project, the executive summary of which is presented below.

BACKGROUND

When in 1991 the independence of Lithuania was restored, the idea of creating a united, modern and universal seaport was promoted. Since that date, the structure of Klaipeda Port has been fundamentally reorganised and the port activities are now legislated by the Klaipeda Port Act. The Klaipeda State Seaport Authority (KSSA) is in charge of the functioning of the Port and is responsible for maintenance, reconstruction and modernisation of the Port infrastructure, while separate independent terminals are managing operations.

In 1997, as part of “the Programme of Construction and reconstruction of infrastructure objects of Klaipeda State Seaport up to the year 2000”, some 25 million USD were invested in the port infrastructure. The navigational channel was deepened and at present ships with draft of up to 10.5 m can enter the Port.

In 1996, as part of the overall plan and with the aim of increasing safety and reducing downtime the KSSA requested Delft Hydraulics of the Netherlands to carry out a study on alternative improvements to the sea entrance. The study included the evaluation of the design layouts on the basis of a series of full mission simulations by the Maritime Simulation Centre of the Netherlands in co-operation with Delft Hydraulics. This feasibility study provided the basis for a new design, which included i.a. the construction of new breakwaters, deepening and widening of the access channel and re-alignment of the axis of the inner harbour channel.

In 1997, KSSA requested the Lithuanian Energy Institute to carry out a technical study on the proposed dredging works. This study provided the basis for the design of the dredging works and the potential impact on the environment. It also addressed the impact of the dredging works on the stability of the existing breakwaters.

In 1998, the KSSA commissioned Frederic R. Harris in association with EDC – Environmental & Dredging Consultancy and Uostamiescio Projektas, to prepare the final design for the Klaipeda Port Entrance rehabilitation, including the final design of the new breakwaters and the dredging works, as well as this Environmental Impact Assessment.

The main purpose of the port entrance rehabilitation is to reduce wave penetration into the port and give larger vessels improved and safe access to the port. The project is co-ordinated by World Bank. The design works are financed by a grant from Netherlands and Japanese Governments.
NEED FOR REHABILITATION

The Port of Klaipeda is the main port of Lithuania. It is located on the south-east coast of the Baltic Sea at the entrance of the Curonian lagoon. Particularly during the winter months, under rough weather conditions, navigation through the entrance channel is dangerous and the deep water berths at the oil port and the Klasco Port are unusable.

In the recent past a number of accidents occurred with ships running out of control at the entrance of Klaipeda Port. Over the last 15 years four major accidents occurred. In two of these cases the ship was wrecked and in one case there was major damage to a quay and cranes. One of the accidents involved a tanker and resulted in a large oil spill. Taking the traffic volume into consideration four major accidents in such a short period is clearly too much.

Especially entering or departing of loaded vessels of 20,000 DWT and more, compose a source of potential danger. These ships must follow the relatively narrow channel and negotiate an abrupt 23° bend, not wider than the channel itself and located directly at the entrance. When inbound this leads to relatively high speeds in order to be able to compensate for wind, waves and current while sailing within the channel limits. Slowing down or stopping occurs relatively close to the oil terminals. Under severe weather conditions the length of the breakwaters provides insufficient protection against waves to the tugs to allow them to assist these vessels should assistance be required. If tankers must leave the oil terminals under emergency conditions, only a relatively small distance is available to accelerate to a sufficiently high speed and an adequate course to depart safely from the sheltered harbour area.

From the above it can be concluded that in its present state the nautical safety of the port is below any international standard. In addition it is to be noted that the harbour's breakwaters (especially the Southern one) have sustained damage during recent storms and possible further damage would enhance the problems just mentioned.

ALTERNATIVES EVALUATED UNDER THIS EIA

Three alternatives were considered under this EIA to address the need for rehabilitation.

Alternative 1: No-Action
In this alternative the present situation will remain unchanged. The proposed project will not be executed, which means no dredging and construction activities will be carried out. This alternative is taken as the "neutral" reference for comparison of the other two alternatives.

Alternative 2: The Proposed (Original) Project
This alternative includes the construction of two new breakwaters and dredging of approximately 2 million m$^3$ of sand, silt and glacial till sediments. In this project alternative, all dredged sands (from the outer entrance channel) will be beneficially used for near shore or beach replenishment. All sily sediments as well as all the glacial till sediments will be disposed off at the designated offshore disposal site. In this alternative all non sand sediments will be dredged as one volume, which means that no differentiation will be made between clean and contaminated sediments and between sily sand and glacial till.

Alternative 3: The Proposed Project Plus Confined Disposal Facility
This alternative is the same as the proposed project, but with some changes in the execution of the dredging works. In this alternative the contaminated sediments will be dredged separately from the clean sediments and subsequently stored in a confined disposal facility (CDF). With respect to the CDF it is to be noted that the feasibility, the design characteristics and the location for implementation are still to be worked out. Some initial studies have been carried in this respect. Dredging of the contaminated sediments will be done in line with modern practice of
removing contaminated sediments, i.e. with high dredging accuracy, minimal turbidity and resuspension of contaminated sediments and minimal spill.

PROPOSED ACTION

Each alternative was evaluated on a number of criteria both for the construction period and the subsequent operational phase, and compliance with international environmental regulations. Although the proposed project (alternative 2) already has a significant positive environmental impact by reducing navigation hazards and consequently oil pollution risks at the Klaipeda port, the planned offshore disposal of contaminated sediments is considered to be a violation of international environmental agreements. Consequently, alternative 3 has been selected as the Preferred alternative and Proposed Action. This alternative will require the implementation of a CDF. The CDF, which can be constructed from uncontaminated dredged materials (Glacial till), should be designed to solve not only the contaminated sediment problem from this project, but also to provide a solution for other contaminated sediment problems elsewhere in the port areas. Details on contaminated sediments elsewhere in the port are included in this EIA.

Environmental information used to produce this document results from numerous studies and field surveys by several agencies and investigators working in the study area over the past several years. Especially the contributions of the experts of the Klaipeda University were extremely useful. The summary of the data and interpretations presented are a synthesis of all available information found to be recent, accurate, and applicable to the evaluations.

