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No. BDP/UNESCO/WHC/13

The Permanent Delegation of Bangladesh to the United Nations Educational, Scientific and Cultural Organization (UNESCO) presents its compliment to the World Heritage Centre of UNESCO and with reference to Decision 39 COM 7.B 8 of the World Heritage Committee concerning the Sundarbans World Heritage Property, Bangladesh, has the honour to attach herewith the following:

1) Updated report of the Government of Bangladesh on the implementation of the Decision 39 COM 7.B 8 with regard to the Sundarbans World Heritage Property, Bangladesh. This 49-page report is attached as PDF file, which can also be accessed at : https://drive.google.com/open?id=0B_IhitSLHv8jY1FjZVctNlp6bXM

2) Updated response/progress report of the Government of Bangladesh on the joint WHC-IUCN reactive monitoring mission's report on the Sundarbans World Heritage Property, which may be treated as annexure to the 49-page main report. This can be accessed at: https://drive.google.com/open?id=0B_IhitSLHv8jRDBMeUZGd0tUSEE

The Permanent Delegation of Bangladesh avails itself of this opportunity to the United Nations Educational, Scientific and Cultural Organization (UNESCO) the assurances of its highest consideration.

EMBASSY OF BANGLADESH PARIS

Paris
28 November 2016

United Nations Educational, Scientific and Cultural Organization (UNESCO)
7, Place de Fontanoy
Paris, France
(Kind attention: Director, World Heritage Centre)

World Heritage Center

United Nations for Educational, Scientific and Cultural Organization

Updated Report of the Government of Bangladesh

on

Decision 39 COM 7B.8 by the World Heritage Committee

27 November 2016

By

Ministry of Environment and Forest
Government of Bangladesh

Table of Contents

Acronyms and Abbreviations

1. 3R's-Reduce, Reuse & Recycle
2. BAGH-Bengal Tiger Activity Project funded by USAID
3. BECA-Bangladesh Environment Conservation Act
4. BFD-Bangladesh Forest Department
5. BHEL-Bharat Heavy Electricals Limited
6. BIFPCL-Bangladesh India Friendship Power Company Limited
7. BIWTA-Bangladesh Inland Water Transport Authority
8. BMZ-Federal Ministry for Economic Cooperation and Development
9. BPDB-Bangladesh Power Development Board
10. BWDB-Bangladesh Water Development Board
11. CETP-Central Effluent Treatment Plant
12. CMC-Co-Management Committee
13. COC-Cycle of Concentration
14. DOE-Department of Environment
15. DOS-Department of Shipping
16. ECA-Ecologically Critical Area
17. ECR-Environment Conservation Act
18. EIA-Environmental Impact Assessment
19. EPC-Engineering Procurement & Construction
20. ESP-Electro Static Precipitator
21. ETP- Effluent Treatment Plant
22. EU-European Union
23. FGD-Flue Gas Desulphurisation
24. FTRT-Forest Tiger Response Team
25. FS-Feasibility Study
26. GOB-Government of Bangladesh
27. GPS-Global Positioning System
28. GWT-Ganges Water Treaty
29. HCSD-High Concentration Slurry Disposal
30. ICS-Improved Cooking Stoves
31. IEE-Initial Environmental Examination
32. IUCN-International Union for Conservation of Nature
33. IFC-International Finance Corporation
34. LOA-Length Over All
35. IRMP-Integrated Resource Management Plan
36. IWRM-Integrated Water Resources Management
37. MOEF-Ministry of Environment and Forests
38. MOS-Ministry of Shipping
39. MPA-Mongla Port Authority
40. MOPEMR-Ministry of Power, Energy and Mineral Resources
41. MOWR-Ministry of Water Resources
42. NOSCOP-National Oil Spill Contingency Plan

43. NOx-Oxides of Nitrogen
44. NTPC-National Thermal Power Corporation
45. OUV-Outstanding Universal Value
46. OP-Operational Policies
47. PA-Protected Area
48. PD-Power Division
49. PLF-Plant Load Factor
50. PPT-Parts per Thousands
51. RWH-Rain Water Harvesting
52. RBC-River Basin Commission
53. RBO-River Basin Organization
54. RMM-Reactive Monitoring Mission
55. SEA-Strategic Environmental Assessment
56. SIZ-Sundarbans Impact Zone
57. SOx-Oxides of Sulphur
58. SRF-Sundarbans Reserved Forests
59. SRCWP-Strengthening Regional Cooperation for Wildlife Protection Project
60. TOR-Terms of Reference
61. TCC-Tiger Co-ordination Committee
62. UNDP-United Nations Development Programme
63. USAID-United States Agency for International Development
64. SEPA-United States Environmental Protection Agency
65. SW-South West
66. USC-Ultra Super Critical
67. VCF-Village Conservation Forum
68. VTRT-Village Tiger Response Team
69. WB-World Bank
70. WCS-Wildlife Conservation Society
71. WHC-World Heritage Committee
72. WHS-World Heritage Site

1. Executive Summary

The report addresses the necessary steps taken by the Government of Bangladesh in response to the Decision 39 COM 7B.8 by the World Heritage Committee (Bonn 2015) to manage and maintain the OUV of the property. The property was declared Sundarbans Reserved Forest in 1875 under the Forest Act and the forest was managed since 1892 under different prescribed management plan. The Integrated Resource Management Plan (IRMP 2010-2020) which includes programme like habitats protection, wildlife sanctuary management (The Property), sustainable forest management, collaborative resource management, food security and wetland management, community based climate change mitigation and adaptation, controlled ecotourism facilities development, conservation outreach, national and international research program, participatory monitoring and capacity development of front line Forest Department's staffs is being implemented.

In response to the UNESCO World Heritage Committee, Bangladesh Forest Department submit periodic online report on the Sundarbans World Heritage Site in every six (6) years, the last online periodic report submitted in the year 2012. Acknowledging the online report from Bangladesh Forest Department, the second cycle of periodic report (2010-12) published in "**World Heritage Papers 35'',** which include the various ecological aspects of the property like conservation, monitoring, social and cultural use of heritage, climate change and severe weather events, invasive and alien species, management and institutional factors of the property. However, in response to the decision of 39 COM 7B.8 the Forest Department is providing the detail ecological monitoring report showing the changes of the property in respect to area, succession, status of regeneration and stands, top dying, utilization of non-timber forest product, floral and faunal information over the time, including the result of monitoring conducted under SEALS project.

New scientific research and studies are being conducted to understand the biodiversity, ecological changes and biotic and abiotic factors which are essential for the future management of the property. The scientific monitoring information indicates that the ecosystem and health of the property are in a good condition.

Different environmental and anthropogenic aspects such as salinity trend, oil spill impacts and response, tourism, carbon pool status are also discussed in this report. National and international initiatives for the protection of the property have been taken effectively in a collaborative way under different Memorandum of Understanding (MOU) and Protocol. A Strategic Environmental Assessment study will also be carried out.

An integrated management involving all relevant agencies like Bangladesh Forest Department (BFD), Department of Environment (DoE), Department of Shipping (DoS), Bangladesh Inland Water Transport Authority (BIWTA), Mongla Port Authority (MPA), District and Sub-District Administration, Law Enforcing agencies, Local Government Bodies, Civil Societies and all other stakeholders for the future conservation and maintenance of the OUV of the property to secure maximum resilience against climate change adverse effects as well as effective protection of the Sundarbans Reserved forests to maintain the property's ecosystem integrity.

Mongla Port started functioning in 1950 as an anchorage in the Pashur River. It has been gradually developed into its present state according to a series of studies. The Pashur is a tidal river and its siltation rate is high. As such, to ensure navigability, occasional dredging is essential. This occasional dredging does not only help to maintain navigability of the Pashur channel; rather it ensures sufficient volume of water to maintain eco-system including bio-diversity in and around the Sundarbans. Without dredging the river would have been silted up with high detriment to the mangrove ecosystems.

Selection of a suitable site for imported coal based power plant is a big challenge for a country like Bangladesh which is highly populous and constrained by geophysical characteristics. Rampal Power Plant site selection considered the following important issues:

i) The site is less fertile with minimum agricultural use;

ii) Least relocation of minimum number of households

iii) The site inhabits minimum people with only 121 persons per sq km where national population density is more than 1000 per sq km. The site needs rehabilitation of only 150 homesteads, which is the least in all other alternate sites.

iv) The site is most suitable with respect to navigation for imported coal transportation.

The Project is safe and environmentally benign because:

i) Rampal project has been designed and developed with modern Ultra Super Critical Technology and latest environment friendly measures. Adoption of such advanced technology and logistics/process, including but not limited to the emission control measures like Electro Static Precipitator (ESP), Flue Gas Desulphurization (FGD), advanced low NOx burner, 275meter tall chimney for wider dispersion and effective dilution, completely covered coal handling & stacking system, dry Fly ash & Bottom ash collection system (for 100% sale to local cement factories existing in the vicinity), use of tailor made, covered, modern environment friendly vessel for transportation etc. will make it one of the most environmentally benign Power Projects.

ii) Rampal Power Plant site satisfies the distance as one of the conditions given in the Sundarbans Ecologically Critical Area (ECA). Rampal site is 14 km away from northeast of the Sundarbans and 65 km the World Heritage Site (WHS). Further, wind flow directions act as a natural shield for the Sundarbans as the predominant wind flows from south and southwest to north and north-east during March to April, and from south and southeast to north and north-west during May to October. During November to February wind flows from north and northwest to south and southeast. Hence, the emissions from the project would not reach to the Sundarbans which has already been established by modelling. The modelling result shows that the incremental level of pollutants (like SOx, NOx, PM10, PM2.5) at the Property is negligibly small and the cumulative level of these pollutants, considering the current base level and future additional pollution load from power plant, and likely increased movement of vessels in the Pashur river will remain very much within the limits specified by World Bank standards, the most stringent standards.

iii) Rampal Project will withdraw miniscule quantum of water from the nearby the Pashur River (a large tidal river) which is only a negligible fraction of its flow (less than 0.05% of the lowest flow during the lean period) for make-up purposes, in the

modern cooling tower of the plant. Water quality of the Pashur is generally saline and not sweet. After using for cooling, a fraction of the make-up water shall be discharged to the Pashur River with proper treatment and at a near ambient temperature. There is no possibility of increasing salinity of the Pashur River or create any thermal pollution by the power plant.

iv) This project will use high quality imported coal from Indonesia/Australia/South Africa, with very low Sulphur (average 0.6 %) and ash content (average 10 %). On an average one purpose-built (as per IMO convention), environment friendly low speed fully covered lighterage vessel for carrying coal per day will come to Project site which is only 2.8% of the existing number of vessels that ply daily in the long established maritime route of Mongla Port.

v) Further, in the draft RMM report (August 2016), mission already endorsed that use of the latest Ultra-supercritical technology would have made the project safe for the Sundarbans and should have been used by the Rampal Project, as acceptable to UNESCO for similar sites. In our official letter, we had provided the technology details of the Rampal Project and established with facts and evidence that project is of the modern Ultra Supercritical Technology, as suggested by RMM in its report of August 2016, with state-of-the-art environment protection/emission control abatement measures.

vi) In consonance with GOB's commitment to the protection of the Sundarbans, it is proposed to put in place an independent monitoring mechanism through a team of experienced and reputed professionals to have a stricter oversight on the proposed Rampal Coal-based Power Project from its very construction phase through its entire operational period.

Parts of the Sundarbans Reserve Forest (SRF) was declared as the World Heritage Site (WHS, the Property) in 1997 during the tenure of our present Honourable Prime Minister Sheikh Hasina. Due to her strong commitment and commendable works for conservation of environment and ecosystems, she was recognized as one of the Champions of the Earth by UNEP. As per her instruction, Rampal Power Plant is being implemented with highest environmental mitigation measures. The Prime Minister gave a detailed statement in the National Parliament addressing all the relevant concerns and assuring the nation that all necessary measures are being taken to mitigate against any harms to the Sundarbans. There are many coalfired power plants around the world which pose no threats to environment since these were constructed and operated maintaining all the environmental mitigation measures and using state-of-the-art technology. There are a number of coal power plants which are located in sensitive sites like WHS which had no reservations from the environment watchdogs.

The incident of the oil spill in December 2014 was just an accident. The relevant ministries, departments and agencies of the Government of Bangladesh have taken quick and immediate actions to response to the accident. The damage of oil spill accident of December Acquisition of two ships equipped with spill oil collection systems has strengthened oil spill preparedness and response capacity. The adoption and implementation of Bangladesh

National Oil Spill Contingency Plan (NOSCOP) will holistically ensure quick and effective preparedness and response of any oil spill incidents in future. After the oil spill accident of 2014, Department of Environment, Bangladesh regularly monitors all parameters of water quality at the Pashur and Shela Rivers within the Sundarbans areas. Recent study found that all parameters are within the limits Environmental Quality Standards of the Environment Conservation Rules 1997.

