Addendum to the Environmental Impact Assessment Three Islands – B. Thulhaadhoo

Proposed by:

Ministry of Housing and Environment

Prepared by:

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June 2011

Executive Summary

The report is an addendum to the "Environmental Impact Assessment Report, Three Islands – B. Thulhaadhoo" report. The need for an addendum occurred to investigate any environmental impacts that may occur as a result of the proposed harbour expansion at B. Thulhaadhoo. The report documents the finding of the study carried out. The original Environment Impact Assessment undertook extensive surveys and research to determine the impacts carried out within a large study area including the area for the proposed harbour extension. General information on the island is therefore not provided in this addendum and is referred to this document. Furthermore, where substantial information is provided in the initial EIA on site specific data relevant for the harbour expansion, such information is highlighted in this EIA without the need for further field investigations.

The study finds that there are no significant environmental impacts caused due to the proposed harbour expansion. However, the report does highlight some of the additional impacts that may occur and related mitigation measures have been provided for these. The report provides a monitoring plan for the new development while also referring to the initial monitoring plan proposed in the original EIA for continuous investigation of the environment for a sustainable development.

1. Introduction

The government of Maldives signed a contract with Boskalis International to reclaim 17 ha of land and the construction of a harbor at Baa atoll Thulhaadhoo. This project is part of the 4 island reclamation project which also included Lhaviyani Atoll Hinnavaru, Haa Alifu Dhidhoo and Noonu Velidhoo. An Environmental Impact Assessment was carried out for all 4 islands, including the reclamation and harbor reconstruction project at Baa Thulhadhoo. This EIA was submitted to the Environmental Protection Agency

As per the original scope of works, a 750 feet long harbour was proposed for Thulhaadhoo. The original designed was based on pre-cast concrete retaining walls for the quay wall and rock groynes for the sides. However following a number of consultations and assessments, the Government of Maldives took the decision to further extend the harbour to 1200 feet. This additional 450 feet is planned to be extended towards the west of the original 750 feet harbor.

1.1 Audit and Assessment team

This assessment has been undertaken by a team of engineers and consultants led Ms. Miruza Mohamed. The team was chosen by the proponent as the environmental consultants for this project.

1.2 Terms of Reference

The terms of reference have been attached in Annex. This report has been prepared based on these terms of reference, which was drafted in the scoping meeting held at EPA on 6th June 2011.

2. Project Description

The project is undertaken on B. Thulhaadhoo, located in the south western part of the Baa Atoll on an extensive reef complex at the geographical locations of 5° 01' 08" N and 72° 50' 30" E. The main project is proposed by the Ministry of Housing and Environment, with the construction works assigned to MT Højgaard. This addendum is based on the expansion of the harbour towards North.