PUBLIC PARTICIPATION

An opportunity to review the draft version of the EIA (in the Lithuanian language) was announced twice in the local Klaipeda newspaper. Public response was limited and the Port Authorities received no formal comments on the EIA by December 31, 1998. In December 1998, copies of the draft EIA have been presented to the Lithuanian Ministry of the Environment, the Klaipeda Municipality, the Klaipeda County Governor's Administration, the Klaipeda public health centre of the Ministry of Health, the fire-fighting department of the Ministry of Home Affairs, the Project Expertise Bureau, the KSSA and to representatives of the World Bank, for review. By June 1999 only comments from the World Bank representatives had been received. A technical public hearing was organised by the Port Authorities on May 11, 1999. The discussions focussed on the costs of the breakwaters, the direct benefits of the works for Lithuanian contractors and the width of the harbour opening. A public hearing on the environmental aspects of the project and the resulting EIA was organised by the Port Authorities on September 15, 1999. During the meeting serious concerns were expressed by the participants in relation to the delay in implementing a Confined Disposal Facility for safe storage of contaminated sediments and regarding the damage of offshore dumping of dredged sediments on fisheries. The findings of the public hearings have been included in the EIA.

ALTERNATIVE ANALYSIS

The impact assessments and use-conflict criteria were divided into two groups, those related to the construction activities during the project and those related to the subsequent operations at the rehabilitated port entrance. The evaluation of each alternative included the consideration of all possible detrimental, mitigatable, or beneficial impacts that could result from implementation of the alternatives. The following information summarises the pros and cons resulting from this analysis.
Major positive effects are expected in relation to navigational conditions and safety, and the related reduction of oil spill risks. The new breakwaters will also have a small positive effect on fisheries and aquatic life in the project area. The project is expected to result in higher future maintenance costs and will have a negative effect on water quality in the Baltic Sea if contaminated sediments are dumped at the offshore disposal site.

During construction several detrimental effects are to be expected. However, as all of these effects are related to the construction and dredging activities they are all of a temporary nature. This means they will stop once the project is finished. Included in these temporary effects are detrimental effects on water quality, aquatic life, especially if contaminated sediments are dredged without precautions. Small detrimental effects are expected in relation to fisheries, navigation (hindrance) and urban land traffic. Mitigating measures to minimise the indicated negative effects are presented in this report.

Summary review of expected effects for the three alternatives.
+ : slight increase; ++ : increase; +++ considerable increase; 0 : neutral;
- : slight decrease or reduction; - - : decrease or reduction; - - - : considerable decrease or reduction

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H7371 Draft Final Environmental Impact Assessment
Executive Summary

September 1999
PREPARED ALTERNATIVE

Alternative 3 has been selected as the so-called Preferred Alternative and was presented accordingly to the Port Authorities in the draft EIA (September 1998). This alternative was found to have the same benefits as alternative 2, but the least and less severe negative impacts, while still meeting the goal of the Client, e.g. a safer and more economic port.

ENCROACHMENT ON PREFERRED ALTERNATIVE AND PROPOSED ACTION

During the execution of the EIA study for the project, upon KSSA’s initiative the area to be dredged under this project was split into two tenders. One tender organised by Frederic R. Harris (FRH) and financed by a World Bank loan, covering the (re)construction of the breakwaters and the dredging (practically) from the existing coastline seawards. The other tender organised by the Lithuanian Energy Institute (LEI) and financed by KSSA itself, covering the dredging from the existing coastline land inwards. The dredging area under the FRH tender comprises only clean sediments, whereas practically all surface sediments under the LEI tender can be classified as contaminated under the Lithuanian classification system.

In view of the fact that a CDF had not yet been implemented, the KSSA requested permission from the Lithuanian Ministry of the Environment to be allowed to dump the contaminated sediments present in the dredging area covered under the LEI tender at sea. Although not in line with the concept of environmental protection, or the international attempts to improve the water quality of the Baltic Sea - measures to improve the water quality in and around Klaipeda are listed as priority actions under the Baltic Sea Programme approved by the regional Ministers of Environment at Helsinki (April 1992) and Gdansk (March 1993) - this permission was granted and early 1999 dredging in the LEI area started. During the summer of 1999 practically all contaminated and clean sediments had been dredged in the LEI dredging area and had been dumped offshore.

Consequently, with no contaminated sediments present in the dredging area covered under the FRH tender and all the contaminated sediments already removed from the LEI dredging area, the so-called preferred alternative as developed in this EIA appears no longer relevant for this project.

However, there is still a considerable volume of contaminated sediments left in various parts of the Klaipeda port. Lithuanian experts estimate the present volume of class 3 and 4 sediments at approximately 200,000 – 400,000 m$^3$. Undoubtedly, more contaminated sediments will be formed (deposited) in enclosed port areas in the years ahead. This clearly demonstrates that the implementation of a CDF is still very relevant. According the Minister of Transport and Communications, Mr. R. Didziokas, the project for storage of contaminated sediments will form part of the Public Investment programme and the Tina programme as a separate project. The implementation of this project is anticipated in 2001.

ENVIRONMENTAL MANAGEMENT PROGRAM

Based on the findings of the EIA it is clear that the execution of the Klaipeda Port Entrance Rehabilitation Project as funded by the World Bank, will influence a variety of environmental aspects. Therefore an Environmental Management Program (EMP) has been developed, which contains the evaluation of the most significant environmental effects, defines adequate measures to mitigate them, and establishes a monitoring program to measure and control both the impacts and the effectiveness of the mitigating measures. The general objectives of the EMP are:
1. to ensure compliance with all pertinent environmental legislation
2. to ensure environmental-friendly practices in relation to dredging and disposal works
3. to give priority to preventive measures in preference to corrective measures
4. to promote two-way communication with the local communities

Additional works directly related to this project have been identified as well. These works, which are summarised at the end of this executive summary, comprise:

- The set-up of a nautical and environmental database system for storage and retrieval of relevant data and information for better planning of future port development projects.
- A remediation study in relation to the contaminated sediment problems of the Port.
- The development of a CDF for storage of contaminated sediments.