Based on the Decision 39 COM 7B.8 by the World Heritage Committee (Bonn 2015),a joint WHC-IUCN Reactive Monitoring Mission (RMM) visited Bangladesh (to the property) to review the state of conservation of the property, and the potential impacts of the thermal power plant development and dredging of the Pashur River in March 2016. The World Heritage Centre (WHC) sent to Bangladesh an RMM report in August 2016 with a request to notify the WHC of any factual errors in the RMM report. Bangladesh, the State Party, thoroughly reviewed and examined the RMM report, and identified many factual errors in the report and transmitted a 63-page response with 36 annexes to the WHC on 10 October 2016 with a request to revise the RMM report by incorporating the factual errors identified by Bangladesh before uploading the RMM report in the website of WHC. The state party was disappointed to notice that WHC published the RMM report in the WHC website on 12 October 2016 without taking care of and incorporating the factual errors identified by Bangladesh. Subsequently, a six-member delegation of high officials of the Government of Bangladesh with Bangladesh Ambassador in France discussed the Bangladesh response report with WHC and IUCN officials at UNESCO HQs in Paris in the last week of October 2016, and agreed to upload Bangladesh's response with a news item in the WHC website. During the meeting with WHC-IUCN officials at UNESCO HQ on 28 October 2016, Bangladesh delegation handed over a letter to the Director of WHC in response to the final report of the RMM published in the UNESCO-WHC's website on 12 October 2016. We appreciate that the WHC has since uploaded the response report of Bangladesh on RMM in the WHC's official website.

This report contains in detail the response of Bangladesh on the Decision 39 COM 7B.8 by the World Heritage Committee (Bonn 2015) including the RMM report providing sufficient information and data with regard to the efforts taken by the state party for conservation and management of OUV of the property.

2. Decision Item No 3 of 39 COM 7B.8 adopted by the WHC (Bonn, 2015)

Notes that the Environmental Impact Assessment (EIA) for the dredging of the Pashur River, adjacent to the property, did not include a specific assessment of the potential impacts on the property's Outstanding Universal Value (OUV), and requests the State Party to submit to the World Heritage Centre an assessment of potential impacts on OUV, in accordance with IUCN's World Heritage Advice Note on Environmental Assessment, and to ensure activities are not conducted before the revised EIA is submitted to the World Heritage Centre and reviewed by IUCN.

Response of the State Party (Bangladesh) on Decision Item No 3:

I. Mongla Port started its function in 1950 as an anchorage. It has been gradually developed into its present state according to a series of study by National and International consultants. All the development works are basically going on according to those reports.

II. The present economic growth of Bangladesh is 7.05% (2015-16). Government of Bangladesh has taken a vision to reach into a middle-income country within 2021 and turned into a developed country within 2041. To achieve these two goals, Government of Bangladesh has taken different initiatives such as construction of Padma Bridge, establishment of Khulna-Mongla railway link, construction of Khan Jahan Ali airport, Special Economic zone etc. These works are expected to be completed by 2018-21. After completion of these works, demand/use of Mongla port will increase significantly and this will be essential to support our sea-borne trade. A Third large sea port named Payra sea port has been under construction. The Payra sea port will rationalise the marine traffic in future. Thereby would reduce the marine traffic burden on the Mongla Port.

III. To face the additional demand, all the planned development works including maintaining adequate depth in the Pashur River is essential. The Pashur is a tidal river and tide brings silt and clay regularly. In addition to this high rate of siltation, erosion along the banks of the Pashur is also very common. As such, to ensure desired volume and flow of water in this river, occasional dredging is done which helps to maintain navigability of the Pashur channel and helps eco-system and bio-diversity in and around the Sundarbans. It may be mentioned that eco-system and bio-diversity of the Sundarbans may be in danger along with the navigability due to insufficient volume and flow of water if dredging is not done in the Pashur River. Without dredging the river would have been silted up threatening the very existence of the mangrove ecosystems. It may be mentioned that occasional dredging is the only means to maintain navigability of the channel.

IV. Mongla Port always carries out Feasibility study and Environmental Impact Assessment (EIA) before implementation of any development projects. According to the recommendation of the consultants, projects are being implemented ensuring safety of the Sundarbans.

V. Presently, GoB has planned to dredge the Pashur river from Mongla port to Rampal project site which is around 4 km river distance from the SRF and around 80 Km river

distance from the WHS. Before operation of the dredging activities a comprehensive EIA has been conducted on the dredging activities from Mongla port to Rampal power plant (13km) in the Pashur river. The summary and conclusions that may be drawn for the Environmental Impact Assessment are the following:

a. The Dredging Area

i. The actions that require the greatest attention to avoid negative effects on the environment are the development of activities performed with the dredge and barges, as well as the operation and maintenance thereof.

ii. The presence of the dredge and the activities thereof will not cause a negative effect to the water quality, air, or flora and fauna of the area, if the adequate recommended measures are adopted. The most important beneficial effect is to promote the development of socioeconomic activities in the area.

iii. The analysis of the physical and chemical characteristics of river water performed in the study area show acceptable values; include low levels of, which satisfy the values established for the criteria of schedule 3 of water quality guideline of ECR 1997.

iv. The results of the metal analyses of bottom sediments in the dredging area, show normal concentrations and, therefore, will not be a limiting factor in the handling and activities performed in the terminal, as well as in the removal resulting from the dredging.

b. Dredged Material Deposit Area

i. The area where dredged materials will be discharged from the barges is located northeast of the dredging area. The turbidity concentration will dissipate quickly as it precipitates to the bottom. The volume of sediments discharge will be insignificant in relation to the contribution from the Pashur Rivers.

ii. In the dredged material deposit area, the result of benthos analysis show less biodiversity than in other analyzed areas.

c. The environmental management plan during the dredging activities:

i. Periodic monitoring of the aquatic flora, fauna, air quality, noise measurement, turbidity in 3 levels and in 3 sampling locations, during the operations in the project area. Monitoring will be carried out during dredging, in order to determine the existence of changes in the aquatic environment.

ii. The dredge must be inspected periodically to evaluate the operation of its equipment and constantly supervised that no change or unevenness occurs in the structure.

iii. It is concluded to that the proposed dredging of the Pashur river can be implemented safely in an environmental friendly manner. Therefore, it is recommended that the proposed dredging project can be cleared to proceed with dredging activities.

VI. **Future Plan:** Dredging in the Pashur River will be carried out on the basis of EIA with a special consideration of impacts on the property's Outstanding Universal Value (OUV) to avoid any negative impact on the Sundarbans.

3. Decision Item No 4 of 39 COM 7B.8 adopted by the WHC (Bonn, 2015)

Reiterates its request to the State Party to undertake a comprehensive Strategic Environmental Assessment (SEA) in order to assess the indirect and cumulative impacts from the power plants and other developments in the vicinity of the property, including a specific assessment of potential impacts on its OUV.

Response of the State Party on Decision Item No 4:

Government of Bangladesh (GoB) has decided to carry out a Strategic Environmental Assessment (SEA) for the south west region (including the Sundarbans region) of Bangladesh. In this connection, Department of Forest has already taken an initiative to assess the indirect and cumulative impacts from the Rampal power plant and other developments (which include existing and proposed policy, plans and programs) in the vicinity of the property and the region to specifically assess the potential impact on the OUV of the Sundarbans, World Heritage Sites. The SEA will be conducted following international and national approach and methodologies.

This study will be conducted under the leadership of Department of Forest in association with relevant Government Ministries such as Ministry of Environment and Forests, Ministry of Industries, Ministry of Power, Energy and Mineral Resources, Ministry of Agriculture, Ministry of Fisheries and Livestock, Ministry of Water Resources, Ministry of Shipping, Local Government Division, Ministry of Civil aviation and Tourism, and associated Government Departments are Department of Environment, Bangladesh Inland Water Transport Authority, Mongla Port Authority, Department of Fisheries, District and Sub-District Administration, Local Government Bodies, Civil Societies and other relevant departments/agencies.

4. Decision Item No 5 of 39 COM 7B.8 adopted by the WHC (Bonn, 2015)

Also requests the State Party to provide further details on the mitigation measures taken for the power plant project, which should fully consider the findings of the SEA.

Response of the State Party on Decision Item No 5:

Rampal power project was undertaken as a flagship project between Bangladesh and India during the historic visit of the Honorable Prime Minister of Bangladesh Sheikh Hasina to India in January 2010. Rampal site for the Rampal project (2x660 MW Maitree Super Thermal Power Project) was selected through a pre-feasibility study of three probable sites in the south-western part of the country. One of the significant criteria for the selection of the site was navigation facilities during the feasibility study. Due to geographic location, Bangladesh has very limited navigation facilities in the country round the year. For a 1320MW coal based power plant, it needs substantial draft which is only available in Rampal at the south-western region of Bangladesh. Bangladesh had limited choice for selection of location due to availability of draft in the river system for navigation and ease of coal transportation. Besides navigation facility, landuse pattern, resettlement etc. were considered for selection of the site. Bangladesh gives high priority to its food security. The site has been selected considering the less fertile and minimum agricultural land. Bangladesh is a highly densely populated country in the world (more than 1000 people live in a sq.km). Consideration has been given on least relocation and rehabilitation of minimum number of households in the project area. The density of people in Rampal was only 121 persons per sq-km, much less than the other potential sites. It requires least evacuation among all other alternate sites.

Rampal project (2x660 MW Maitree Super Thermal Power Project) will be constructed, owned and operated by **BIFPCL**, a company incorporated and registered in Bangladesh. It is promoted by Bangladesh Power Development Board (BPDB) and NTPC Limited of India with equal (50:50) equity participation. As per the Environment Conservation Rules, 1997 of Bangladesh**,** after getting Site Clearance, the proponent can develop their land and infrastructure of a project. So, land owning is not barred before getting EIA approval from DoE (this would, among others, establish the seriousness of the project sponsors and not whittle away regulatory resources). EIA approval is needed for starting construction activities of a project which has been followed in the project accordingly. The site development activities (land filling, temporary office buildings etc.) started only after obtaining all requisite clearances as per the laws of Bangladesh.

BIFPCL has appointed an internationally reputed engineering consultant (M/S FICHTNER of Germany) as Owner's Engineer (OE) for engineering, project management and quality control. Engineering Procurement &Construction (EPC) Contractor for construction of Rampal Power Project (2x660 MW Maitree Super Thermal Power Project) was selected through a transparent method of open international competitive bidding process. Bids were received from reputed organisations from countries like, Japan, India, and China for the EPC contract. BHEL was adjudged technically qualified lowest bidder and hence the EPC contract has been awarded to BHEL. THE TECHNO-COMMERCIAL BID WAS EVALUATED BY BIFPCL AND OWNERS ENGINEER, **M/S FICHTNER GmbH A GERMAN ENGINEERING FIRM**.

i) Measures against air and water pollution:

Rampal project has been designed and developed with modern Ultra Supercritical Technology and latest environment friendly technologies. Adoption of such advanced technology and logistics/process, including but not limited to the emission control measures like Electro Static Precipitator (ESP), Flue Gas Desulphurization (FGD), advanced low NOx burner, 275meterhigh chimney for wider dispersion for effective dilution, completely covered coal handling & stacking system, dry Fly & Bottom Ash collection system (for 100% sale to cement factories existing in the vicinity), will make it one of the most environmentally benign Power Project.

Further, a sophisticated model (CALPUFF) which is an advanced, integrated Lagrangian puff modelling system for simulation of atmospheric pollution dispersion and adopted by the United States Environmental Protection Agency (EPA) has recently been used to determine the level of pollution at the WHS (Property). The result shows that the incremental level of pollutants (like SO_x, NO_x, PM_{10}, $PM_{2.5}$) at the Property is negligibly low and the cumulative level of these pollutants, considering the current base level and future additional pollution load from power plant, likely industries as well as the increased movement of vessels in the Pashur river will remain very much within the limits specified by World Bank standards. Rampal project is being designed and developed with Modern Ultra Supercritical Technology and with high standard of care for the Sundarbans/nearby areas. Environment management norms as per WB/IFC guidelines are being followed to ensure the same. Some of the measures planned to minimize air and water pollutions around its surroundings areas including the Sundarbans are mentioned below:

Measures against air pollution:

- Electro Static Precipitator (ESP) of efficiency above 99% shall be used to collect the fly ash and control the emission of Particulate Matter (PM) within the limit of **50 mg/Nm³** as per WB/IFC guidelines
- Advanced Low-NOx burner shall be used to control emission of NOx within the limit of **510 mg/Nm³** as per WB/IFC guidelines
- Highly efficient Wet lime based Flue Gas Desulphurisation System (FGD) of efficiency above 90% shall be used to control the emission of SO2 within the limit of **200 mg/Nm³ as per** WB/IFC guidelines
- High quality coal will be used as fuel. The content of Sulphur in the coal will be around 0.6% on an average.

Combination of above three will be the best technology to arrest the heavy metals like mercury (Hg) etc. Use of Electrostatic Precipitator (ESP), Advanced Low NOx burner and Wet Lime based Flue Gas Desulphurization (FGD) will reduce the pollutant emission from the stacks complying the ECR, 1997 standard as well as the IFC 2008.

Moreover, the height of the stack will reduce the ground level concentration of the pollution, effect of inversion layer, shoreline fumigation. Additionally, during the EIA study of coal transportation a sophisticated USEPA regulatory model CALPUFF has been used to estimate the ambient air quality during operation stage of the power plant. The maximum Ground Level Concentration (GLC) of the criteria pollutants in the SRF area including WHS was predicted by the updated Model (CALPUFF) study. The results of the model study shows that the GLC is much lower than the Bangladesh Standard (ECR 1997, amended 2005) and

IFC 2008 standard during operation of the Rampal Power Plant. **Annexure-1** shows the level of criteria pollutants concentration at the nearest tip of Sundarbans (i.e. the closest point from the Power Plant) during the baseline as well as the project case. During operation period of the power plant, annually NO_x will increase from 2.2µg/Nm^3 to 2.3 µg/Nm^3 which is far below the WB/IFC standard of 40 µg/Nm^3 and SOx from 2.1 µg/Nm^3 to 2.2 µg/Nm^3 which is far below the ECR standard of 80 µg/Nm^3 at that nearest tip of Sundarbans. The following table shows the comparative level of pollutions as observed by the CALPUFF model. The result shows that the level of pollutants at the Property is very much within the limits specified by World Bank standards.