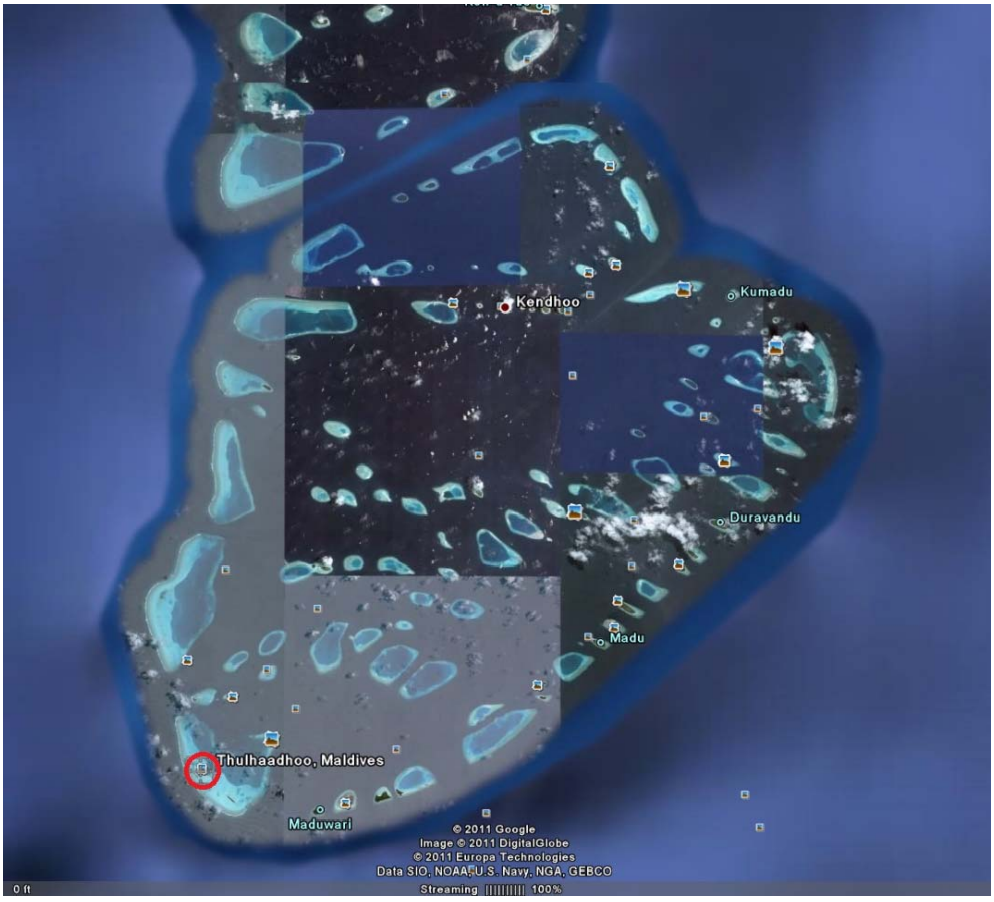
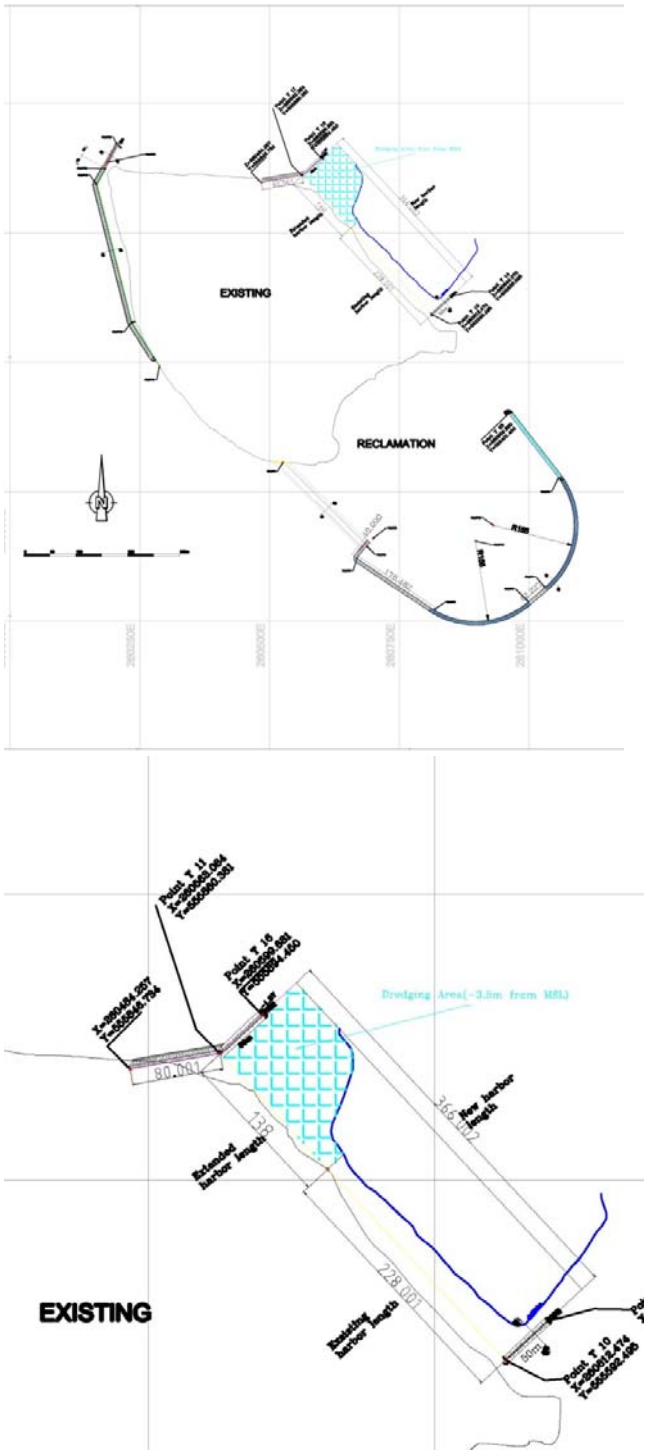