With respect to the EMP it is to be noted that several aspects of the works are still unclear, e.g. the equipment and working methods of the selected contractor, the source and transport of the breakwater construction materials, etc. Consequently, the EMP presented is to be considered a DRAFT version, which is to be elaborated when the selected contractor has made relevant details available.

On the basis of the information provided in the EIA (section 1 to 7), a matrix of the environmental aspects has been prepared, which summarizes possible relevant effects on the natural and social environment. This matrix has been used to facilitate the definition of the mitigating measures and the development of the monitoring program.

**MITIGATING MEASURES**

Environmental Impact Assessment studies are designed to identify environmental problems, which may be caused by a development project, and to determine the magnitude of the effects on the environment. Through this process, design and operational changes can be introduced in the detailed design phase of the project, thereby minimizing any adverse effects of the development.

During the past five years the independent Environmental Impact Assessment Committee in the Netherlands noted, that less and less mitigating measures were required after the EIA had been completed. The pure fact that it is known to the project developers that an EIA will have to be made, automatically resulted in more environmental friendly project proposals. Just like technical and economical aspects are taken into consideration during the initial drafting of the project, so are environmental aspects.

This is also true for the Klaipeda Port Entrance Rehabilitation project. The design of both the entrance channel and the new breakwaters was oriented towards providing better protection against waves and improvement of the navigational and safety conditions. This by itself strongly reduces the risks of oil spills and is to be noted as a major benefit for the environment. With the new layout (and other safety measures taken) the port entrance design will comply with international safety standards.

The beneficial usage of dredged sand for beach or near shore replenishment was also based on environmental considerations, i.e. preventing further coastal erosion. This will be the first time dredged sediments will be beneficially used in Lithuania.
Nevertheless, for some aspects of the project mitigating measures have been identified to prevent or reduce possible detrimental effects. Two measures are related to the operational phase (consequences) of the project, whereas the remaining measures are related to the construction phase of the works.

A: MITIGATING MEASURES RELATED TO THE OPERATIONAL PHASE OF THE PROJECT

Set-up of an Automated Database System
Future maintenance dredging costs are expected to increase as more sedimentation in the navigational channel is anticipated. In this respect it is important to note, that the removal of sediments by dredging from the coastal zone with disposal offshore has been identified as one of the possible causes of coastal erosion along the Klaipeda coastal area. To facilitate the planning of beneficial usage of the sediments originating from maintenance dredging works (e.g. relocating the sediments at appropriate locations within the coastal zone, beach replenishment, etc.), a database system is to be set up. Information regarding the locations, types, quality and quantities of the sediments to be dredged are stored in the database for future analyses. With sediment characteristics and quantities known in advance (proven records), beneficial usage can be better planned. This database system should be easy accessible and PC based. In addition to storage of the sediment characteristics of maintenance projects, the database can also be used to store other soil/sediment-related information and other environmental relevant information. This would facilitate future planning of development projects by the Port Authorities. More detailed information regarding the development of an "Environmental and Nautical Database System" is presented in the section on additional works at the end of this Executive Summary.

Introduction of Alien Species
The increase in size and number of ships entering the port will result in increased risk of alien species invasion. To mitigate this effect, which is associated with ballast water, appropriate measures as indicated in the IMO guidelines should be taken by the Port Authorities.

B: MITIGATING MEASURES RELATED TO THE CONSTRUCTION PHASE OF THE PROJECT

During the construction phase some temporary negative effects are foreseen. For these effects the following mitigating measures are developed:

Protection of Fish Migration Routes and Spawning Areas
The Lithuanian Ministry of the Environment has already to some degree regulated dredging operations, which might interfere with fish migration. These regulations are known as "Order No 67" and are called "On the assessment of the effects of Klaipeda port dredging works on fisheries" (included as appendix B to this report). These regulations comprise both strong and very weak points. Strong points are that dredging is only allowed during fish spawning migration in case of "urgent necessity". Secondly, the dredging contractor is to provide information regarding the planned dredging works and the measures taken to reduce the negative effects on fish migration. In case of dredging during the fish spawning migration periods the dredging contractor is to pay a fee for possible damage caused. Very weak points are that the fees are so low that they will not put any restriction on dredging from a financial point of view. Secondly, in the course of the dredging works the port must carry out a monitoring investigation of migration intensity and the effects of dredging on migrating fish. Assessment of the latter is believed to be practically impossible, as there are too many other parameters besides dredging that might affect fish migration (natural variability of currents, flow directions, discharge of waste water, spills, shipping, other port related activities, etc.). Thirdly, the regulations do not in any way protect the spawning areas on the existing breakwaters.

In view of the above, the dredging contractor should plan the dredging works outside the fish spawning migration periods to the maximum extent possible. Besides, the Contractor is to take
protective measures for the breakwater spawning areas (to prevent smothering by resettling sediments), if and when required.

As less intense fish migrations across the Klaipeda Strait take place throughout the year, dredging and the resulting increased levels of resuspended sediments are likely to affect fish migration in any period of the year. To mitigate these effects special attention should be paid to predicting, monitoring and minimizing turbidity generation during the dredging operations.

**Note:** With practically all the contaminated sediments removed from the study area and no contaminated sediments found present in the remaining World Bank dredging area, the mitigating measures for dredging and disposal of contaminated sediments (as given below) are considered no longer relevant for the dredging works forming part of the World Bank project. However, as there is still a considerable volume of contaminated sediments left in various parts of the Klaipeda port, the implementation of a CDF is still very relevant, as is an adapted dredging methodology in these areas. More detailed information regarding the present situation on contaminated sediments, the need to carry out a remediation study and the development of a CDF is presented in the section on additional works at the end of this Executive Summary.