EIA study report for coal transportation using CALPUFF Model: USEPA Approved regulatory sophisticated air dispersion modelling software Annual Average for the Criteria Pollutants				
Criteria Pollutants	**Annual avg. baseline Air Quality at the nearest tip of the Sundarbans**	**Annual avg. of Air Quality after Post Project the nearest tip of the Sundarbans**	**ECR, 2005 of Bangladesh Standard**	**WB/IFC Standard, 2008**
			Annual	**Annual**
NOx (µg/nm3)	2.2	2.3	100	40
SOx (µg/nm3)	2.1	2.2	80	-
PM2.5 (µg/nm3)	3.1	3.3	15	10
PM10 (µg/nm3)	6.5	6.8	50	20

Inside the Sundarbans Reserve Forest (SRF) the level of pollution concentration is also predicted lower than the tipping point of Sundarbans.

Therefore, the possibility of chemical transformation and forming of lower pH in the upper atmosphere is less as dry or wet scavenging would be taking place with the increasing distance from the stack point.

Further, the yearly average wind flow shows that wind flowing from south to north direction in most of the time in a year **(Annexure-2).** During November to February, wind flows from north and north-west to south and south-east direction and for rest of the period of approx. 8 months it flows from South to North direction. Therefore wind flow directions act as a natural shield for the Sundarbans.

Measures against contamination of water:

The Pashur is a tidal river from which the saline water will be withdrawal during operation of this power plant. Only 2.5 cum/sec water will be withdrawn as makeup water out of available 6000 cum/sec flow in the Pashur river in the leanest season, which is less than 0.05% of the Pashur river water flow.

The practice of recycle and reuse of water has been adopted in this project. Close cycle cooling system (with Cooling Towers) has been planned to reduce water drawl and consumption. No heated water will be released in the open water and thus, it will not hamper the surrounding aquatic life.

Besides, the power plant will adopt central Effluent Treatment Plant (refer B6 of EPC Technical Specification attached as **Annexure-3**) which will be a combination of oil water separator, physical, biological and chemical technique to treat the effluent. Maximum treated water would be reused in the plant area.

All the waste water inside the plant area (blow down water from boiler and cooling water recirculation system; waste water from coal stack area etc.) shall be treated in Central Effluent Treatment Plant (CETP). Sewerage Treatment Plant (STP) will also treat the domestic waste generated from the townships and administrative areas. Most of the treated water will be reused for gardening and other purposes inside the power plant premises. Remaining treated water will be discharged at ambient temperature from the CETP complying with all standards of environmental laws prescribed by Government of Bangladesh ECR, 1997 and IFC 2008 standard. Hence, no hot and untreated water will be discharged into the Pashur river.

Furthermore, coal will be transported through covered barges up to the power plant jetty. The lighterage vessel will be modern vessel(miniship) tailor made as per applicable standard (classifying norms) and environment friendly with zero effluent discharge low SOx emission, Low noise pollution and GPS vessel) **(Annexure-4)**. Transhipment will be done through most modern environmental friendly floating transfer station. At the jetty the coal will be unloaded through covered conveyer and coal will be stored in a fully covered stack yard to arrest all the fugitive dust emission. Hence there will be no possibility of water pollution due to coal transportation and handling process.

Measures against high wind zone:
All buildings and tall structures in the plant area shall be designed considering wind speed of 265 km per hour.

Therefore there is no “high likelihood” of air and water pollution.

ii) Movement of lighterage vessel for coal transportation:

On an average one lighterage vessel per day will come to Rampal Project which is only 2.8% of the existing number of vessels**(refer Chapter 7 page 58 of EIA study report of coal transportation enclosed at Annexure-5)** that ply in the maritime route of Mongla Port Authority daily which has been used by MPA for decades. Modern environment friendly vessel (“mini-ship”), tailor made as per applicable classifying norms and environmental friendly, shall be with zero effluent discharge, low SOx emission, low noise pollution and GPS vessel shall be used. Hence the chances of accidents will hardly be there.

To prevent dispersion of coal dust that may pollute air and water, the entire coal transportation will be done through fully closed vessels and unloading will be done through covered conveyer, and coal will be kept in covered stack yard. In addition to that complete coal handling plant and loading/unloading equipment will be designed with efficient dust suppression and dust extraction system to reduce the generation of fugitive dust.

Maintenance dredging is a normal activity for most of the international sea ports. Quantum and frequency of maintenance dredging are not directly related with number of

ships. They depend on the rate of siltation on river bed. Since 1979 Mongla Port is performing maintenance dredging to keep the port operational. After establishment of Power plant, maintenance dredging may be required at the upstream of Port which is far from the property.

iii) Water withdrawal for the plant:

The Pashur river is a tidal river and hence its water is saline in nature. However, BIFPCL has optimised the water withdrawal/usage in the Rampal Project. Only 2.5 cum/sec water will be withdrawn as makeup water out of available 6000 cum/sec in the leanest season. Most of the time of the year i.e. 10 months, flow in the Pashur river is higher than 6000 cum/sec; moreover, The Pashur being a tidal river, any water drawl from this river gets replenished twice a day by tidal action. The practice of recycle and reuse of water has been adopted in this project also. Close cycle cooling system (with Cooling Towers) has been planned to reduce water drawl and consumption. The design cycle of concentration (COC) is based on this saline river water quality.

The plant is designed for a maximum withdrawal of raw make-up water which is still less than 0.05% of the leanest period flow of the Pashur river. Despite the limitation of using saline water, the net water consumption of Rampal plant will remain within the range of 3litre/ which is considered to be same as per international practice.

Further, the waste water inside the plant area and from coal stack area etc. will be treated through Effluent Treatment Plant (ETP) and part of it will be reused for gardening, watering or other purposes (Article- 5.16.2 and Table-5.10 of the EIA report). Remaining treated water will be discharged to the river, maintaining all standards of environmental laws of Bangladesh and WB and IFC. Since the power plant is located 65 KM **(Annexure-6)** away from the nearest periphery of the UNESCO world heritage site, such miniscule drawl of water will have no perceptible effect on the property.

The pre-construction, construction and operation phases of the Project will be implemented considering the pollution abatement measures. The water quantity shown in the water balance diagram is adequate. (Refer to page # 118 of EIA Report) for the ongoing 1st Phase (2x660 MW) Project. There is already a temporary water drainage system, onsite waste disposal system, safe sanitation facilities existing at site. During construction phase the Contractor will have his own waste management plan as mentioned in page # B 12 Part 9-13 in the Tender Document**.** In the operation phase, only a handful number of contractor's workers will stay in the worker shed inside the Project premises. Rest of the employees of the project shall stay in dormitories. Solid waste collection, disposal system and Sewerage Treatment System (STP) shall be operating during full operation of the plant. Moreover, monitoring of impact and compliance monitoring will check the air and water pollution during construction and operation of the power plant

iv) Effectiveness of the EIA:

The EIA study of Rampal Power Plant has been conducted maintaining the basic principles of EIA that are being practiced all over the world. During the study, the consultant focused on the following principle such as Purposive, Rigorous, Practical, Relevant, Cost-effective, Efficient, Focused, Adaptive, Participative, Interdisciplinary, Credible, Integrated, Transparent and Systematic. The systematic approach of EIA was carried out sequentially like Screening, Scoping, Examination of the Alternatives, Baseline

Study, Impact Analysis, Evaluation of the Significance, Mitigation and Management Plan, Public Consultation and Participation, Preparation of Environmental Impact Assessment Report, Review and Decision on EIA report by competent authority, follow up and monitoring activities as per international practice. This EIA has considered all issues as mentioned in the Operation Policies (OP) of The World Bank. The EIA study has been conducted as per approved Terms of Reference (ToR) by Department of Environment who is the mandated authority to do so. Stakeholders' consultations, as a part of ToR, have been done at every stage of the EIA study. Records of consultation in this regard are available.

Ten public consultation meetings (PCM) were conducted during the EIA studies. The details of PCM date, place and participants are given in table 15.1, 15.2 and 15.3 **(Annexure-7)**. A number of Focus Group Discussions and Key Informants Interview (KII) were conducted, and experts' opinions were taken during the study period. Moreover, local level stakeholder consultations, as well as national level consultations were carried out before completion of the EIA study. The draft EIA Study report was made available in the website for wide circulation and experts and public comments (Refer Stakeholders Consultation chapter 15 of EIA Report enclosed at **Annexure-7**). All issues raised by the national and international bodies were given due consideration and addressed. Considering the sensitivity of the Sundarbans, a 25 km of radius for EIA bounding has been considered for this EIA study while 10 km radius is considered as a normal practice.

A detailed bio-physical and socio-economic status of the project influenced area was studied maintaining the scientific process and technique. Representative sampling of each of the environmental parameters (air quality, water quality, noise level, soil quality) were analysed in lab, and a number of social survey (KII, FGD, stakeholder consultation) were conducted during the study period. Moreover, the sensitive receptors like the Sundarbans were given special attention during the baseline study.

Impact analysis was done to identify and predict the likely environmental, social and other related effects. USEPA approved regulatory model has been used to determine the pollution dispersion around the project site. Checklist, networking and professional judgment were utilized to figure out the impacts at every steps of the project development. Evaluation of the significance to determine the relative importance and acceptability of residual impacts (i.e. impacts that cannot be mitigated) was done.

In the EIA report of Rampal Power Plant, a number of pollution control measures like Super/Ultra-super critical boiler, cooling tower, Low-NOx burner, Electro-Static Precipitator, Flue-Gas Desulphurization Plant, High Concentrated Slurry Disposal system, Effluent Treatment Plant, Sewerage Treatment Plant and green belt of 1/3 of the project area have been precisely recommended to reduce the pollution level within national or international standard. Considering the importance of the Sundarbans Reserve Forests, lots of site specific environmental management plans were described for each of the stage for sound and environmental friendly project development. Moreover, site specific monitoring parameters, process, frequencies were also recommended depending on the sensitivity of the receptors for the proposed activities. Public consultations have been carried out at every steps of the project study.

Considering all of the above facts, it can be concluded that the EIA study of Rampal 2x660 MW coal based power plant project was conducted following best international practice and scientific procedure**.**

v) The phenomenon of acid rains:

The phenomenon of acid rains is generally observed, if the built-up of the acidic gases in the environment reaches significant proportions. In case of Rampal Power Project, the emission of both SO_x and NOx shall be effectively controlled through FGD/Low NOx Burner Technology. Therefore, there is no likelihood of any acid rain, thereby no possibility of causing acidification of waterways and leaching aluminium from the soil, thereby harming or killing fauna and flora.

For instance, there is no evidence of acid rain in and around the surrounding areas of the Barapukuria subcritical coal fired power plant of Bangladesh which uses high quality coal of the nearby mine and has been in operation for almost a decade .

vi) Mercury Control:

Firstly, the type of coal to be used as fuel in Rampal Power Project will have very negligible mercury content which will check the emission of Hg. Secondly, a modern highly efficient ESP at the downstream of Air Preheater and Wet type FGD will be used. The above combination will strip off the maximum part of the Hg. Power plants based on these technologies are already in use worldwide. 100% sale of ash produced in the plant has been planned based on actual demand survey from nearby cement manufacturing plants. However, in case of unlikely situation of ash sale not taking place for limited period, ash produced during such limited period will be stored in ash impoundment in high concentrated slurry form, which turns into ash stone within two hours of its formation. In HCSD System ash is stored as solidified layers. The captured mercury shall become part of solid matrix of ash/cement/concrete/ash stone/gypsum and will have no chance of entering the environmental systems of aquatic flora and fauna.

vii) Coal Ash Management

The power plant will use high Gross Calorific Value (GCV), low ash and low sulphur content imported coal. Moreover, Rampal project is being designed and developed with modern Ultra-supercritical Technology and with utmost care for the Sundarbans/nearby areas.

Due to high cycle efficiency (leading to low specific coal consumption) and low ash content in coal, the plant is estimated to generate less than 0.6 million ton of ash in a year if the power plant runs in full load capacity.

The generated ashes are of two types namely fly ash and bottom ash, and both the types will be collected in the plant in dry form in a closed silo.

Dry fly ash as collected will be sold to cement manufacturing companies and transported in covered trucks or covered vessels. The Dry bottom ash as collected will also be sold to users for brick manufacturing, road building etc.

As the project envisages 100% of ash generated from the project will be sold in cement sector, the ash particles along with the traces of these heavy metals, shall become part of solid matrix of concrete and will not cause any harm to the environmental systems. This will substitute existing ash import from India and will save Forex which can be shown from the following calculation.

Coal use in Maitree STPP per year=about 4000000 Ton (at 100% PLF)

Total Ash production after the combustion of coal per year = 0.15x4000000 = 600000 Ton (considering 15% content in Coal)

Considering 90% of 600000 Ton = 540000 Ton will be used in Cement industries, so import of 540000 Ton of coal ash will be reduced.

