Action Plan for Deepar Beel

Priority - III

Environment & Forest Department
Government of Assam

ACTION PLAN FOR DEEPAR BEEL-PRIORITY III

1. Basic information about the Stretch

Deepor Beel is a permanent fresh water lake and largest Beel in the Brahmaputra valley of Lower Assam. Deepor Beel is the only Ramsar site in Assam and amongst the third Ramsar site of the north eastern region of India. It is located between latitude 26°03′26″–26°09′26″N and longitude 90°36′39″–90°41′25″E and situated 10 km southwest of Guwahati city, surrounded by residential, commercial and institutional areas. It is situated at an altitude of 53 meters above MSL, maximum depth is 4m, however during the dry season it drops to about 1 m. Ramsar Convention in 2002 declared 40.14 sq km as Deepor Beel wetland and 4.14 sq km area was proposed as a bird sanctuary under the Wildlife Protection Act of India, 1972 (Government of Assam, 1989).The main inlets of the beel are the Mora Bharalu and the Basishtha-Bahini rivers which carry the sewage as well as rain water from Guwahati city. The only outlet of the beel is Khanajan located towards the northeast having connection with the main river Brahmaputra. The beel is fringed by Rani-Garbhanga reserve forest in the south and the beel has also been playing crucial role in catering the biological need of elephant population of Rani and Garbhanga Reserve Forest with other important mammals of the area. The Deepor Beel and its fringe areas are made up of recent alluvium consisting of clay, silt, sand and pebbles.

1.1. Polluted river stretch/length

The total area of the polluted stretch of Deepar Beel is 40.14 sq km (Fig 1). The area has been suffering from environmental degradation due to continuous encroachment and waste dumping as the Guwahati Municipality dump yard (24 Ha) located in Boragaon, lies in the eastern corner of Deepor Beel. The encroachment of the beel is also very evident and rampant as there are a number of dwelling units and cement structures and hence encroachment and settlements around the periphery has contributed to shrinking of the beel. The wetland ecosystem is also disturbed by the railway railroad in the southern boundary and the embankment for the railroad has resulted in the water flow blockage.