**Dredging Clean and Contaminated Sediments**

The lack of differentiation between dredging clean and contaminated sediments will result in negative effects on water quality (resuspension and dispersion of contaminated sediments and release of contaminants to the water column), aquatic life and fisheries. Besides, offshore open water disposal of contaminated sediments will not only have a temporary and local negative effect on water quality (during disposal), but also a more permanent and more widespread negative effect. The contaminated sediments will be dispersed over a wide area (lithodynamically active zone) and will act as a source of pollution.

The effects in the dredging areas can be mitigated by removing the contaminated sediments separately from the clean sediments in a manner appropriate for the removal of contaminated sediments (high accuracy dredging, no or minimal turbidity generation and minimal spillage). The dredging contractor should prepare a method statement on the removal of the contaminated sediments, in line with modern dredging practice.

**Disposal of Contaminated Sediments**

The effects in the disposal area can be mitigated by not allowing contaminated sediments (above a certain level of contamination) to be dumped at sea. A confined disposal area should be prepared for safe storage of these sediments. In addition, periodic testing should be carried out to verify that the sediments, which are to be dumped at the offshore disposal site, do not contain hazardous materials.

**Offshore Disposal of Uncontaminated Dredged Sediments**

At present four open water disposal areas for dredged sediments exist in the Klaipeda coastal zone. Two of these sites have been closed, whereas the other two are still in operation. A fifth disposal area is being studied. All these disposal sites will positively or negatively affect fisheries. Disposal of glacial till sediments (including rocklike hard clay and boulders) is planned to take place at disposal area III, which is located more than 20 kilometres from the Port entrance. The presence of mounds of rocklike clay and boulders make these areas less suitable/ attractive for certain types of fishing (bottom trawling). To minimize the damage to fisheries caused by disposal of dredged sediments, disposal should be restricted to the designated disposal site. However, in view of the long transport distance to this disposal site and the related costs, it is not unthinkable that disposal of dredged sediments from barges also takes place at shorter distances from the port entrance. These “unplanned” and uncharted dumpings at various locations between the port entrance and the official disposal site have already caused serious damage to the fishing industry in general and fishing gear in particular. To ensure proper disposal of the dredged sediments, the
Barges should be equipped with a GPS (or better) positioning system and a PC-based electronic monitoring system for continuous recording of the parameters time, position and load data.

**Beach or Foreshore Replenishment**
The sandy sediments dredged at the entrance channel will be beneficially used for prevention and remediation of coastal erosion. However, special care should be taken in case the sandy sediments contain inclusions of clay-balls or silty sediments. In view of the recreational value of the beach areas, these "mixed cargoes" should not be used for beach or dune replenishment. When the cargoes contain limited amounts of clay-balls or silty sediments, they can be used for foreshore replenishment. In case too much silt is present in the cargo, the load should not be used for replenishment purposes, but should be redirected to the offshore disposal site.

**Planning of Navigation During the Construction Works**
To minimize the interference of stationary dredging equipment and the construction of the breakwaters with other maritime traffic two mitigating measures should be taken. Firstly, planning of the works should be done in such a way that the interference with other maritime traffic is already minimized. The contractor should provide a method statement in this respect. Secondly, a program should be developed by the Port Authorities in advance of the works, to co-ordinate and further reduce this interference. This program is to include aspects like advance warning to other maritime traffic of closure of areas and presence of equipment, but also advance warning to the contractor(s) of relevant maritime traffic, e.g. arrival or departure of oil tankers or other large ships.

**Hindrance and Information to the Public**
No matter how well planned, the construction of the new breakwaters, the repair works for the existing breakwaters and the dredging and replenishment works will cause hindrance to the people who are living, working or recreating at or near these sites. To mitigate this effect, ample attention should be paid to informing the public about the project, its timing and its progress.

**Planning of Road Transport During the Construction Works**
In case considerable road transport is foreseen as a consequence of the works (e.g. supply of breakwater construction materials to the site and transport of sand to beach and/or dune areas), more or less identical mitigating measures (see planning of navigation) should be taken with respect to road transport.

**Pollution Caused by the Construction Activities**
Pollution related to the construction activities can be caused by the equipment used, e.g. dredgers, cranes, etc., and at the construction site(s), e.g. construction of concrete armour units, storage areas for solid and liquid wastes, storage areas for stockpiling construction materials, etc. To mitigate these forms of pollution, the contractor should be requested to supply an anti-pollution method statement. In this statement measures taken to prevent or minimize pollution, including spillage during bunkering and waste handling, should be indicated. The statement should also include a clean-up plan to be carried out after completion of the works.

*Note: In the contractual arrangements relating to the environmental and social management of the project, the above mitigating measures will be included.* (Conditions of Particular Application of the contract between the KSSA and the Contractor).

**ENVIRONMENTAL MONITORING**
The main objectives of the monitoring program can be described as:

- The works should comply with laws, rules, regulations and permit requirements. This is the legal basis for the monitoring program.
The learning objective for future planning. This is the common sense basis for the monitoring program.

With respect to the proposed project and in line with the mitigating measures, the monitoring activities can be split into two sections, i.e. monitoring related to the operational phase of the new Port entrance (design consequences) and monitoring related to the construction activities of the project (operational control). The monitoring activities related to the operational phase are long term monitoring activities and fall under the responsibility of the Port Authorities. The monitoring activities related to the construction activities are mainly control monitoring activities and are the responsibility of the Contractor and/or the Port Authorities. Management and execution of the monitoring activities are discussed in section "C" below.