Considering bulk of this coal ash import through the Pashur river i.e. about 500000 Ton import of coal ash can be alleviated. Considering average capacity of barge of 800 to 1000 Ton, being used now a days for transportation of imported coal ash from India, total no of barges per year in the Pashur river= 500000/900= 555 say 550 Nos.

So, 550 nos of Barges (unregulated and more polluting type) engaged in ash import from India and is used to plying via core area of the Sundarbans through the Pashur river presently, will be stopped. Pollution load and risk of capsizing/ accident of barges is high for such vessels.

On the other hand, for Coal transport of Rampal power Project modern environment friendly barges with sophisticated navigation system (non-polluting vessel) will be used and it is anticipated that 500 nos of such vessels will move through the Pashur Channel which implies that

i) There is no net additional vessels movement through the Sundarbans area for coal transportation for Rampal Power Project.
ii) Since the coal transportation vessels will be environment friendly with sophisticated navigation system, the pollution and chances of capsizing/ accident will reduce drastically.
iii) This will effectively help maintaining the Pashur channel and its ecology.

As per the United States Environment Protection Agency (USEPA), beneficial use of ash produced in power plants falls into two major categories: 1) fly ash used in “concrete / concrete products/grout” and 2) FGD material gypsum used in “gypsum panel products”. When ash is used for such beneficial purposes, and their market demand is already established, there won’t be any need for disposal of ash. Market survey carried out has established the fact that demands for ash in the cement factories in the vicinity is more than four times the ash production in the Plant. Hence, in the ordinary circumstances there will not be any ash DISPOSAL from Rampal project.

However, for disposal of unutilised ash during emergencies, a High Concentration Slurry Disposal System has been envisaged, which results in formation of hardened layers of ash stone. This stone like ash will not emit dust from the ambient air or allow any leaching to

contaminate the ground water. As an abundant precaution, the ash impoundment will have impermeable layers to avoid leaching and appropriate dust control measures and will be encircled by green belt. Substantial height of the ash dyke and HCSD system will protect to spread of ash.

Thus, temporary ash disposal will pose no risks of leaking of contaminants into groundwater, blowing of contaminants into the air as dust, and catastrophic failure of coal ash surface impoundments. Waste from the power plant (ash) will not be transported along the route from which coal is brought. The Expressions of Interest have been received from the nearby Cement Industries for taking of the fly ash generated from the Rampal Power Plant. Ash will be transported either by covered trucks or covered vessels from the power plant to the industries concerned.

The main reason behind prohibiting construction of coal ash impoundments on such lands could be the risk of failure of impoundments leading to flow of slurry in nearby areas. However, as explained above, these risks are eliminated in HCSD System where ash is stored as solidified layers.

Moreover, according to the specification as mentioned in the EPC Contract, the coal ash impoundments will be constructed on a virgin land which is stable land as well. This impoundment will be encircled by a strong dyke of 5.6m height. This height has been set out considering the 100 years highest storm surge level which is 4.5m and also considered the surge height of Cyclone 'Sidr' occurred in 2007. The basement and wall of the ash impoundment will have impermeable lining. Dust suppression system and suitable storm water drainage system will be provided in ash impoundment to cater environmental care. The bearing capacity of the area will be not less than 100KN/sq meter. This is as per international practices.

viii) Coal Handling and Transportation:

The project will use high quality imported coal from Indonesia/Australia/South Africa, with very low Sulphur (average 0.6 %) & ash content (average 10 %). On an average one purpose – built (as per international convention), environment friendly low speed lighterage vessel for carrying coal per day will come to Project site which is only 2.8% of the existing number of vessels that ply in the long established maritime route of Mongla Port daily. To prevent dispersion of coal dust that may otherwise pollute air and water, the entire coal transportation will be done using fully closed vessels and unloading will be done through covered conveyer at plant Jetty. Coal will be kept in completely covered stack yard.

The lighterage vessel will be modern seaworthy vessel (miniship, tailor made as per IMO classifying norms and environmental friendly with zero effluent discharge low SOx emission, Low noise pollution and GPS vessel) **(Annexure-4)**. Transhipment will be done through most modern environmental friendly floating transfer station. At the jetty the coal will be unloaded through covered conveyer and coal will be stored in a fully covered stack yard to arrest all the fugitive dust emission. Hence there will be no possibility of water pollution due to coal transportation and handling process.

ix) Maintenance Dredging

The distance between Akram Point (Trans-shipping point) and power plant is around 100 km. From Akram Point to Mongla Port Jetty, the Channel distance is 87 km where no dredging is required right now. The remains stretch of 13 km [Port Jetty to Power Plant] dredging will be required. Government of Bangladesh has recently approved a project under which 3.88 million cubic meters spoil will be dredged and total length of dredging area will be 7.95 km at 5 different locations. Institute of Water Modelling (IWM) has carried out EIA study for this dredging project and subsequently it was approved by competent authority. The Recommendations of EIA study suggests that dredging need not be carried out at a stretch of 35 km of the Pashur.

The Dredged Material of Mongla Port to Rampal Power Plant will be disposed of in the low laying area of acquired land by Bangladesh Power Development Board. The total area of low land is 1834 acres. Up to now 485 acres have been developed and remaining area will be used for disposing off the dredged material. The disposed dredged material will be protected by earthen dyke/ embankment to prevent the spill of dredged material into the river.

As far as dredging of outer bar is concerned, the dredged material will be disposed of in deep sea during ebb tide only along the south-east side of fairway buoy, where present water depth is around 28 m from CD and which is far away from Swatch of No Ground.

Orion Power plant:

Orion power plant was planned. However, it did not get any approval. Without an independent, scientific and comprehensive EIA study, any industry or project including Orion power plant will not be implemented.

Future Plan:

It has been decided not to pursue the proposed 2nd Phase of the Rampal coal based thermal Power Plant.

In respect of the environmental protection measures for the Rampal Power Project and in consonance with GOB's commitment to the protection of the Sundarbans, it is proposed to put in place an independent monitoring mechanism through a team of experienced and reputed professionals to have a stricter oversight on the proposed Rampal Coal based Power Project from its very construction phase through its entire operational period. The designated monitoring committee may be entrusted with the following responsibilities:

- Monitoring of the plant during construction phase;
- Plant emission related data evaluation as the plant goes into operation;
- Monitoring of environmental data and recommendations, if any, during the operational phase of the plant;

Conclusion:

Parts of the Sundarbans Reserve Forest (SRF) was declared as the World Heritage Site (WHS, the Property) in 1997 during the tenure of our present Honourable Prime Minister Sheikh Hasina. Due to her strong commitment and commendable works for conservation of environment and ecosystems, she was recognized as one of the Champions of the Earth by UNEP. As per her instruction, Rampal Power Plant is being implemented with

highest environmental mitigation measures. She gave a detailed statement in the National Parliament addressing all the relevant concerns and assuring the nation that all necessary measures are being taken to mitigate against any harms to the Sundarbans. There are many coal fired power plants around the world which pose no threats to environment since these were constructed and operated maintaining all the environmental mitigation measures and using state-of-the-art technology. She also mentioned that there were a number of coal power plants which are located in sensitive sites like WHS which had no reservations from the environment watchdogs. (Speech of the Honourable Prime Minister Sheikh Hasina is attached as **Annexure-8**).

5. Decision Item No 6 of 39 COM 7B.8 adopted by the WHC (Bonn, 2015)

Regrets that the ecological monitoring data for the property requested by the Committee in Decision 35 COM 7B.11 has not been provided, and urges the State Party to submit the results of the ecological monitoring programme for the property without delay, to the World Heritage Centre for review by IUCN, ensuring that the impact of climate change on the OUV is documented, as initially requested in Decision 33 COM 7B.12

Response of the State Party on Decision Item No 6:

In response to the UNESCO World Heritage Committee Bangladesh Forest Department (BFD) submit periodic online report on the Sundarbans World Heritage Site in every six years. The last periodic report submitted in the year 2012 and was published in "World Heritage Papers 35" (2010-2012). The above periodic reporting includes various aspects of Ecological Monitoring of the property. Such as activities for the conservation of the property, monitoring, factors affecting the property, pollution, social/cultural uses of heritage, climate change and severe weather events, invasive/alien species, management and institutional factors.

5. Ecological Monitoring Report

Ecological monitoring is the collection, analysis, and interpretation of data of a particular ecosystem over time. It attempts to observe the response of the ecosystem to human interventions and to predict likely impacts, thereby helps understanding the processes that takes place as an "early warning" system. Ecological monitoring is a helpful tool is used to assess the state of conservation of a particular WHS. The Sundarbans being the largest mangrove ecosystem in the world requires observation on the changes in response to different interventions as a part of natural resources management. Therefore, the data are collected on different parameters relevant to observing the ecological health of the Sundarbans. Here in these monitoring report parameters have been selected on the basis of guideline of SAFIRE 2007, depending on the availability of data and relevance to the situation. It is remarkable that Govt. of Bangladesh has imposed on logging in Sundarbans since 1989. Limited harvesting of non-wood forest product are allowed outside property to meet the local demand. For thatching materials, fish, crab and honey. It is regulated through. Integrated Resource Management plan (IRMP). It has a check and balance between the territorial forest Divisions and a management plan division of Bangladesh Forest Department. This IRMP was prepared by international consultant for the Ministry of environment and forests in 2010 using the biophysical data collected by the Bangladesh Forest Department in 2009 in collaboration on with US Forest Service. Sustainable forest management is practiced there in the management of mangrove forest. The inventory data processed and current annual and mean annual increased was determined. The harvesting thus prescribed on the basis of mean annual increment (MAI). The prescription of annual allowable cut, however has been fixed fur below the MAI.

Apart Bangladesh forest department has established 120 Permanent Sample Plots (PSP) in the Sundarbans from where data are collected every 5 years interval. The parameters

include height, girth, crown cover, side exposure, litter status, salt crust on the soil surface, field moisture condition, soil compaction, drainage, understory, ground flora, cyclone damage, unplanned and planned harvest, the health of individual trees of the plots, etc. The data on such parameters are recorded and preserved for analysis to monitor the ecological condition of the forests and used in preparing the management plans. However, most recent data from PSPs were collected in 2014. Apart from Forest Department, Department of Environment, Institute of Water Modeling, Bangladesh Inland Water Transport Authority, Khulna University, CEGIS based on these data the ecological monitoring report has been prepared.

Present management practice includes programs like, Habitat protection; Wildlife Sanctuaries (The Property) management; Sustainable forest management; Food Security and wetland management; Climate change mitigation; Climate change adaptation; Eco-tourism; Facilities development; Conservation of outreach, conservation research, participatory monitoring and capacity building.

5.1 Ecological monitoring shows the following changes in the Sundarbans.

5.1.1 Area

The changes of the forest land of Sundarbans Reserved Forest (SRF) including the property (excluding water bodies) are mainly due to river bank erosion.

Inventory/ Mapping, Year	Forest land (excluding water bodies)	Organization
Forest Inventory, 1959	407,130 Hectares	Canadian Forestry, Forestal
Forest Inventory, 1983	414,246 Hectares	Overseas Development Administration, UK
Forest Inventory, 1996	411,227 Hectares	MADECOR, Philippines
Forest Mapping, 2013	390,550 Hectares	RIMS, BFD & CEGIS Bangladesh

5.1.2 Succession of the Sundarbans

In the Sundarbans succession began in the newly accreted land created by fresh deposits of eroded soil. The pioneer vegetation on these newly accreted sites is Keora (Sonneratia) followed by Baen (Avicennia) and Nypa as the ground is elevated as a result of soil deposition, other trees make their appearance. The most prevalent, though one of the late species to appear, is Goran (Excoecaria). The Sundri (Heritierafomes) begins to appear last as climax species as the level of land rises through accretion and the land is only occasionally flooded by tides. The ecological succession is a dynamic process and leads to the vegetation cover of the Sundarbans. The vegetation cover changes of major tree species class found in different inventory/mapping are given below:

Vegetation Cover Class	Area in 1959 (ha)	Area in 1983 (ha)	Area in 1996 (ha)	Area in 2013 (ha)
i. Heritierafomes	98, 551	82,845	74,992	74,264
ii. Heritiera –Excoecaria	92,139	123,247	105,967	102,264
iii. Excoecariaagallocha	12,557	18,556	19,909	21,454

Vegetation Cover Class	Area in 1959 (ha)	Area in 1983 (ha)	Area in 1996 (ha)	Area in 2013 (ha)
iv. Excoecaria-Heritiera	58,897	59,973	75,704	73,505
v. Excoecaria-Cerriops	32,196	37,593	34,604	32,575
vi. Ceriops- Excoecaria	42,115	57,597	56,536	54,655
vii. Sonneratiaapatala	8,854	3,509	8,287	10,603
ix.Ceriopsdecandra-Excoecariaagallocha	42,115	57,957	56,536	54,655

Source: Canad Source: Asian Forestry, Forestal (1959), Overseas Development Administration, UK (1983), MADECOR, Philippines (1996), RIMS, BFD & CEGIS Bangladesh (2013).