Figure 1 Project location

2.1 Proposed Changes

The major alteration includes dredging a new area for the new harbour basin, including a 138m quay wall, constructed using L section concrete blocks. Additionally an 80m long rock boulder revetment is proposed for shore protection at the adjacent beach to the extended area. Furthermore, a 50m groyne has also been proposed to prevent sand accumulating in the basin, which may lead to the basin becoming too shallow for large vessels to be able to use the harbour.



Harbour Expansion

Figure 2 Proposed Harbour Expansion

2.2 Justification for alteration

The proposed harbour expansion was needed due to the following reasons

- Expansion of fisheries in the island.
- Continuous Increase in population
- Increase in vessels, including large fishing vessels
- To improve the livelihoods of the island community
- To provide easy access to and from the island to nearby islands within the region and also within the island.

The specific location was determined after extensive consultation with the island council. It was the wish of the council for the harbour to be located in the area shown on the Figure. Therefore, this particular location was identified for the expansion for socio-economic reasons.

3. Consultation

A scoping meeting was held between the major stakeholders of the project at EPA on 6th June 2011 to highlight the important issues that need to be covered in the addendum. Participants at the meeting included

- Ibrahim Naeem (Environment Protection Agency)
- Mohamed Hamdhaan (Environment Protection Agency)
- Amir Musthafa (Ministry of Housing and Environment)
- Miruza Mohamed(Environmental Consultant)

Furthermore, consultations were held with the island council on several occasions by the proponent and also continuous communication was held with the island council via emails and letters. Copies of the responses from the island council are attached as an annex. Final location on the habour expansion was also communicated extensively with the island council. The final approved location of the harbour extension by the island council and the proponent is attached as an annex.

4. Methodology

Several methods were employed in assessing the existing environmental conditions and also in identifying the environmental impacts due to the harbour expansion. Since there already exists a substantialEIA report formulated for B. Thulhaadhoo by Hydrodynamic bv, this report has been used as the main source of reference and as a support for the investigations. The original EIA report covers the existing environmental conditions at the site, potential environmental impacts, significance of these impacts, mitigation of the impacts, within a large study area which includes area in which the harbour is proposed to be expanded.

The consultations that were carried out during the scoping meeting and during the field visits were used in identifying the problem areas and for determining potential impacts. Furthermore, purpose-built checklists, existing literature and reports on similar developments, were used for impact identification and identifying relevant mitigation measures.

4.1 Uncertainties in impact prediction

Generally, one can never be definite when predicting the possible impacts on the environment, as significant differences are apparent with minor differences in ecological, geomorphological or social conditions in the given location.

Long-term data and information about the site under consideration are absent, making it rather difficult to predict impacts. However, the case of B. Thulhaadhoo is better compared to other islands as there has been an extensive study undertaken for the island. Furthermore, similar projects have been undertaken in the Maldives and therefore, the level of uncertainty, for the proposed works inB. Thulhaadhoo Island may be expected to be considerably low.

Exact effects of the dredging and reclamation works and other associated activities at the island cannot be predicted in detail.

5. Legal and Policy Requirements

The legal and policy requirements that are relevant to the assessment or audit of desalination plants and their registration areas include; Environmental Protection and Preservation Act, and EIA Regulations among others. The relevant Legal and policy regulations are mentioned in the original EIA.

6. Exiting Environment

Existing environment was determined by the conditions that have existed in the island prior to undertaking the current study and during study. The existing conditions are based on previous environmental assessment studies for the island and from data obtained from similar islands in the Maldives.

General meteorological conditions for B. Thulhaadhoo such as the climate, tides, wind and waves experienced in the island and the terrestrial environment is well covered in the original EIA and thus will not be dwelled upon in this addendum. The areas of significance for this report is the waste management system and the marine environment of the specific located in which the harbour expansion is to take place and associated areas.

6.1 Waste Management

As mentioned in the original EIA, a lot of waste is currently to be found on the beaches and on the reef flat despite the waste being collected in the south side of the island where they are partially buried. A designated waste management system for the island is to be implemented for the island in the near future.