A: MONITORING RELATED TO THE OPERATIONAL PHASE OF THE PROJECT

Permanent Reduction in Hydraulic Resistance in the Klaipeda Strait

Due to the dredging works in the sea access channel and the northern harbour area, the flow conditions in the Klaipeda Strait will change. The expected permanent reduction of the hydraulic resistance of the Strait will have a variety of secondary effects, like:

- changes in flow characteristics and discharge rates
- changes in sediment transport and sedimentation/erosion processes,
- changes in salt intrusion into the lagoon,
- water level changes in the lagoon

Based on computer modelling, it is expected that the present project may result in a 3-4% initial increase in discharge and may lead to approximately 2 cm lower water levels in the lagoon during outflow periods. Based on the LEI dredging study (LEI 1997), it is clear that considerable additional deepening dredging works are foreseen for the area from the present project up to Alksnyne (more than 5 kilometres in the direction of the lagoon). If executed these dredging works will lead to a much larger reduction in hydraulic resistance (up to 10%) and subsequently in much stronger secondary effects. In order to be able to indicate the environmental effects of the planned future works with more accuracy, the effects of the present project should be assessed by monitoring several key characteristics before and after the present project. The key characteristics should include: water flows in time, suspended sediment levels, salt intrusion measurements and water level registrations. Several of these measurements are already included in ongoing monitoring programs, but coordination may be required.

Coastline Development

A clear difference of opinion exists between scientists about the littoral drift in the study area. Depending on the expert the execution of the project (and mainly the construction of the breakwaters) may have a considerable or an insignificant effect on coastline development. To make sure severe coastal erosion effects are noted in time to take preventive or mitigating actions, the coastline both north and south of the access channel should be monitored. The information should not only include details of the actual location of the coastline (sea-land interface), but should also include changes in the dune/beach, as well as the near shore topography. For this purpose both land and near shore topographic measurements are required on a regular basis (extended hydrographic survey area). A part of these monitoring activities are already included in ongoing monitoring programs.
Maintenance Dredging and Beneficial Usage of Dredged Sediments
Regular monitoring is required with respect to changes in sedimentation in the navigational channel and the northern harbour part, to study the effects of the project on maintenance dredging. The resulting information is to include information on the characteristics of the sediments (type of sediment, grain size distribution and level of pollution) in view of possible beneficial usage. The proposed monitoring activities are part of the normal maintenance dredging related activities, which may need to be adjusted to fulfil the present and future needs.

The data resulting from all the above monitoring programs should be stored in a so-called “Nautical and Environmental database system” for analyses and future use. Background information on the N&EDS is presented in the section on additional works at the end of this ES.

B: MONITORING RELATED TO THE CONSTRUCTION ACTIVITIES OF THE PROJECT

Increased Levels of Suspended Sediments - Turbidity
Resuspension and dispersion of fine sediments will take place during dredging operations and during placement of the construction materials. In view of fish migration and nearby spawning areas monitoring of this aspect is required. The resulting information should indicate the scale of resuspension for the various types of dredgers and auxiliary equipment, the various types of sediment or construction materials, as well as the dispersion in time and place. Based on the monitoring information additional mitigating measures may be developed if and when required.

Fish migration and spawning during the construction and dredging works are to be monitored as well. The key parameters for fish migration should include: type of species, migration routes and migration intensity. For fish spawning the key parameters should include: spawning locations, timing and duration of spawning, period till hatching, spreading of fry, temperature and suspended sediment levels.

Dredging Contaminated Sediments
In case contaminated sediments are to be dredged, the relevant characteristics of this type of dredging should be monitored, e.g. accuracy of dredging, turbidity and spillage. The resulting information should indicate differences between the design level and the dredged level in centimetres.

Offshore Disposal
To ensure that dredged sediments are only dumped at the designated offshore disposal site, control monitoring is required. For this purpose the equipment to be used for transporting the sediments to the offshore disposal site should be equipped with:

- a GPS-positioning system (or better)
- a PC and related software to record: date, time, position, and load information (based on depth gauges of the barge/transport-ship).

Beach or Foreshore Replenishment
To ensure that only sand and no silt and clay balls are placed on the beach, the dredging contractor should carefully monitor the loading process during dredging. Each load should be judged individually in order to assess if the load is suitable for beach replenishment, for near shore replenishment or should go to the offshore disposal site.

Anti-Pollution Program
To ensure compliance with the anti-pollution program as is to be presented by the contractor, control monitoring in the form of independent incidental audits during and after completion of the works are required. Items to be included in the control monitoring are: fuel bunkering, waste handling, storage facilities and construction facilities.
C: MANAGEMENT AND EXECUTION OF THE MONITORING PROGRAMS

As the owner of the project, the Port Authorities are responsible for monitoring the design consequences of the project (operational phase). These monitoring activities, which will cover a period of at least 2 to 10 years after the works have been completed, include:

- Reduction of hydraulic resistance and related effects
- Changes in coastline development
- Changes in maintenance dredging volumes

As parts of these monitoring activities are already elements of ongoing monitoring programs, it is recommended that the KSSA will work out detailed monitoring programs for these items, in close co-operation with the involved third parties.

In view of the KSSA’s direct involvement in the project, it is recommended that an independent monitoring authority is appointed to oversee and conduct monitoring related to the construction activities. The “Construction Supervision Team (CST)” to be appointed for the execution of the works, is proposed to be this independent monitoring agency for the following reasons:

- The CST has a clear task and commitment to ensure the works are undertaken according the contract and the EMP.
- The CST has a clear view on project planning as well as on the daily activities, which facilitates planning of the monitoring activities.
- In view of its role, the CST has direct and open communication lines with both the Project Implementation Unit (PIU) and the Contractor. This greatly facilitates quick response actions when required in case of non-compliance with the contract or the EMP.
- The CST is directly involved in technical monitoring, like production processes and work progress. Items that are directly related to the environmental monitoring program, like turbidity control.

It is foreseen that for specific monitoring activities, like fish migration, fish spawning and other field measurements, the CST will be assisted by experts from Lithuanian institutes, e.g. the Klaipeda University, the Marine Research Centre, The Fishery Research Laboratory, the Institute of Geography and the Vilnius University.

Based on the planning and the work methods of the contractor, and in line with the items presented in this EMP, the CST is to work out a detailed works program for the environmental monitoring activities. This works program is to include the monitoring topics, the monitoring strategy, timing, frequency of measurements, people and equipment involved, as well as costs involved. The monitoring works program is to be completed before the start of the execution of the works.