5.1.3 Regeneration and Plant Growth

Government of Bangladesh has imposed a ban on cutting all sorts of timbers and fuel wood from Sundarbans since 1989. As a result, the number of seedlings and saplings per hectare for all species has increased. Again, the total number of poles for all species of 2.5-5 cm, 5-10 cm, and 10-15 cm DBH class has also increased. Likewise, the tree number per hectare (N/ha), basal area per hectare (BA/ha) and volume per hectare (V/ha) have increased for all DBH classes.

Diameter class: Changes of diameter class of major species of Sundarbans stated below.

	Size class	Seedlings Ht<1.5m	Saplings DBH<2.5 cm	Poles in DBH class in cm				
				2.5 – 5	5 -10	10-15		
	Species	N/ha	N/ha	N/ha	N/ha	N/ha	BA/Ha (m^2)	V10/ha (m^3)
Year 2009	Sundari	34776	3044	2166	1596	234	2.818	13.922
	Gewa	13235	1266	1984	2393	255	2.929	9.844
	Baen	42	0	0	0	0	0.001	0.005
	Keora	5	5	3	9	1	0.016	0.067
	Others	5748	1231	850	366	17	0.199	0.651
	Total	53806	5547	5003	4364	507	5.963	24.490
Year 1996	Species	N/ha	N/ha	N/ha	N/ha	N/ha	BA/Ha(m^2)	V10/ha (m^3)
	Sundari	20522	3957	428	523	188	2.165	10.397
	Gewa	5971	2627	476	560	184	2.045	6.647
	Baen	23	6	1	1	1	0.002	0.005
	Keora	5	3	1	0	0	0.006	0.025

	Size class	Seedlings Ht<1.5m	Saplings DBH<2.5 cm	Poles in DBH class in cm				
				2.5 – 5	5 -10	10-15		
	Species	N/ha	N/ha	N/ha	N/ha	N/ha	BA/Ha (m^2)	V10/ha (m^3)
	Others	8203	1495	100	49	10	0.118	0.384
	Total	34723	8088	1008	1133	384	4.336	17.457

Source: Integrated Resources Management Plans for the Sundarbans (IRMP, 2010-2020).

5.1.4 Number of Stems per Hectare

Carbon inventory conducted jointly by US forest service and Bangladesh Forest Department in 2009 revealed the fact that the regeneration of most of the main species including Sundri has increased in comparison to previous inventories of 1983 and 1996.

Year	(*Heriteira fomes)* Sundri		(*Exchoecariaagalocha)* Gewa		Others		Total
	N/ha	%	N/ha	%	N/ha	%	N/ha
2009	439	55.00	317	40.00	41	5.00	797
1996	290	51.79	228	40.71	42	7.50	560
1983	296	53.14	224	40.22	37	6.64	557
1959	511	53.68	345	36.20	97	10.19	953

Source: Integrated Resources Management Plans for The Sundarbans (IRMP, 2010-2020).

5.1.5 Volume per hectare of different species in Sundarbans

According to inventory carried out in 2009 the number Sundri **(*Heriteira fomes)*** trees per hectare found 205 per hectare in comparison to 106 in 1996 and 125 in 1983. The volume of Sundri found 48.2 cu. meter per hectare in comparison to 17.8 and 19.9 in 1996 and 1983 respectively.

Species						
Year	Sundari		Gewa		Others	
	N/ha	V10/ha	N/ha	V10/ha	N/ha	V10/ha
2009	205	48.2	62	7.8	30.4	11.2
1996	106	17.8	20	2.1	20	7.5
1983	125	19.9	35	2.7	20	7.1
1959	211	33.6	61	5.0	24	5.9

Source: Integrated Resources Management Plans for the Sundarbans (IRMP, 2010-2020).

5.1.6 Result of Ecological Monitoring Conducted under SEALS Project

A recent study on "Species richness and diversity of floristic composition in relation to special habitat and salinity" conducted by Dr. Saiful Islam and others under the SEALS project in the Sundarbans shows the following changes.

Studies in the Sundarbans	No. of family	No. of species	Area coverage	Remarks
Prain, 1903	75	334	Entire Sundarbans& its periphery (Bangladesh and India)	Taxonomic study plus compilation of other studies
Heining, 1892	34	69	Entire Sundarbans (Bangladesh and India)	
Chaffey & Sandom,1985	37	66	Entire Sundarbans, Bangladesh	
Hossain, 2003	?	44	Entire Sundarbans, Bangladesh	Undergrowth species
Leech & Ali, 1997	?	48	Entire Sundarbans, Bangladesh	
Gopal& Chauhan	34	100	Indian Sundarbans	
Rosario, 1997	27	37	3 Protected Areas, Bangladesh Sundarbans	
Rashid *et al*., 2008	?	48	Entire Sundarbans, Bangladesh	Undergrowth species
Saiful*et al*., 2014	32	78	3 Protected Areas, Bangladesh Sundarbans	The World Heritage Site
Sundarbans Environmental And Livelihoods Security Project, 2015	59	182	Entire Sundarbans, Bangladesh	Published

Source: Species richness and diversity of floristic composition in relation to special habitat and salinity; The Malaysian Forester 2016, 79 (1&2), 7-38

5.1.7 Major Non-Timber Forest Product

In order to reduce human interventions inside the WHS, the harvesting of non-timber forest products (NTFP) including honey, wax, fish, hantal, bark, nypa leaf etc. have been prohibited. However controlled harvesting of the NTFPs are allowed from Sundarbans excluding the property (WHS). The amounts harvested over time are as follows:

Product (in M ton)	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
Fish	3685.29	3860.72	3484.42	3615.75	3431.33

Product (in M ton)	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
Honey	134.93	165.44	232.94	198.73	158.34
Nypa leaf	47340.72	29995.97	31761.61	18304.82	16867.52
Grass	1915.26	1312.74	1101.19	1211.19	668.17
Crab	1159.73	1301.56	1253.81	1160.71	1127.73
Dry Fish	2830.59	2720.89	2331.99	2524.11	2772.88

Source: Bangladesh Forest Department (2016).

5.1.8 Top Dying of Sundri

Sundri top dying syndrome has been affecting the Sundarbans forests for many years and has been cited by several authors as a significant ecological and management problem. But the inventory carried out in 2009-10 did not find top dying as a major ecological problem in the Sundarbans.

5.1.9 Faunal Study

The existence of flagship species like Tiger and Crocodiles indicates the sound health of the ecosystem and rich biodiversity in the Sundarbans. However, estimate of population trends of the flagship species has been conducted as part of the ecological monitoring of the Sundarbans.

5.1.9.1 Tiger Estimations

Population estimation of the tiger was done by different scientists and FD using different methodology. The result of population estimation of tiger is given below:

Year	Source	Method	Number
1975	H. Hendrichs	Interview	350
1982	Bangladesh Forest Department and Dhaka University	Pugmark	450
1992	Bangladesh Forest Department	Interview	359
1993	K M Tamang	Pugmark	362
2004	Bangladesh Forest Department	Pug mark	440
2007	Monirul H Khan	Camera Trap	200
2015	Bangladesh Forest Department	Camera Trap	106

Source: Dr. Monirul H Khan, JU (2016)

For the protection of Tigers in the Sundarbans National Tiger Recovery Program has been undertaken. The present Tiger Action Plan (2009-17) has been initiated to revise for the next ten years period. To reduce the human-tiger conflict, 49 groups of Village Tiger Response Team (VTRT) with 332 community people and a three-member Forest Tiger Response Team (FTRT) has been formed and working at the Sundarbans Impact Zone (SIZ).

5.1.9.2 Crocodile Survey Report

The estimated number of crocodile is listed below:

Year	Source	Method	Number
1983	Dr. SMA Rashid	Interview	250
1987	Dr. Ali Reza Khan	Interview	250

Year	Source	Method	Number
1989	Mr. Mokhlesur Rahman	Interview	200
2003	Dr. SMA Rashid	Interview	150-200
2014	Dr. SMA Rashid	Interview	150
2016	CARINAM	Transect Method	150-205

Source: Dr. SMA Rashid, CARINAM (2016)

To increase the population of crocodile government has established a crocodile breeding center at Karamjal one of the entrances of the Sundarbans. The center is capable induce hatching and rearing of the baby crocodiles to release them in the natural environment of the Sundarbans. Till date about 68 crocodiles has been released in the SRF.

5.1.9.3 Cetaceans Report

During the years 2010-2012, a study was conducted in the six 5-km channel segments in the Eastern Sundarbans Reserved Forest identified as dolphin hotspot (where occurrence of freshwater dolphins was much higher than in other areas) and six 5-km randomly chosen non-hotspot channel segments (where occurrence of freshwater dolphins was significantly lower than in hotspots) to understand the ecological attributes including biological, physical and human use characteristics of prime freshwater-dependent cetacean habitat in the waterways of the Eastern Sundarbans. During the study 192 dedicated surveys were conducted in dry, pre-monsoon, monsoon and post-monsoon seasons of the study year 2010, a total of 181 sightings of 334 Ganges River dolphins and 22 sightings of 41 Irrawaddy dolphins were recorded in the hotspot segments, whereas a total of 40 sightings of 62 Ganges River dolphins and eight sightings of 17 Irrawaddy dolphins were recorded in the non-hotspot segments.

5.1.9.4 Fish Population Status

There is an increasing trend in a number of fishers as well as fishing effort. The fish production figures from the Sundarbans show sharp fluctuations from year to year and cannot be used to gauge the possible availability of stocks. However study revealed the fact that the total fish production from the Sundarban remains static.

Year	Fish Harvested (MT)
2010-2011	3685.29
2011-2012	3860.72
2012-2013	3484.42
2013-2014	3615.75
2014-2015	3431.33

Source: Bangladesh Forest Department (2016).

In view to maintaining ecological balance and to develop the fisheries resources for sustainable utilization following management, actions are in place in the Sundarbans as prescribed in Integrated Resources Management Plan of the Sundarbans.

5.1.10 Salinity Trend

The salinity measure at the Karamjalpoint of the Pashur River**.** Highest salinity found in the month of April & May and the lowest in the month of August to November. The factors affecting the salinity are mainly rainfall pattern, upstream water flow, temperature etc.

Year	2012	2013	2014	2015	2016
Range (ppt)	0.2 - 13.4	0.1 - 15.9	0.3 - 19.2	0.3 - 17.6	0.6 - 13.1

Source: DOE, Khulna, Bangladesh Lab report (2016).

5.1.11 Oil Spill Monitoring Report

The oil spill in the Shela River happened in 09/12/2014. At present DOE Khulna is measuring all the parameters monthly. During the oil spill and the present condition water quality of the Shela River report is as follows:

Parameter	During oil spill 10/12/2014-18/12/2014	Present (July 2016)	Standard value range*
Total dissolved solid (TDS)	1635-1890 mg/L	1163 mg/L	-
Ph	7.8-8.0 mg/L	7.83 mg/L	6.5-8.5
Electrical Conductivity (EC)	3250-3800 micro S/cm	2326 micro S/cm	-
Chloride (Cl)	1030-1200 mg	688 mg	-
Dissolve Oxygen (DO)	5.6-7.0 mg/L	6.1 mg/L	>=5
Salinity	1.2-2.2 ppt.	1.8 ppt.	-
Turbidity (Tbd)	104-131 JTU	70.7 JTU	-
Total Solid (TS)	-	1243 mg/L	-
Suspended Solid (SS)	-	80 mg/L	-
Biological Oxygen Demand (BOD)	-	0.8 mg/L	<2
Total Alkalinity (TA)	-	36 mg/L	-

Source: DOE, Khulna, Bangladesh Lab report (2016).

Department of Environment regularly monitors water quality such as pH, DO, BOD, Turbidity, Salinity, EC, etc at the Pashur River and Shela River. This monitoring finds that salinity increases in the dry season while decreases in the monsoon.

5.1.12 Tourism Information

The Sundarbans has become one of the most attractive tourists' destinations in the world. About 0.15 million national and international tourist visits the Sundarbans every year. The **Dubla fishing** and **Rash Mela**, the indigenous method of **honey collection**, **Otter fishing**, **Nypa leaf collection**, the way **people live with the tigers** in the vicinity of Site are special attractions of the Sundarbans tourism. Three rest houses were established by Forest department in three different tourist hotspots of the Sundarbans. **Karamjal**, **Herbaria, Munshiganj**, **Kalagachia**, **Jamtola**, **Dubla** are the notable tourist spots. Tourism is providing employment opportunities for the nearby people, some of the educated youth have been trained as Eco Tour Guides, and others are providing transportation facilities and supplying food and necessary commodities to the tourists to earn their livelihood. The numbers of tourists (both National & International) tourist in the SRF in the recent years are as follow:

Year	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
Number	132705	227038	155317	100540	100817

Source: Bangladesh Forest Department (2016).

To reduce the pressure of the tourists' carrying capacity of major tourist has been measured by the University of Khulna recently and tourist is regulated accordingly. Moreover, Sundarbans Tourism Policy has been finalized by the MoEF where duties and responsibilities of concern stakeholders (FD, Tourist, and Tour operator) have stated for sustainable ecotourism in the SRF.

5.1.13 Carbon Pool

The total carbon stocks in the Sundarbans mangrove forests were estimated based on the forest inventory done jointly by the US Forest Services and Bangladesh Forest Department in 2009 and compared with similar parameters estimated by using 1997 inventory data set. In 1997 the total carbon density was found 76 Mg/ha which became 117 Mg/ha in 2010. It indicates the health of the Sundarbans is improving.