More relevant to this report is the sewage system in the island, more specifically the sewage outfalls. There have been 10 sewerage pipes discharging at the reef flats prior to the reclamation. Among these, 6 pipes are located on the ocean side in the west, one on the south side of the island,

and 3 on the lagoon side facing North East. These 3 pipes are located in the area where the harbour expansion is to take place. These pipes will be relocated as part of the project or extended.

6.2 Beach Environment

The existing beach on the east side is relatively narrow compared to the North, West and South side of the island. The beach is approximately 0-5m wide. There has also been significant erosion on both the west and east side of the island within the last 5 years. Therefore, construction of the harbour extension in the north east side of the island would have minimum impact on the existing beach, and will even prevent further erosion of the beach in the expansion area. Furthermore, adjacent beach in the north east face towards west will be nourished from the material obtained from dredging the harbour basin.

6.3 Marine environment

Surveys conducted by 'Seamarc' estimated that the live corals is less than 1% in the shallow reef area, while there was practically no coral coverage in the reef edges. As mentioned in the initial EIA, this may be due to the coral bleaching in 1998 and due to the tsunami in December 2004.

The EIA reported that live coral coverage varies from less than 5% to 35% at the ocean side and from 6% to more than 70% at the atoll side.

Sea grass composition in the harbour expansion area is relatively few. The greatest composition of live sea grass cover is South East of the island, which has 80-90% cover. The sea grass cover at the North Eastern lagoon is approximately 32%.

Corals are also sparse on the reef flat. Only a few coral colonies can be found in the north eastern part and at the eastern part of the flat. Further to the east, the sea bed is only covered in sand and no vegetation or corals were found.

Further marine surveys were carried out on the reef ocean side, reef atoll side, in 7 different sites in the initial EIA for the island. Among these Site 6, is the more relevant for this addendum. The site is located in the middle of the inner lagoon. The reef represents a platform where corals have settled, but mostly bare at the site. There is a steep break to the sandy bottom of the lagoon and a few patches of corals mostly of branching species such as *Acroporaaspera* are present in the region.

Since the harbour expansion area and associated regions have relatively few marine life, impact from the new development on the marine environment will be kept at a minimum. A summary of the results of the extensive marine survey undertaken for the initial EIA is given in in the original EIA.

7. Impact Identification and Mitigation

This area will focus on additional impacts that may occur due to the harbour expansion works. Since the expansion is of smaller scope to the initial harbour development project, the impacts are fewer but similar to those of the major harbour development.

7.1 Marine Environment

Impact on the marine environment is caused mainly due to the impact on marine water during the construction phase of the project.

The main impact due to the expansion works will result from the additional dredging that is required for the harbour basin. The current shallow lagoon will be dredged to 3m deep as is the standard for Maldivian harbours. Dredging will lead to inevitable damages to existing corals in the area and possibly other marine life. However, as mentioned in section 6.3, marine life in the area is relatively few.

Turbidity levels may exceed in the expansion area, which would result in the reduction in light availability to corals and other marine life. The critical values of turbidity for corals are 50mg/l. Sedimentation would also have detrimental effects on the marine organisms. Critical value for sedimentation on corals is 0.1kg/m2/day. Since the percent of live corals in the project area is very small, this impact is not considered to be significant. Moreover, due to the strong long shore currents in the area, the water quality would be affected only for a short duration and the sediments would therefore undergo rapid dilution.

The impact on the oceanography in the area will be minimum from the harbour extension compared to the previous project of dredging and reclamation of a large land area of the island. Environmental impact from this activity has been discussed in the initial EIA for the island.

One of the most important mitigation measures for the impacts due to dredging is to close off the dredging area from the ocean by placing a bund before dredging activities commence. This would lead to the inevitable run off from the dredging to be concentrated to one location, thereby minimising the impact area. Furthermore, when the dredged material is to be used for back filling activities and for beach nourishment further west of the harbour expansion area, sufficient space should be allowed for the finest particles to settle out of the reclamation run off water before it is released to the ocean. The more fine particles can settle in the reclamation area and/or settling basin, the fewer fine particles will be able to get released into the ocean.

Implementing these mitigation measures will significantly decrease the potential reduction of oxygen levels in the newly dredged area.