A series of report requirements and communication channels have been identified under this EMP:

- Weekly progress reports from the CST to the Project Implementation Unit
- Daily and weekly reporting on specific topics by involved third parties to the CST
- Reporting between the Project Implementation Unit and the Funding Institution(s)
- Communication and coordination on a regular basis between the Project implementation Unit and the Ministry of the Environment
- Communication and coordination on a daily basis between the CST and the Contractor(s)

The main players and reporting modes are outlined in the framework given below.

Organization schedule for monitoring activities.

**Note:** The contractor will be directly involved in the monitoring activities in allowing access to his working sites and equipment, but also in view of dredging and construction planning. In the contractual arrangements relating to the environmental and social management of the project this will be reflected.

**ADDITIONAL WORKS**

The following additional works directly related to the project are recommended:

1. Set-up of a database system for dredging and environmental data
2. A contaminated sediment remediation program
3. The design and implementation of a CDF for contaminated sediments
ADDITIONAL WORKS 1: Database System for Nautical and Environmental Data

The data and information which had to be collected for this World Bank project, included a variety of environmental and dredging related data, e.g. bottom topography, sediment composition, layer thickness, levels of contamination, water quality characteristics, dredged areas, dredged volumes and characteristics, hydrographic survey data, salinity data, levels of suspended sediments, fishery data, etc.

Although quite some information was known to exist, it was sometimes very hard or even impossible to get the data made available to the study team. Although several earlier studies were carried out on behalf of the Port Authorities, most of the information and data was only available from the original source (private company, public organization or University experts). Besides the information was fragmented, incomplete and sometimes incompatible. Data on levels of sediment contamination were considered “Classified” and only a part of the information could be bought from the original sources; often after several months of requesting.

This situation is a clear disadvantage to the Port Authorities, being the manager of the entire Klaipeda port area. Not only has it caused considerable delays to the World Bank project, but the lack of a central knowledge base, or “Nautical and Environmental Database System” (N&EDS) also hampers proper planning of future development projects. With respect to the wish of Lithuania to become part of the European Community, it is to be noted that the present situation is not in line with the 1990 EC Directive on freedom of access to information on the environment.

It is clear that information availability can be improved by creating a N&EDS for the Port Authorities. By storing and analysing nautical and environmental information, future works and activities of the Port Authorities can be better planned, e.g. maintenance dredging, beneficial usage of dredged sediments, contaminated sediment problems, coastal erosion problems, etc. Besides, by making data and information free and easy accessible to third parties, the data and information can also be used for other then their original purpose, e.g. coastal zone management, fishery research, education, in-house training, marketing, etc.

The N&EDS should be PC based and should include so-called GIS (Geographical Information System) software. In this way data can be presented on standard maps and charts. The retrieval of information and knowledge should be facilitated by use of simple metadata records accessible through Internet-based gateways.

Although developed with and for the Port Authorities, the N&EDS should also be promoted and developed in close co-operation with other possible end-users, especially University experts. This to ensure that the results from research projects, surveys and monitoring activities will find their way into the database system as well.

The development of the N&EDS, including the purchase of hardware and software, the design of the database structure, implementation, testing and training, reporting and external consultancy, is estimated at approximately US$150,000.

ADDITIONAL WORKS 2: A Contaminated Sediment Remediation Program

A serious problem with respect to the contaminated sediment issue and consequently with planning of the capacity of a CDF (Confined Disposal Facility) is the fact that there are no accurate data available regarding the volumes of contaminated sediment present, the variations in layer thickness, the toxicity of the contaminated sediments, dredgeability and effects of dredging tolerances on dredged volumes, treatment options to minimize the volumes to be stored, etc.
To fill this information gap, a remediation program is highly recommended. This program should preferably be carried out as a joint effort by the World Bank study team and Lithuanian experts. The total costs of the program, including limited field sampling and laboratory analyses are estimated at approximately 200,000 US$.

**Background Information on Presence of Contaminated Sediments**

In the summer of 1998 the Geographical Institute in Vilnius (Lithuania) executed an extensive investigation on the presence of contaminants throughout the port of Klaipeda. Sediment samples were taken in 192 positions from the port entrance up to and including Malku Bay. The results of the investigations have been reported separately (Geographical Institute, 1998) and have also been used in a preliminary report to the implementation of a confined disposal facility (Association of Lithuanian Hydrobiologists, 1999). The results of the investigations show that most of the contaminated areas are related to the presence of silty sediments. The assessed quantities of contaminated sediments are summarized in the table below.

### Contaminated Sediment in Klaipeda Port

<table>
<thead>
<tr>
<th>Class</th>
<th>% of Silty Sediments</th>
<th>In Situ Quantity $m^3$</th>
<th>Area $(km^2)$</th>
<th>Average Layer Thickness $(cm)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Clean</td>
<td>4</td>
<td>31,000</td>
<td>0.6</td>
<td>5</td>
</tr>
<tr>
<td>II Little polluted</td>
<td>36</td>
<td>271,000</td>
<td>2.5</td>
<td>10</td>
</tr>
<tr>
<td>III Polluted</td>
<td>58</td>
<td>437,000</td>
<td>1.1</td>
<td>40</td>
</tr>
<tr>
<td>IV Highly polluted</td>
<td>2</td>
<td>13,000</td>
<td>0.05</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>13,000</td>
<td>0.05</td>
<td>25</td>
</tr>
</tbody>
</table>

Source: Treatment site for contaminated sediments from the water territory of Klaipeda Port. (Association of Lithuanian Hydrobiologists, 1999).

Looking at the distribution of these sediments (see figure) it is observed that most of the port’s fairway is contaminated with Class II sediment, whereas Class III and Class IV contaminated sediments are found along most of the quays and in inner harbours (Winter port, Malku bay). Implicitly this means that any expansion or rehabilitation of the existing quay structures requiring deepening in front of the quays, requires Class III and/or Class IV sediments to be dredged. According Lithuanian guidelines these materials cannot be dumped in open sea. The aforementioned studies emphasize the findings of the EIA that for the future planning and progress of the port a Confined Disposal Facility for environmentally safe storage of contaminated sediments is urgently required.