5.2 Present Monitoring Intervention:

5.2.1 Aquatic Resources

5.2.1.1 Fishing Area Ban: Year round fishing ban in-

- All water bodies in the existing six wildlife sanctuaries.
- 18 canals that have been declared closed in the buffer zone.
- Canals less than 25 feet wide within 3 km area of FD permanent camp office/ Petrol office located throughout the Sundarbans.

5.2.1.2 Fishing Ban during Breeding Season:

- Fishing ban in all canals during the months of July and August.
- Fishing ban in Beels/Chatals during the months of February and March.

5.2.1.3 Seasonal Gear Ban:

- Illishjal/ Fashjal ban in September and October.

5.2.1.4 Complete Gear Ban:

- Bhendi/Bebdi/Bendi/Bhasan (Set bag net)
- Net jal/ Current jal for post larvae collection of Golda and Bagda.
- Khalpata jal.
- No fishing by de-watering.
- No fishing with poison.

5.2.1.5 Mesh size Control:

- Fishing net with mesh more than 1 inch (knot to knot at stretch condition) will not be allowed for fishing.
- Ban on using insecticides and poisons for catching fish.

5.2.1.6 Boat license Certificate (BLC) Limit:

- The maximum number of annual BLC issuance will be 12000.
- The first priority in issuing BLC will be given to those boat owners live within 5 km area around the Sundarbans.

5.2.1.7 Fishing Permit Limit:

- One BLC holder boat will get a fishing permit in a year for all gears for fishery type. However, 8 fishing permit on an average will be attended by each range.
- The maximum limit of permit for a month will be 3 times.
- 5-7 days fishing under a permit.
- Compliance with the Bangladesh Fish Act of 1950 is important through the active participation of communities.

5.2.1.8 Fishing Duration: The maximum fishing duration against a permit will be 7 days.

5.2.1.9 Species Ban:

- Pangas (*Pangasiuspangasius*) and Sea bass (*Latescalcarifer*): Fishing ban on each alternating year.
- Ilish (*Hilshah ilsha*): Fishing ban in September and October.
- Mussel (Jhinuk): Ban in march to October.
- Crab: Ban in January and February.

5.2.1.10 Fish Size limit:

- Catching of Ilish **(***Hilshah ilsha*) and Pangas (*Pangasiuspangasius*) below 23 cm is prohibited during November to April.
- Crab: For a male the minimum weight size for a catch is 200 mg and for a female is 120 gm.

5.2.1.11 Vegetation Management Measures

- Extraction of trees from the Sundarbans has been banned for biodiversity conservation since 1989.
- Species conservation initiatives as embodied in CBD. In addition to ban on tree extraction from the Sundarbans Government has imposed a ban on sale and use of Sundri (*H. fomes*) and The Pashur (*C. mollucensis*) timber to stop the illegal extraction of these trees from the Sundarbans.
- Outside the World Heritage Site and Sanctuaries controlled extraction of non-timber forest products are allowed to support the livelihood of surrounding population, for their subsistence.
- The number and quantity ofnon-timber forest resources extracted determined through scientifically based approved Integrated Resources Management Plan (IRMP).

5.2.1 Present Tiger Monitoring Program

USAID's Bengal Tiger Conservation Activity project under Bangladesh Forest Department has been conducting several diverse activities with an objective of ecological monitoring in Sundarbans. These activities include monitoring abiotic factors that can affect ecosystem such as salinity assessment to monitoring habitat, prey base, tigers. The summary of these activities are given below.

5.2.3.1 Tiger Monitoring

Baseline information of population status of wildlife is a prime requirement of any monitoring and management plan designed for conservation of a given species. It helps

to conservation practitioners and donors to evaluate the effectiveness of their efforts based on changes in population trend.

Tiger monitoring has been conducted by conducting sign surveys along creeks, and land with an objective of relative abundance estimation and occupancy survey. Along with this camera trapping and DNA based population monitoring survey will be done.

5.2.3.2 Occupancy estimation

Occupancy is a scientifically robust method to monitor wildlife population by estimating the probability of occurrence in their habitat indicating their distribution pattern. Estimating occupancy is much easier, cheaper and efficient in terms of time and logistics requirement compared to other monitoring methods as the occupancy modeling framework can use all kind of presence-absence data e.g. sighting records, camera trap photos, and signs (tracks, fecal material, calls etc.), as well as interviews. Occupancy modeling is robust enough to work well with imperfect data, if detection of animals are missed while surveying. Considering the logistics constraints in the Sundarbans mangrove forest, occupancy estimation would be the most easily implanted and replicable means of monitoring tiger and prey including their population trend.

5.2.3.3 Camera trapping

Camera trapping has long been scientifically robust and well established method for monitoring and estimating tiger populations. In Bangladesh Sundarbans, baseline data has already been collected by BFD, and the report has been published and released in Oct, 2015. It is optimal to continue regular monitoring as frequently as annually to assess the population status of tigers, their spatial density variations, and their habitat occupancy. Camera trapping also can gather information on a range of species simultaneously and continuously, over large areas and for several months at a time. These can be used to estimate population size, species richness, site occupancy or relative abundance indices of many species of surveyed area. BFD and Bagh will be conducting camera trapping for assessment of tiger population in the target area in Sundarbans in 2016-2017.

5.2.3.4 DNA analysis

Non-invasive DNA sampling has great potential for monitoring and management applications of tiger population in Sundarbans. The advancement of DNA based population monitoring methods has enabled researchers and managers to monitor their population with accuracy. Reliable and accurate data can be collected from non-invasive DNA samples such as scats, hairs, and kills. We had conducted land survey in Sundarbans for collection of fecal and hair samples in 2015-2016 field season. We will be analyzing these samples to get information on genetic identity of individuals, estimation of population size, density, gender identification and sex ratio, and other crucial information pertaining to their genetic health such as genetic variation and diversity, relatedness, and gene flow. All of this information is critical to assess population-wide viability.

5.2.3.5 Prey Monitoring

Occupancy estimation method is a robust and logistically easy to implement in Sundarbans to monitor prey population. We have surveyed predefined sampling units to record deer tracks along the creek banks as a representation of deer presence. The collected presence/absence data has been analyzed to obtain relative abundance of prey population in Sundarbans.

5.2.3.6 Habitat Monitoring

Several research activities have conducted to assess status of Sundarbans vegetation and habitat for deer and tiger.

5.2.3.7 Mangrove monitoring

About 200 plant specimen from Sundarbans had collected along with collection of leaf samples to assess the effect of salinity on leaf traits during our field research in 2015-2016. We have also systematically sampled 120 vegetation plots in Sundarbans. Species identification and digitization of the reference herbarium is in process. Assessment of plant traits that might drive prey feeding selectivity. Specifically, plant tissues will be analyzed for nutrient content (carbon, nitrogen and phosphorus), chemical defenses, and general morphometries indicative of herbivore preferences (e.g., specific leaf area, water content, and leaf toughness). For this we have sampled three most abundant tree species from all across Sundarbans to assess the effect of salinity on leaf traits. We had also collected genomic grade plant tissues in 2016. These samples will be analyzed in 2017 to assemble a DNA barcode reference library, to allow identification of plant species that occur in faecal pellets of tiger prey (deer and pig) using DNA bar-coding.

5.2.3.8 Land cover mapping

Change detection in land cover and land use classes can help management to assess the suitability of habitat for their target species, and take appropriate management interventions. It is possible to map the land cover and detect change of land cover in a given landscape very effectively by using Remote Sensing techniques and satellite images. Satellite images can be analyzed to quantify land cover changes over last 25 years with accuracy. We have conducted and finished a pilot study to detect change in land cover in Kotka-Kochikhali area in year 2015-2016. The result shows a significant decline of grasslands in these areas.

5.2.3.9 Disease monitoring in dogs living in the Sundarbans periphery:

Canine distemper is a proven emerging threat to the tiger populations in some tiger-range countries, including India and Russia, and could potentially affect the tiger population in the Sundarbans as well due to the close proximity to human habitation and interaction between domestic carnivores (dogs) and tigers. Domestic dogs are the most abundant and common commensally carnivore found in Bangladesh. They may act as the reservoir host of CDV (Canine Distemper Virus), which is an emerging threat for tigers globally. This disease can be Identified and monitored by sampling domestic dogs for prevalence of CDV. We plan to conduct a study to asses such risks to the Sundarbans tigers. We have already collected serum and blood samples of ~100 dogs from 10 villages around the Sundarbans periphery area in 2016. This sampling followed by laboratory analysis (conducted at Glasgow University) will give us conclusive answer

if the domestic dog population is host to CDV or not. Based on this information we will devise our other disease surveillance activities in the Sundarbans.

5.2.3.10 Endoparasites in Carnivores and herbivores of Sundarbans:

Diseases and parasites have a major role in population regulation of wild animals. They have the potential to reduce host fitness by competing with the host for limited resources. An excessive load of endoparasite can adversely affect the reproductive potential and survival of the host population. To our knowledge no such study of endoparasite prevalence has been done on wild mammals of the Sundarbans.

In 2016 we collected ~2380 samples from wild mammals (including tiger, small carnivores, deer and wild pig) across the Sundarbans. In 2017 we plan to analyze these samples with our partner from Chittagong Veterinary and Animal Sciences University.

5.4 Involvement of Local Community for Conservation and Monitoring of the Property

Government of Bangladesh has adopted collative resource management in the Sundarbans. Four (4) Co-management Committee (CMC), have been formed across the Sundarbans Impact Zone (SIZ). CMC deliver their duties with the help of 210 Village conservation forums (VCF) and 4 people's forum (PF) the total member of the VCF is 32000. The CMCs are represented by local community elected democratically. The Community Patrol Group (CPG) also has been formed to reinforce the Front Line staff of BFD.

5.4.1 Alternative Income Generation Activities (IGA):

There are more than one million people 28% of the population in the impact zone are dependent on the Mangrove Forest for their livelihood support. The increased population with few alternative livelihood options around the Sundarbans causes resource depilation. Different AIG programs have been taken by the government and non-government organizations to reduce their dependency on the property.

5.5 SMART Patrolling:

Spatial Monitoring and Reporting Tool (SMART) is a new site-based approach; to monitor, evaluate and improve the effectiveness of conservation management with of the Sundarbans special reference to Law Enforcement Monitoring. SMART approaches use the power of information where right information is delivered to right persons for effective law enforcement. From the SMART patrolling temporal and spatial information is collected which are fed into SMART software. Using software the manager becomes able to know about the wildlife encounter rate (such as tiger, deer crocodile masked finfoot, dolphin, prey etc.) human activities and also the information on unique and special habitats of wildlife.

With the joint collaboration of Department of Forest, Police, Border Guard Bangladesh, Customs and Coast Guard Wildlife Crime Control Unit (WCCU) has been established and playing a vital role in the protection and conservation of tiger and wildlife. The WCCU also takes effective conservation measures for the protection of the Sundarbans.

5.6 Adaptation and Mitigation measures of Climate Change impacts on the property

To mitigate the impact of climate change the Forest Department has taken massive coastal afforestation program since 1962 along the coastline of the country. So far about 200,000 hectares of thecoastal green belt has been created through coastal afforestation acting as a carbon sink by sequestering carbon dioxide from the atmosphere. Additionally, special measures are in progress to address the vulnerability by improving the damaged parts of the embankment surrounding the Sundarbans, and building thecapacity of the forest dependent people living adjacent to the Sundarbans. So far about 5 km embankment has been rehabilitated along with greening of the area by plantation involving thelocal community. Embankment Management Committee has been formed with the local community. About 50,000 SRF dependent people trained for different alternate livelihood income generation.

The recent two strong cyclones Sidr and Aila affected the Sundarbans in 2007 and 2009 respectively. Aerial reconnaissance in late 2009 and the IPAC inventory (2010) plot data both indicated a range of apparent cyclone damage, but only a small area of the forest was affected overall. By the resilient nature of the mangrove forest the vegetation damaged by the cyclones it rejuvenate again.

Government of Bangladesh already maintains strong and praiseworthy position in putting in place sufficient measures to address adverse impacts of climate change through various activities/projects. To that efforts one of the significant activities is the creation of on-going 2280 km. coastal green belt covering the coast line and the islands. It is a priority project of the Hon'ble Prime Minister. However, considering the lacks of data relating to assessment of damage due to climate change impacts because of global warming, Department of Environment of Bangladesh with support from German Technical Cooperation (GIZ) is conducting a country-wide vulnerability assessment, which would develop a substantial database that would contribute to the overall planning and decision making process and ultimately to enhance the resilience of vulnerable communities and ecosystems in the coastal regions of the country including the Sundarbans.

Department of Environment conducted an "Assessment of Sea Level Rise on Bangladesh Coast through Trend Analysis" (published July 2016). Analysis of tide gauge (Tide Gauge of BWDB, BIWTA, Chittagong and Mongla Port Authorities) data of 30 years shows trends of water level in the Ganges tidal floodplain of 7-8 mm/year. On the other hand, the trend is 6-10 mm/year in the Meghna Estuarine floodplain and 11-21 mm/year in the Chittagong coastal plain areas. So, it has been found that the overall trend in the coastal zone in the last 30 years has been 6-21 mm/year from west to south of the coastal zone of Bangladesh. The trend obtained from this study corresponds with the trend cited by SMRC (2003), where the trend is lower in the Ganges followed by medium range values in the Meghna and highest values in the Chittagong coastal plain. Also, in addition to similarities regarding rising trends, this study reveals that sea level has raised at a higher rate than in the past, thus consolidating the notion of rising sea level.