7.2 Beach Environment

Dredging of the basin and construction of the quay wall will consequently have a significant impact on the beach environment. Disruption of the littoral drift due to the quay wall may cause erosion in the adjacent beach and the dredged area can act as a sediment sink. However this can be resolved with affective shore protection and beach nourishment techniques. Therefore, revetments are to be constructed in the adjacent beach area to the harbour expansion area to prevent any such erosion issues. Furthermore, the dredged sand from the new basin is to be used for beach nourishment in the area.

7.3 Mobilisation Impacts

The transport of construction equipment and supply of construction materials may have a negative impact on the environment as a result of increased traffic, and accidental pollution. Impacts may be due to;

- Propellers wake breaking fragile corals in the lagoon
- Anchor damage to the reef by the vessels
- Accidental grounding of large vessels
- Accidental spills of construction materials, oils and other chemicals.

Mobilisation impacts for the harbour expansion will be at a minimum as the contractor is already mobilised on the island to undertake the original harbour development project. However, care must be taken throughout the construction phase to prevent any accidental damages to the environment.

7.4 Construction Equipment and Materials

In addition to excess carbon emission from construction equipment and machines, fuel management and handling issues will also arise since these machines depend heavily on diesel. Poor management may lead to contamination of the lagoon and possibly the groundwater aquifer of the island. Improper handling of fuel may also result in accidents such as fires or other disasters. Therefore, a comprehensive fuel management plan has to be put in place to prevent such easily avoidable impacts to the environment. Furthermore, construction materials such as cement have the potential to damage the marine environment. Debris from the construction phase of the project may also lead to pollution of the lagoon and the reef ecology.

7.5 Coastal Structures

Use of cement for in-situ casting of concrete quay wall blocks at the site may create cement siltation around the immediate marine environment. Quay walls would also have a significant long term impact on the environment as it would disrupt the littoral drift in the area. In the short term, there won't be any major impacts caused by the construction of the quay walls.

In addition to the quay wall, harbours and harbour extensions usually consists of a breakwater spanning the length of the harbour. Construction of an offshore breakwater involves movement of excavator and the placement of the structures near the reef flat, leading to coral damage in the area and subsequently affecting the marine fauna in the area. However, the proposed works for this project does not include the construction of a breakwater, thereby reducing any impact it may have on the environment.

Construction of groynes and revetments would not lead to any major negative impacts on the environment. However, they would help in preventing erosion of the beach, and prevention of soil accumulation in the harbour basin. Therefore, this construction is essential for the habour basin.

7.6 Operational Impacts

Operational impacts are continuous impacts that would take place due to the operation of the harbour facility. Environmental impacts may include those that arise from; coastal structures, vessel transportation, and waste disposal. Furthermore, the operation of the harbour would lead to several

socio economic impacts that are usually beneficial rather than detrimental. The environmental impact is expected to be low compared to the long term socio economic benefits brought to the region due to the presence of a large harbour.

The long term impact on the proposed area is difficult to quantify due to the lack of long term site specific and concept specific data availability. The impacts are often difficult to deal with due to the complexity of unknown impacts. Therefore, an effective monitoring program is necessary to observe subtle changes that may be brought to the environment and to identify the cause of these changes. Subsequent mitigation measures would depend on an effective long term monitoring plan. The monitoring program outlined in this report and in the initial EIA would cover these aspects of the project.

7.7 Environmental impacts summary

Environmental and Social Aspects	Magnitude of Impact	Significance of Impact	Duration of Impact	Nature of Impact	Mitigation Measures
Marine Environment	Moderate	Moderate	Short to long term	Cumulative	Placing temporary bund. Continuous monitoring
Beach Environment	Moderate	Moderate	Long term	Cumulative	Continuous surveying of the shoreline. Putting in place temporary protection for the beach during construction phase
Mobilisation	Minor	Moderate	Short term	Reversible	Thorough training of workforce to be disciplined to avoid accidents as much as possible
Construction Materials	Moderate	Moderate	Short to Long term	Reversible	Proper storing and handling of construction materials.
Coastal Structures	Minor	Low	Short term to Long term	Cumulative	Care to be taken when placing coastal structures

Table 1 Environmental Impacts from the construction phase

Note: the magnitude of impacts progresses from better to worse in the following order; Positive, Negligible, Minor, Moderate, Major.