The Lithuanian experts of the Association of Hydrobiologists indicate in their report that in some cases Class III sediments are overlying layers of Class II contaminated sediments. Theoretically it is assessed that the actual quantity of Class III contaminated sediments includes some 201,000 $m^3$. However, taking into account the available dredging techniques it is concluded not possible to dredge with the required accuracy. Hence, the total quantity of contaminated sediment required to be stored or treated is estimated at 450,000 $m^3$.

Consultants would like to indicate that present day’s dredging techniques manage to maintain a vertical accuracy of 0.10 m, when using advanced dredging equipment (with respect to horizontal and vertical dredging control) and a trained crew. However, for the quantities indicated Consultants assess it to be more realistic to apply a dredging tolerance of 0.20 m. Based on a practical dredging tolerance of 20 cm, the amount of sediment dredged including the layer of contaminated sediments would be around 550,000 $m^3$. Including the Class IV sediments, this will lead to a minimal 600,000 $m^3$ storage volume in a Confined Disposal Facility.
In addition to this amount of contaminated sediment to be stored to re-mediate the present day contaminated sediment problems of the port, a reservation has to be made for the future maintenance dredging in the port as well. Lithuanian experts assess the amount of silty sediments to be deposited annually at 100,000 m$^3$. Based on the area distribution of contaminated silty sediments, it is assessed that initially 34,000 m$^3$ of Class III/IV material will be deposited each year. However, when sources of pollution will be re-mediated in due course this amount of contaminated maintenance dredging will be reduced as well, for which argument Consultants assume the annual contaminated maintenance dredging to be some 20,000 m$^3$ for the coming 10 years. Hence the required size of a Confined Disposal Facility to solve the contaminated sediment problems for the port of Klaipeda in the coming 10 years is about 800,000 m$^3$.

A storage amount of 800,000 m$^3$ is a considerable amount and reduction of this quantity may be looked for in the following areas:
• Precisely identifying the layers of contaminated sediment. Presently some 200 samples have been taken throughout the port to identify the contaminated sediment problem. Most of these samples have been limited to the top 10 cm of the bottom. By precisely indicating (vertically and horizontally) where Class I to Class IV contaminated sediment can be found, not only a detailed estimate of the quantity of contaminated sediments can be obtained, but also a detailed dredging plan can made where to dredge which layers to what depth.

• By minimizing the inclusion of clean or lightly contaminated sediments (due to over-dredging and dredging tolerances), the indicated amount will be reduced. However, increasing the accuracy of dredging and reducing the dredging tolerances will put a larger demand on the dredging capabilities (equipment and staff) of a dredging contractor, resulting in increased dredging cost.

• Considering the effect of bulking of sediments (increasing volume as a consequence of handling) as filling of the CDF is expected to take place gradually during the years. Settlement and compaction of the sediments inside the CDF will strongly reduce the bulking effect caused by handling.

• Separation of clean sand and contaminated silts can reduce the quantity of contaminated sediments to be used. Generally, with more than 50% sands in the dredged spoil, separation of sand and silt will lead to a reduction of the quantity to be stored. However, with less than 50% sand in the dredged spoil, the quantity to be stored does not reduce due to the adverse dewatering characteristics of the remaining silt-water mixture.

• Treatment of the sediments in the form of cleaning (removal or destruction of contaminants) may result in a very large reduction of the quantity of sediments to be stored.

It goes without saying that reduction of the total quantity of contaminated sediments to be stored does have its price. Which options can be used will have to be studied in more detail as part of the remediation program, which in itself can be included in the CDF study.

Overview of Finalized, Ongoing and Planned Capital and Maintenance Dredging Works
On additional problem in relation to proper planning of the required CDF capacity is the ongoing removal of contaminated sediments from various parts of the port and its subsequent dumping at the offshore disposal site. A summary of the finalized, ongoing and planned dredging works inside the Port of Klaipeda is presented in section 8 of this EIA.

It is noted that a considerable number of capital dredging works is planned for the period from the present to 2003. Practically all of these projects will involve dredging of contaminated sediments. The present plans to implement a CDF after all of these works have been completed, is like putting the cart before the horse. It is therefore highly recommended to expedite the implementation of a CDF and to postpone all dredging works in contaminated areas till a CDF has become available.

ADDITIONAL WORKS 3: Confined Disposal Facility for Contaminated Sediments

Introduction
With part of the bottom sediments in Klaipeda port being too contaminated to be dumped offshore, the dredging and disposal of these contaminated sediments forms a regularly recurring problem. To solve this problem, this EIA describes a so-called "Preferred Alternative", which includes the storage of contaminated sediments in a Confined Disposal Facility (CDF).
In this section some concepts of a Confined Disposal Facility to store contaminated sediments from the Klaipeda port are being discussed. Two of these concepts have been developed by Haskoning in 1995 and the Consultants within the present study have identified two other concepts. For all concepts a first order cost estimate for the implementation costs have been provided. Recommendations for the further design and construction of such CDF, including detailed cost estimates for implementation, are provided in the main text.

**Locations**

When deciding on the implementation of a CDF, an important issue to take into account is the location of the CDF to be constructed. The Haskoning study resulted in a preliminary design and a preliminary environmental impact study for two possible disposal sites: the Ship Cemetery and the Dreverna site:

**The Ship Cemetery**
The Ship Cemetery is located along the Klaipeda Port fairway at approx. location 55°40.8' N, 21°08.1' E (see figure). With the depth of the fairway locally being nearly 9 m, due to its location the site is easily accessible for dredges and barges. Further, the disposal site is located approximately in the middle of the port and thus in the heart of the contaminated sediment problem. The resulting short transport distances will be beneficial for the execution of contaminated sediment dredging and disposal.

**The Dreverna Site**
The Dreverna site is not as well defined in location as the Ship Cemetery, but has roughly been indicated between 55°34' N and 55°36.5' N on the eastern shore of the Kursiu Lagoon (see figure). This results in considerable sailing distances (order of 10 to 15 km) from the areas where the contaminated sediments are to be dredged. Second disadvantage about the location is the rather shallow depth in the Kursiu Lagoon.