Therefore, the MSL trend derived from the tidal gauge data along the coast of the Bay of Bengal is much higher than the GMSL trend derived from long term global tide gauge data and short term satellite data.

Ministry of Environment and Forests, Ministry of Shipping and Ministry of Water Resources have been aware of the impacts of sea level rise, and taking adaptation and mitigation measures and monitoring mechanism using mainstream national revenue fund and Bangladesh Climate Change Trust Fund.

6. The state of conservation of the property

6.1 Present administrative set up for the Property as well as the Sundarbans Reserved Forest (SRF):

The property was declared the Sundarbans Reserved Forest in 1875 under the Forest Act and the Sundarbans Reserved Forest was managed since 1892 under different prescribed Management Plan. The present Management Plan (Integrated Resource Management Plan, **IRMP** 2010-2020) are followed for all activities in the SRF. At present the Forest Department has permanent administrative set up in the Sundarbans as follows:

I. Conservator of Forests, Khulna Circle, Khulna
II. Divisional Forest Officer, Sundarbans West Forest Division, Khulna
III. Divisional Forest Officer, Sundarbans East Forest Division, Bagerhat
IV. Divisional Forest Officer, Wildlife and nature conservation Division, Khulna
V. Divisional Forest Officer, Management Plan Division, Khulna.

The Sundarbans, the largest natural mangrove wetland in the world, covers an area of 6017 sq km in Bangladesh. The Protected Areas are as follows:

i. The Sundarbans East Wildlife Sanctuary(WHS)
ii. The Sundarbans West Wildlife Sanctuary(WHS)
iii. The Sundarbans South Wildlife Sanctuary (WHS)
iv. Dhangmari Wildlife Sanctuary
v. Chandpai Wildlife Sanctuary
vi. Dudhmukhi Wildlife Sanctuary.

To make the sufficient financial and human resources available for the Sundarbans Management, 103 number of new frontline staffs have been recruited and placed. A total of 590 persons have been given capacity building training on first aid. Biodiversity management training has been given to 150 persons, Ecosystem management training to 140 and Forest Guard capacity building including rifle training for 284 persons for monitoring of the property on a sustainable basis by the Forests Department. For the sustainability of SMART patrolling and Monitoring of WHS and SRF, a new project “Protection of the Sundarbans Mangrove Forests” (2016-2020) is under active consideration of Government to take over the ongoing activities along with new activities to ensure protection of the property.

The 900 forest staff are delivering duties in the Sundarbans including the property from 72 Campsand17 Stations at present, moreover about 32 Coast Guards are working in 6 Camps namely at Kachikhali, Supati, Alorkol, Kagadobeki, Dobeki and Kokilmony. Bangladesh Border Guard post also have been established in Kachikata to prevent illegal activities in the Sundarbans.

Wildlife Crime Control Unit (WCCU) and Tiger Co-ordination Committee (TCC) has been formed in national and regional level to control wildlife poaching and illegal trafficking and working effectively in national and international level.

6.2 Conservation Measures:

- Extraction of trees from the Sundarbans has been banned for biodiversity conservation since 1989.
- Species conservation initiatives as embodied in CBD. In addition to ban on tree extraction from the Sundarbans Government has imposed a ban on sale and use of Sundri (*H. fomes*) and The Pashur (*C. mollucensis*) timber to stop the illegal extraction of these trees from the Sundarbans.
- Outside the World Heritage Site and Sanctuaries controlled extraction of non-timber forest products are allowed to support the livelihood of surrounding population, for their subsistence.
- The number and quantity ofnon-timber forest resources extracted determined through scientifically based approved Integrated Resources Management Plan (IRMP).
- Partial closure of fishing out of 400 canals 18 Canals of the Sundarbans have been closed for fishing as these canals found suitable as a breeding ground for fishes and aquatic animals.
- A protocol and Memorandum of Understanding has been signed between the government of India and Bangladesh 2011 to conserve Tiger and the Sundarbans. Exchange of views, visits, and technical co-operations are in place between two countries. First meeting of India-Bangladesh joint working group on conservation of the Sundarbans was held in July 2016 to take initiative for 9 point issues including the river water quality monitoring, siltation trend analysis, that affects the Sundarbans as well as conservation of Tiger of the Sundarbans. Marine Protected Area (MPA) of 1738 sq km has been declared including Swatch of No Ground for better protection of fishes, marine mammals, and aquatic wildlife.
- From the strong commitment of our Honorable Prime Minister on St. Petersburg declaration, Global Tiger Recovery Program plan (GTRP)as well as National Tiger Recovery Program (NTRP) has been undertaken for the protection of Tigers in the Sundarbans. A Tiger Action Plan (2009-17) is going to be revised and updated.
- **Wildlife Crime Control Unit (WCCU)** has been formed with the joint collaboration of Department of Forest, Police, Border Guard of Bangladesh, Customs and Coast Guard. It is playing a vital role in the protection and conservation of tiger and wildlife. The WCCU also takes effective conservation measures for the protection of the Sundarbans.
- To reduce the human-tiger conflict, 49 groups of **Village Tiger Response Team** (VTRT) with 332 community people and a three-member **Forest Tiger Response Team** (FTRT) has been formed and working at the Sundarbans Impact Zone (SIZ).
- **Compensation Policy for wildlife victims** 2012, has been approved which is helping to reduce the human-tiger conflict in the Sundarbans Impact Zone.
- A National **Tiger Coordination Committee** (TCC) has been formed in 2014 headed by

Secretary, MOEF with all law and enforcement agencies working in the Sundarbans area. A **Regional Tiger Co-ordination Committee (RTCC)** at Khulna has been formed and is working to protect illegal wildlife trafficking from World Heritage Site.

- Co-management committee is formed from the people forum, VCF in the following way, Village conservation Forum (**VCF) of 210 groups with 32000 Sundarbans dependent people,** Four (4) People's Forum (**PF**), and 30 in numbers of Eco Tour Guides (**ETG**) have been organized. Thirty (30%) percent of the VCF members and 50% of PF members are women. They motivate village people to conserve resources of the Sundarbans for future generation. 184 VCF members In 5 Community Patrol groups **(CPG)** are working with FD front line staff, for information gathering to protect the Sundarbans from illegal activities.
- Resource users of the Sundarbans are identified and provided with alternative income generation (**AIG**) opportunities to reduce pressure on the Sundarbans. Different GO and NGOs have been involved in providing AIG supports through ongoing projects in the Sundarbans.Improved Cooking Stoves (**ICS**), **Solar System, Pond Sand Filter (PSF), Rain Water Harvesting (RWH), Desalinization of solar power** units have been set upin the SRF to reduce the pressure on fuelwood and to provide drinking waterfacilitiesof the FD staff and people living adjacent to Sundarbans.
- Forest Department developed smart green infrastructures are built for front line staffs so that the management is easier, enforcement is efficient, surveillance to curve down the poaching, like 6 **Watch Towers**, 4 raised **Walk Ways**, 2 **Nature Trails**, 1**Information Centre**, 1 Deer Rehabilitation Centre, and 1 Crocodile Breeding Center for tourism as well as biodiversity conservation of SRF.

6.2.1 For better protection of the Sundarbans including the WHS following logistics are provided:

- Supply of water vessels to ease the movement of staff for performing their duties: 13 number of fiber body boats, 8 number of speed boats, 50 wooden body engine trawlers, 7 still body patrol boats, 1 research vessel has been provided.
- Improvement of Landing: 25 Numbers of Pontoon and gangways established in different camps and stations.
- Improvement of accommodation and offices: 21 camps and stations established for safety and security of the front line staffs as well as Sundarbans dependent people.
- Logistics for patrolling: Supply of Uniform (1/yr/staff), Footwear (1pair/year/staff), Torchlight (292), first aid box (196), Raincoats (1per staff).
- Development of communication system: Establishment of Mobile tower by Teletalk at Katka, Nilkamal, Dublaand and Alorekol.

For the prohibition of illegal activities such as poaching of wildlife and non-compliance with existing regulations of the Sundarbans Reserved Forest including WHS, SMART Patrolling is going on for last one year in west Sanctuary with Bengal Tiger Activity Project (BAGH) funded by USAID and Strengthening Regional Cooperation for Wildlife Protection Project (SRCWP) funded by World Bank. Finding effectiveness in the detection of crime SMART has been extended to South and East Sanctuaries since June 2016. SMART has successfully arrested offenders and water vessel during committing

offense in the Sundarbans. For the capacity development of the Forest Department frontline staff, Wildlife Conservation Society (WCS), PANTHERA, and Bangladesh Forest Department officials are working together. GIZ has come forward to provide technical support for SMART to join the logistic support of World Bank.

6.3 Involvement of local community for the Sundarbans management including WHS:

For the management of Protected Areas (WHS) i.e. the property Four (4) Co-management Committee (CMC), have been formed with the local people in the impact zone to work jointly with BFD for the control of Wildlife Poaching and Illegal activities and awareness development in the Sundarbans Reserved Forest.

Co-management committees are the executive body under Co-management council. Four Co-management councils formed in 4 ranges each with 65 members from all stakeholders in which Honorable Member of Parliament is the advisor, The local Upazila Nirbahi Officer working as member secretary, Forest officials, local leaders of Union Parishad, all relevant government and non-government agencies and resource users are active member of the council. The Co-management committee is consists of 29 members in which representative of VCF, and CPG, resource users, forest officials and other relevant government agencies are present. The council sits once in a year for approving the decisions and activities of Co-management committee (CMC). CMC is shouldering the responsibilities of management of the protected area concern. CMC deliver their duties with the help of 210 Village conservation forum (VCF) and 4 people's forum (PF) the total member of the VCF is 32000 who has become the official actors for the conservation of the Sundarbans, perform jointly with the forest department.

European Union (EU), German Federal Ministry for Economic Cooperation and Development (BMZ), World Bank, USAID-funded projects are in place to reduce the dependency of people on the Sundarbans resources.

As per integrated Resources Management Plan for the Sundarbans 2010-2020 (IRMP) the total population living in the identified landscape around the SRF is estimated as high as 85.5 lakh (IRMP, Page.57). The dependency on SRF surrounding living people is quite high: BIDS (2010) reported that more than 28% of the landscape populations are dependent on the SRF. More than 1 million people are involved in various resources collection from SRF, a large majority of which are fishers including about 2.00 Lakh of shrimp fry fishers. If it is assumed that on an average, a collector harvests 1.8 products over the year, the number of SRF collectors are estimated at about 0.59 million. Various non-timber forest products help generate considerable employment and income generation opportunities for at least half a million poor coastal population (IRMP, Page.60).More than half a million people live on the collection of fuel wood and NTFPs such as fish, honey, wax and leave of trees from the SRF (IRMP, Page.59).

Adequate measures are already in place and continuity is being maintained with sufficient emphasis on maintenance of OUV of the property which is manifested in the following lines. The financial and human resources already have been enhanced by recruiting 103 number of frontline staffs and undertaking new projects for implementation, a number of projects are being implemented. A 96 million dollar (approx.) project is under active consideration for better protection of the Sundarbans and the property. Interagency cooperation in the local and National level already in

place for the greater interest of the Sundarbans protection. Formation of Co-management councils (CMC) and Co-management committees and different CBOs (As mentioned below) under CMC, the Crime Control Units, Village Tiger Response Teams are the examples of local coordination among agencies. National coordination is maintained by the "Sundarbans Suraksha Project" meeting in the office of the Honorable Prime Minister.

For maintaining sustainability and conservation of biodiversity, the Forest Department has undertaken projects in the Sundarbans Reserve Forest as well as for the property. Names of the projects implemented in recent past are as follows:

6.4 Mitigation and Adaptation measures due to climate change impact on the property

Department of Environment conducted an "Assessment of Sea Level Rise on Bangladesh Coast through Trend Analysis" (published July 2016). Analysis of tide gauge (Tide Gauge of BWDB, BIWTA, Chittagong and Mongla Port Authorities) data of 30 years shows trends of water level in the Ganges tidal floodplain of 7-8 mm/year. On the other hand, the trend is 6-10 mm/year in the Meghna Estuarine floodplain and 11-21 mm/year in the Chittagong coastal plain areas. So, it has been found that the overall trend in the coastal zone in the last 30 years has been 6-21 mm/year from west to south of the coastal zone of Bangladesh. The trend obtained from this study corresponds with the trend cited by SMRC (2003), where the trend is lower in the Ganges followed by medium range values in the Meghna and highest values in the Chittagong coastal plain. Also, in addition to similarities regarding rising trends, this study reveals that sea level has risen at a higher rate than in the past, thus consolidating the notion of rising sea level. Therefore, the MSL trend derived from the tidal gauge data along the coast of the Bay of Bengal is much higher than the GMSL trend derived from long-term global tide gauge data and short term satellite data.

To mitigate the impact of climate change Forest Department has taken massive coastal afforestation program since 1962 along the coastline of the country. So far about 200,000 hectares of the coastal green belt has been created through coastal afforestation program. The plantation created along the coasts minimizing global warming by sequestering more carbon from the atmosphere in addition to minimizing the devastating impact of Cyclone and tidal surges to save the life and properties of the people living on the coast.