Environmental and Social Aspects	Magnitude of Impact	Significance of Impact	Duration of Impact	Nature of Impact	Mitigation
Coastal Structures	Moderate	Moderate	long term	Cumulative	Continuous monitoring to observe the cause and effects
Vessel Transportation	Moderate	Moderate	Short to Long term	Cumulative	Putting the responsibility of any deterioration of the environment by the vessels on the vessel owners.
Waste disposal	Minor	Moderate	Short term	Reversible	Daily clean up of the harbour.
Beach environment	Moderate	Moderate	Short to Long term	Cumulative	Hard engineering coastal structures to be used

Table 2 Environmental Impacts from the operation phase

Note: the magnitude of impacts progresses from better to worse in the following order; Positive, Negligible, Minor, Moderate, Major.

Environmental Management and Monitoring

This section deals with the Environmental Management and Monitoring plan for B. Thulhaadhoo. The data collected for this assessment and previous assessments will be used as baseline data while undertaking the monitoring plan. The monitoring plan outlined in the original EIA is very comprehensive and there are few additions that are needed due to the harbour expansion. The monitoring plan outlined here will only be targeted towards the changes brought to the original concept, i.e. the harbour expansion. Monitoring should be undertaken quarterly, while summary monitoring reports should be submitted to the EPA annually. Marine water quality monitoring and monitoring of sand accumulation in the harbour basin and shoreline erosion of adjacent areas should take place on a more frequent basis.

The monitoring program outlined in this report should be regarded as complementary to the program already mentioned in the previous EIA study for the island. This is essential in making the monitoring program feasible and cost effective.

The proponent is fully committed to carry out the monitoring program outlined in this report.

Monitoring Methodology and Costs

The methodology used for monitoring will be similar if not the same as those used in the monitoring plan outlined in the original EIA. In addition to the standard methods of monitoring parameters such as water quality, marine environment, and beach environment, it is recommended that public surveys to be carried to identify if the community valuations and perceptions of the harbour and the impacts it may have had on the islands ecology. The following costs are calculated for monitoring to

be undertaken at different stages for different parameters. While ideally monitoring could be done as frequently as possible, emphasis was given to make the monitoring program feasible and practical when determining the frequency of investigating specific parameters.

Table 3 Summary of information required for environmental monitoring

Parameter	Indicator	Location	Frequency	Estimated Cost*
Marine water quality	DO, COD, BOD, pH, TDS, EC/Salinity, Turbidity	Harbour basin and boundary	Every 3 months during first year. Once every 6 months afterwards.	$250 per quarter
Marine Environment	Coral cover (type and quantity of corals), sea grass cover,	Harbour basin and boundary	Every 3 months during first year. Once every 6 months afterwards.	$250 per quarter
Beach Environment	Shoreline changes	Entire island, with a special focus on the adjacent areas of the harbour.	Every 3 months during first year. Once every 6 months afterwards.	$500 per survey
Social Status/ Public views	Survey reports	Entire Island	Yearly	$300 per survey

**Note: the costs are approximations made at the time of making this report and are subject to change.*

Monitoring Report

Monitoring report should be compiled based on the baseline data collected. This report should be submitted to the EPA or any other relevant government agencies for compliance, if requested. The report will include details of the site, data collection and analysis, quality control measures, sampling frequency and monitoring analysis and details of methodologies and protocols followed.

References

Hydrodynamic bv., 2009, Environmental Impact Assessment: Three Islands – B. Thulhaadhoo.

Environmental Impact Assessment Regulations, Minsitry of Environment, Energy and Water, Government of the Maldives, 2007

National Environmental Action Plan III, Ministry of Housing, Transport and Environment, 2008

National Strategy for Sustainable Development, Ministry of Housing Tranport and Environment, Government of the Maldives, UNEP, 2009

Thulhaadhoo Benthic Survey, Seamarc, 2009

Declaration of the consultants

This Addendum to the Environment Impact Assessment has been prepared according to the EIA Regulations 2007, issued by the Ministry of Environment, Energy and Water. The EIA was carried out by a multidisciplinary consulting team.

I certify that the statements in this Environmental Impact Assessment study are true, complete and correct, to the best of my knowledge and ability.

Name: Miruza Mohamed

Signature:

ANNEX