In the execution of this EIA, Consultants identified two alternatives for a CDF. One of these is located behind the Sea Museum, taking advantage of an already present basin. The other exact location for a CDF still has to be specified. Requirement for this last location would be that the glacial till bottom layer should be quite near to the ground surface. According the soils investigations carried out for the project, this layer can be found at a depth of approximately -12 m CD under the Curonian Spit. In short these two sites can be described as:

**The Sea Museum Site**
The Sea Museum site is located at approx. 55°43.2' N, 21°06.2' E (see figure). The site is located close to the fairway through Klaipeda port and with the depth locally being nearly 12 m, easy accessible for dredges and barges. The sailing distances to the locations with contaminated sediment are in the order of 2.5 to 8.5 km.

Locations of CDF’s (indicative)
The Curonian Spit Site
The Curonian Spit site is not as well defined as the Sea Museum site, but is roughly proposed to be located between the Ship Cemetery site and the Sea Museum site. This puts the site close to the fairway with sufficient depth for dredges and barges. Further, also the sailing distances to the dredge areas with contaminated sediments are short (order of 5 km). It is emphasized that in proposing three potential locations of a CDF on the Curonian Spit, it has not been overlooked that the Curonian Spit is a National Park. However, when it is considered that a CDF is essentially a closed system from which contaminants are not supposed to leak, the proposals do have some specific advantages:

1. With large scale infrastructural and urban developments not allowed in the National Park, it will be very unlikely that the CDF will ever be in the way of any future developments, as it might be when located near urban Klaipeda.

2. The long term after care of a CDF constructed in the National Park could fall under the obligations of the organization maintaining the National Park. This organization, in itself concerned with the care for nature, should understand the importance of the CDF and take proper care of it.

3. It being a NATIONAL park, a clear directive from the National Government (i.e. the Ministry of Environment) can overrule the well-known Not-In-My-Backyard attitude to the implementation to the CDF. Clearly, the Ministry of Environment has to be convinced of the advantages of having the CDF on the Curonian Spit

4. Once filled, capped and completed, the CDF can be properly embedded in the natural environment of the National Park.

Finally, it is observed that at the Northern part of the Curonian Spit a lot of activities take place, such as: presence of quays of ferry links, museums, houses, Coast Guard station. In view of this, it is not considered a loss for the park if a well functioning disposal site is created here.

Still, the above sites are identified as being potential sites. The feasibility of these sites has not been demonstrated yet, let alone that approvals to construct a CDF at one (or more) of these sites have been received. Prior to the design and construction of a CDF at any of these sites a detailed feasibility study to the (final) location of the CDF will be required.

Storage Capacity
The storage capacity of the Ship Cemetery and the Sea Museum site have been assessed at:

- Ship Cemetery: 85,000 m³ volume corresponding to 65,000 m³ in situ dredge sludge
- Sea Museum: 60,000 m³ volume corresponding to 45,000 m³ in situ dredge sludge

In view of these relatively small capacities, these sites may be considered as temporary disposal facilities. As final CDF's these sites might be attractive when the amounts of contaminated sediment to be stored in the depots can be reduced. Some of these techniques are indicated in the EIA, but in the following these have not been taken into account.

The storage capacity for the Dreverna site and Curonian Spit site are much larger, as both sites are supposedly to provide a long-term solution to the contaminated sediments problem of the port of Klaipeda. The storage capacity for these sites have been assessed at:
Klaipeda Port Entrance Rehabilitation Project

- Dreverna Site: 500,000 m$^3$ volume corresponding to 350,000 m$^3$ in situ dredge sludge

- Curonian Spit Site: in view of the uncertainties about the quantities of contaminated sediment still present in Klaipeda Port, a CDF's with capacities ranging from 200,000 m$^3$ to 800,000 m$^3$ have been identified.

The construction/design concepts of the Confined Disposal Facilities at the aforementioned sites are described in section 8 of this EIA.

**Environmental Impact Assessment**
Adopting that the isolating measures, after care and monitoring program for the CDF function properly, it is assessed that the impacts of the mere CDF to the environment will be minimal, provided that efforts are made to integrate the CDF in its natural environment.

**Implementation Costs**
It is clear that the storage capacity of the CDF will strongly affect the costs of implementation. The implementation costs calculated for the presented alternatives vary from 1 million dollar for the 60,000 m$^3$ depot to 9 million dollar for the 800,000 m$^3$ depot.

**Conclusions and Recommendations**
One of the main conclusions of this EIA is that the design and construction of a CDF is urgently required if the port of Klaipeda is to carry out maintenance dredging and capital dredging inside the port in accordance with national and international guidelines for the preservation of nature.

Based on the 1998 field investigations on contaminated sediments still present in the port, Lithuanian experts estimate the amount of level III and IV contaminated sediments inside the port to be 215,000 m$^3$ minimum up to 440,000 m$^3$ maximum. The actual amount actually depends on possibility to differentiate (vertically) during dredging operations between level II and level III contaminated sediments. Yearly 100,000 m$^3$ of fresh silt will be deposited in the harbour. How much of this 100,000 m$^3$ of silt is contaminated is not quite clear, but may be in the order of 20,000 m$^3$ per year. When considering the storage of existing and anticipated contaminated sediment for another 10 years to come, the storage capacity required may be as much as 800,000 m$^3$. Methods to reduce the volume of contaminated sediments to be stored will have to be studied as part the remediation study. Based on the present estimates, it will be clear that a small CDF will not be sufficient. The capacity of both the Ship Cemetery Site and Sea Museum site are insufficient to store all the contaminated materials present.

With the requirements for the implementation of a CDF (again) clearly demonstrated in this EIA and the impact which a delay in the implementation may have on the development plans of the Port of Klaipeda, it will be clear that a fast start up of the design and construction of a CDF is to be promoted by all parties involved: KSSA, Ministry of Transport and Ministry of Environment.