Additionally, special measures are in progress to address the vulnerability of the property by improving the damaged parts of the embankment surrounding the Sundarbans, and improving the capacity of the forest dependent people living adjacent to the Sundarbans. So far about 5 km embankment has been rehabilitated along with greening of the area by plantation involving the local community. Embankment Management Committee has been formed with the local community. About 50,000 SRF dependent people trained for different alternate livelihood income generation.

The government of Bangladesh already maintains strong and praiseworthy position in putting in place sufficient measures to address adverse impacts of climate change through various activities/projects. To those efforts, one of the significant activities is the creation of on-going 2280 km. coastal green belt covering the coastline and the

islands. It is a priority project of the Hon'ble Prime Minister. However, considering the lacks of data relating to assessment of damage due to climate change impacts because of global warming, Department of Environment of Bangladesh with support from German Technical Cooperation (GIZ) is conducting a country-wide vulnerability assessment, which would develop a substantial database that would contribute to the overall planning and decision-making process and ultimately to enhance the resilience of vulnerable communities and ecosystems in the coastal regions of the country including the property.

The above information suggests climate change impacts of sea level rise, salinity intrusion, and freshwater flow reduction from upstream have been posing threats to the environment and ecosystem of the Sundarbans. Ministry of Environment and Forests, Ministry of Shipping and Ministry of Water Resources have been aware of the impacts of sea level rise, and taking adaptation measures and monitoring mechanism using mainstream national revenue fund and Bangladesh Climate Change Trust Fund.

6.5 Recent Completed Projects:

6.5.1 Sundarbans Environmental and Livelihood Security Project (SEALs), covering an area of 290 villages under 36 Unions of 11 Upazilas of Khulna, Satkhira, Bagerhat and Pirojpur districts of the Sundarbans Impact Zone (SIZ) involving 45,000 Sundarbans dependent local peoples.

6.5.1.1 The major activities sunder the project:

Alternate income generation (AIG) like crab fattening, grocery shop, sewing machine, fish culture, nursery development etc.Supply of 73 energy saving stove. Cash for works, for 200000 man-days.440 Disaster risk reduction awareness meeting. Training:For FD front line staff 598 on First Aid, 150 on Biodiversity management and skill development, 140 on Ecosystem management and skill development, 284 on FG capacity building.

6.5.1.2 Outcome of the Projects

Cyclone proof SRF protection infrastructure has been restored and modernized.The capacity of the FD front line staffs improved.45000Sundarbans dependent people got alternate livelihood support. Climate Vulnerability of SRF dependent people reduced. Partial Ecological Monitoring and Documenting of the property completed and published.

6.5.2 Sustainable development and biodiversity conservation in coastal protection forests (SDBC-Sundarbans)

6.5.2.1 Major Activities:

A Total 5.105 Km of vulnerable embankment sections in 10 locations of Satkhira and Khulna districts rehabilitation and 10 Embankment Management Committees (EMCs) formed. 470,000 non-mangrove and 15000 coconut seedlings distribution with 80 Km strip and 90 ha char/island plantation. Support 3,200 shrimp farmers to produce bio-organic certified shrimp, plantation of 300 ghers' dike. Re-excavation of four (4) ponds for supplying fresh water to the local communities. Training of 1740 Community people on Nypa palm harvesting, honey collection, plantation that depends on the Sundarbans resources. Hatchery based mud crab production trial in BRFI, Paikgacha, Khulna.

6.5.2.2 Outcome of the Project:

Reduction of climate vulnerability risks of the Sundarbans adjacent people through rehabilitation of damaged embankment. Establishment of green belt to protect life and property of adjacent people. Technology for mud crab hatchery developed. (1st time in Bangladesh).

6.6 Ongoing Projects:

6.6.1 Climate-Resilient Ecosystems and Livelihoods (CREL)

6.6.1.1 Major activities are

Improve governance of natural resources and biodiversity**.** Enhance Capacity of key stakeholders**.** Strengthening implementation of climate resilient natural resources management**.** Improving livelihoods those are environmentally sustainable and resilient to climate change.

6.6.1.2 Updated achievement of the project:

19,296 forest dependents people are provided livelihood supported. 195 Local Service Providers (LSP) recruited and trained. 31 farmer field days (FFD) done to promote new technologies. 18 market linkage workshops held to connect farmers with the markets. 87 demonstration plots (fish and vegetable) established to demonstrate technologies to the farmers. 84 Financial Literacy Learning Centers (FLLC) established, educating about 5000 forest resources users. A total of 31430 seedlings planted covering an area of 22.853 ha.

6.6.2 Bengal Tiger Conservation Activity (BAGH) project

6.6.2.1 Major Activities:

Tiger monitoring**,** Prey monitoring**,** Habitat monitoring**,** Vegetation sampling for current mangrove abundance**,** High-resolution vegetation mapping**.** Mobilizing five (**5)** community patrolling groups**.** SMART patrolling in west sanctuaries (WHS). Assess current status of Village Tiger Response Team (49 VTRT groups with 332 members), capacity development and training, Mitigation of Human Tiger Conflicts. SMART training to 30 FD staff by Panthera.

- SMART Patrolling is going on with Bengal Tiger Activity Project (BAGH) funded by USAID and Strengthening Regional Cooperation for Wildlife Protection Project (SRCWP) funded by World Bank. Wildlife Conservation Society (WCS), PANTHERA and Bangladesh Forest Department officials are working together to stop all illegal activities in the Sundarbans.

- To improve management of the Sundarbans 103 new frontline staffs have been recruited and placed. For the sustainability of SMART patrolling and Monitoring of WHS and SRF, a new project “Protection of the Sundarbans Mangrove Forests” (2016-2020) is under active consideration of the government. The project also includes other activities necessary to keep OUV of the property in addition to conserve the rich biodiversity of the Sundarbans.

- The Bengal Tiger Conservation Activity (BAGH) project under Bangladesh Forest Department (BFD) has been conducting sever diverse activities with an objective of

Ecological Monitoring of the Sundarbans these are Tiger monitoring, Occupancy Estimation, Camera Trapping, DNA Analysis, Prey Monitoring, Habitat Monitoring, Mangrove Monitoring, Land Cover Mapping, Disease Monitoring and Endoparasite in Carnivores and Herbivores in the Sundarbans.

- For the conservation of the property as well as SRF our Government is the member of CITES, GTI, GTF & SAWEN and working very effectively with the members following the respective regulations.

The above-mentioned conservation measures have been taken by BFD in order to protect the Biodiversity of the World Heritage Site as well as SRF. This is a continuous effort and in future, these measures with new conservation approaches and technology would be implemented for the better management of the resources in the SRF.

European Union (EU), German Federal Ministry for Economic Cooperation and Development (BMZ), World Bank, USAID-funded projects are working with Forest Department for the Sundarbans forest-dependent people to reduce the dependency on the property as well as SRF.

7. Future Conservation Plan

- A holistic management plan for the conservation of the Sundarbans will be developed involving all relevant agencies and the respective agency will come forward for implementing the plan.
- Ecological monitoring under international standard guideline will be continued with the help of acceptable international organization.
- Monitoring and Research will be continued with the new technique and technology.
- National and International coordination will be enhanced.
- Local level participation and capacity development for the management of the Sundarbans will be strengthened.
- Forest Department capacity development and logistic support will be increased for better protection and scientific management.
- Strategic Environmental assessment will be carried out.

Bangladesh Forests Department, Department of Environment, Department of Shipping, Bangladesh Inland Water Transport Authority, Mongla Port Authority, District and Sub-district Administration, Local Government Bodies, Law Enforcing Agencies and all other stakeholders are all working on that to secure maximum resilience in the face of climate change impacts as well as effective management of the Sundarbans Reserve Forests (SRF) to protect the property's ecosystem health and services.

6. Decision Item No 7 of 39 COM 7B.8 adopted by the WHC (Bonn, 2015)

Further requests the State Party to continue monitoring the effects of the December 2014 oil spill on the aquatic environment, and to take measures to prevent such accidents, drawing on the lessons learned so as to strengthen its oil spill preparedness and response capacity, in particular in view of the anticipated increases in river navigation related to the power plant developments upstream

Response of the State Party on Decision Item No 7:

1. The incident of the oil spill in December 2014 was just an accident. The relevant ministries, departments and agencies of the Government of Bangladesh have taken quick and immediate actions to response to the accident. The damage has been minimised with sincere actions in time. However, since then Government of Bangladesh has taken few measures to strengthen its oil spill preparedness and response capacity. In addition to the formulation of National Oil Spill Contingency Plan (NOSCOP), two ships equipped with spill oil collection systems have recently been added to our Coast Guard Fleet. Two more similar ships are also in the process of induction in Bangladesh Coast Guard. Mongla Port Authority is also in the process of procuring one spilled oil collection vessel.
2. The incident of the oil spill in December 2014 was just an accident. The relevant ministries, departments and agencies of the Government of Bangladesh have taken quick and immediate actions to response to the accident. The damage has been minimised with everybody's sincere and actions in time. However, since then Government of Bangladesh has taken a few measures to strengthen its oil spill preparedness and response capacity. In addition to the formulation of a comprehensive oil spill contingency plan, two ships equipped with spill oil collection systems have recently been added to our Coast Guard Fleet.
3. Mongla Port Authority has been also in the process of procuring one spilled oil collection vessel as such our monitoring system along with preparedness is now much better which will be more improved in future with the inclusion of a few more pollution control vessels in our fleet.
4. National Oil Spill Contingency Plan (NOSCOP), Bangladesh has been drafted and will be adopted soon. Bangladesh NOSCOP will be implemented by the Government according to the protocol laid down in the Plan, and international and regional support will be sought in case of necessity.
5. After the oil spill accident of 2014, Department of Environment, Bangladesh regularly monitors all parameters of the water quality at the Pashur River and Shela River within the Sundarbans area monthly. During the oil spill and the present condition water quality of the Shela river report are as follows:

Parameter	During oil spill 10/12/2014-18/12/2014	Present (July 2016)	Standard value range*
Total dissolved solid (TDS)	1635-1890 mg/L	1163 mg/L	-
Ph	7.8-8.0 mg/L	7.83 mg/L	6.5-8.5
Electrical Conductivity (EC)	3250-3800 micro S/cm	2326 micro S/cm	-
Chloride (Cl)	1030-1200 mg	688 mg	-
Dissolve Oxygen (DO)	5.6-7.0 mg/L	6.1 mg/L	>=5
Salinity	1.2-2.2 ppt.	1.8 ppt.	-
Turbidity (Tbd)	104-131 JTU	70.7 JTU	-
Total Solid (TS)	-	1243 mg/L	-
Suspended Solid (SS)	-	80 mg/L	-
Biological Oxygen Demand (BOD)	-	0.8 mg/L	<2
Total Alkalinity (TA)	-	36 mg/L	-

Source: DOE, Khulna, Bangladesh Lab report (2016).*EQS of ECR, 1997

6. Future Plan: Implementation of NOSCOP along with inclusion of different platforms with pollution control system will strengthen our oil spill preparedness and response capacity.
7. On an average one purpose – built (as per international convention), environment friendly low speed lighterage vessel for carrying coal per day will come to Project site which is only 2.8% of the existing number of vessels that ply in the long established maritime route of Mongla Port daily.

7. Decision Item No 8 of 39 COM 7B.8 adopted by the WHC (Bonn, 2015)

Requests furthermore the State Party to invite a joint World Heritage Centre/IUCN Reactive Monitoring mission to the property to review the state of conservation of the property, and the potential impacts of the thermal power plant development and dredging of The Pashur River

Response of the State Party on Decision Item No 8:

Based on the above decision a joint WHC-IUCN Reactive Monitoring Mission (RMM) visited Bangladesh (to the property) to review the state of conservation of the property, and the potential impacts of the thermal power plant development and dredging of the Pashur River in March 2016. The World Heritage Centre (WHC) sent to Bangladesh (to Ambassador Extraordinary and Plenipotentiary of Bangladesh to France) an RMM report in August 2016 with a request to notify the WHC of any factual errors in the RMM report. Bangladesh, the State Party, thoroughly reviewed and examined the RMM report, and identified many factual errors in the report and transmitted a 63-page response with 36 annexes to the WHC on 10 October 2016 with a request to revise the RMM report by incorporating the factual errors identified by Bangladesh before uploading the RMM report in the website of WHC. The state party with huge disappointment noticed that WHC published the RMM report in the WHC website on 12 October 2016 without taking care of and incorporating the factual errors identified by Bangladesh. A six-member delegation of high officials of the Government of Bangladesh with Bangladesh Ambassador in France discussed the Bangladesh response report with WHC and IUCN officials at UNESCO HQs in Paris in the last week of October 2016, and agreed to upload Bangladesh's response with a news item in the WHC website. The Bangladesh delegation also attended some of the sessions of the World Heritage Committee's 40th meeting held at UNESCO HQ in Paris. During the meeting with WHC-IUCN officials at UNESCO HQ on 28 October 2016, Bangladesh delegation handed over a letter to the Director of WHC in response to the final report of the RMM published in the UNESCO-WHC's website on 12 October 2016 (copy of the letter enclosed as **Annexure-9**).

The response report of Bangladesh on the RMM report which was sent to WHC on 10 October 2016 has been updated with some progress done in the meantime. A copy of the updated response report on the RMM report is enclosed with this document **(Annexure-10).**