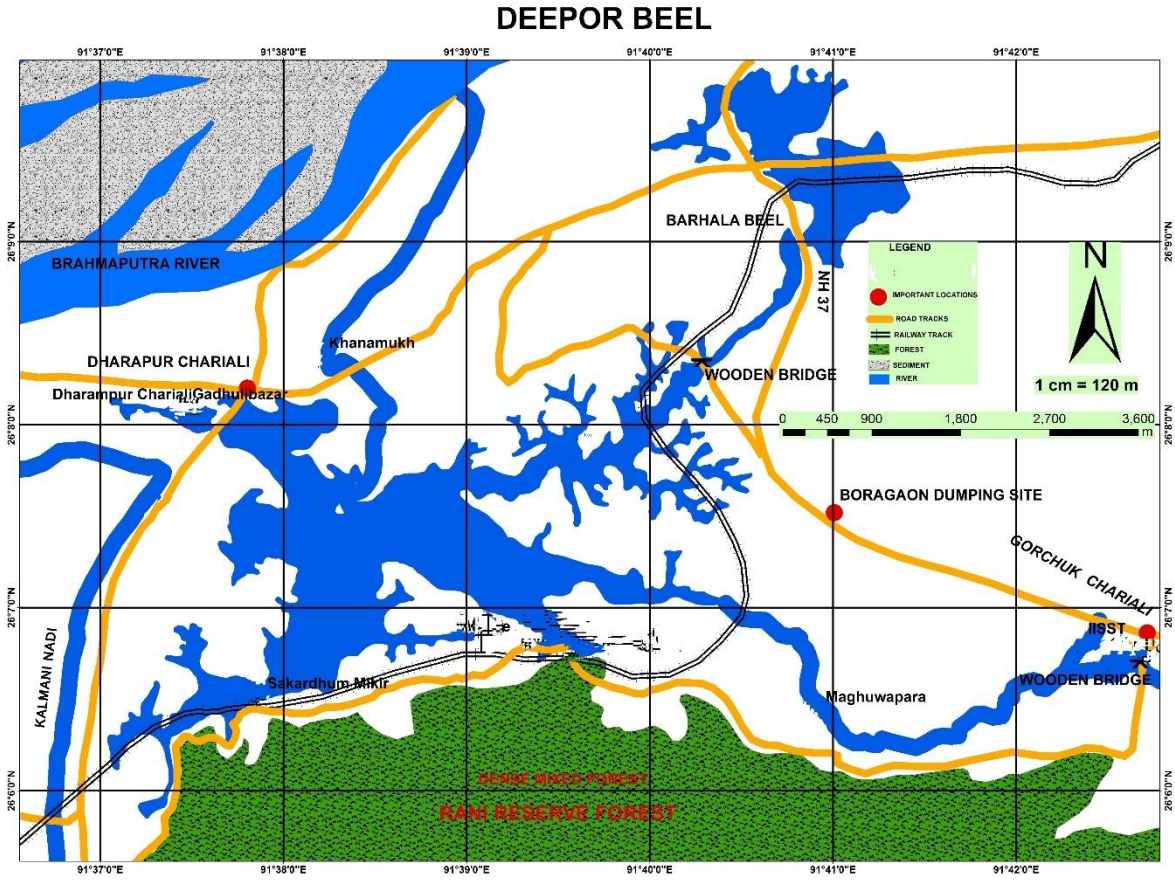

Fig 1: Map showing the Deepar Beel wetland

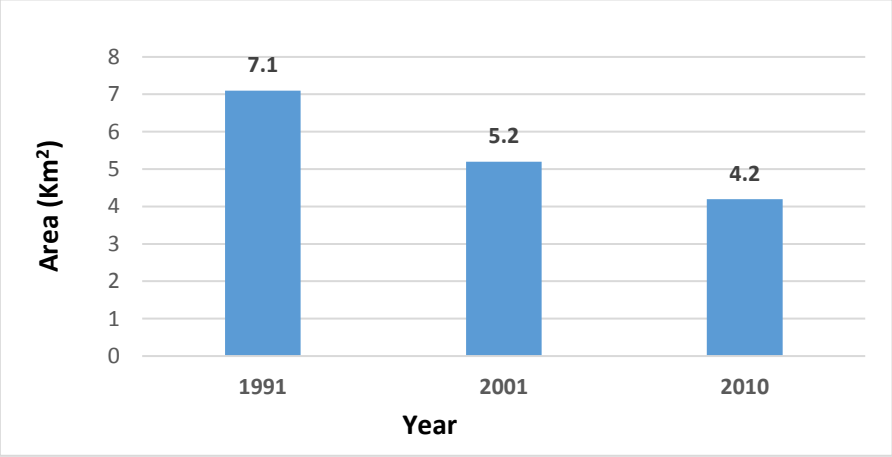

Fig 2: Decadal changes in the spatial extent of Deepar Beel (1990-2010)

2. Background:

In compliance of the direction of Hon'ble National Green Tribunal, Principal Bench, New Delhi in the matter of news published in 'The Hindu' authored by Jacob Koshy, Tiltled 'More river stretches are now critically polluted CPCB', Government of Assam constituted River

Rejuvenation Committee (RRC) vide memorandum 673/2018 dated 19/12/2018 for effective abatement of pollution, rejuvenation, protection and management of the identified polluted stretches, for bringing the polluted river stretches to be fit at least for bathing purposes within six months

3. Basis of Action Plan for Deepar Beel

The action plan for rejuvenation, protection and management of the identified polluted river stretch of Assam has been prepared based on the following

- As per direction of Hon'ble National Green Tribunal, Principal Bench, New Delhi in the matter of news published in 'The Hindu' authored by Jacob Koshy, Tiltled 'More river stretches are now critically polluted CPCB'
- Comprehensive report on Prevention and Control of Pollution in River Hindon: An Action Plan for Rejuvenation' [Submitted in compliance to Hon'ble National Green Tribunal]

4. Components of Action Plan

(a) Industrial Pollution Control

- Inventorisation of industries
- Categories of industry and effluent quality
- Treatment of effluents, compliance with standards and mode of disposal of effluents
- Regulatory regime.

(b) Identification, Channelization, Treatment and Utilization of Treated Domestic Sewage

- Identification of towns in the catchment of river
- Town-wise Estimation of quantity of sewage generated and existing sewage treatment capacities to arrive at the gap between the sewage generation and treatment capacities;
- Identification of towns for installing sewerage system and sewage treatment plants.
- Storm water drains now carrying sewage and sullage joining river and interception and diversion of sewage to STPs,

- Treatment and disposal of septage and controlling open defecation.

(c)River catchment/Basin Management-Controlled ground water extraction and periodic quality assessment

- Periodic assessment of groundwater resources and regulation of ground water extraction by industries particularly in over exploited and critical zones/blocks.
- Ground water re-charging /rain water harvesting
- Periodic ground water quality assessment and remedial actions in case of contaminated groundwater tube wells/bore wells or hand pumps.
- Assessment of the need for regulating use of ground water for irrigation purposes.

(d)Flood Plain Zone

- Regulating activities in flood plain zone.
- Management of Municipal, Plastic, Hazardous, Bio-medical and Electrical and Electronic wastes.
- Greenery development- Plantation plan.

(e) Ecological/Environmental Flow (E-Flow)

- Issues relating to E-Flow
- Irrigation practices

(f) Such other issues which may be found relevant for restoring water quality to the prescribed standards.

5. Action Plan as per direction of Hon'ble NGT

The components to be discussed in the action plan for rejuvenation, protection and management of identified polluted stretch of Deepar Beel are as follows

5.1. Industrial Pollution Control

Classified industrial units in the form of Health care Units, Hotels, Tea estates etc. are observed with infrastructural facilities (ETPs, STPs) in the periphery of the polluted river stretch of Deepar beel along with few small scale industrial establishments which is presented at **Table I**

Further directions were issued by the PCBA to all the industrial units which has failed to comply with the discharged norms. Moreover, the Board has also issued direction to build their own set up in their premises which do not have STP/ETP

Table I: Industry details as per the following of Deepar Beel polluted stretch												
Sl. No	**Name of the Industry**	**Category**	**Total Water Consumption (KLD)**		**Waste Water /waste Generation (KLD)**	**Without consent/Directions issued**	**ETPs**		**CETPs**	**OCEMS**	**Gaps in KLD**	**Proposed CETP**
			Ground Water/ Surface water	**Supply Water**			**Functional**	**Non-Functional**				
1	NE RMC, Pamohi, Garchuk	Orange	3	-	ZLD	Consent Granted	Functional	-	**Nil**	Nil	**Nil**	**Nil**
2	Tantia Construction Company, Pamohi, Garchuk		5	-	ZLD	Consent Granted	Functional	-			**Nil**	
3	Radisson Blue, Near NH-37, Gotanagar		100	-	80	Consent Granted	Functional				**Nil**	
4	Ayurvedic College Hospital, Jalukbari, Guwahati		30	-	24	Closure notice issued		Non-Functional			**24**	
5	Excelcare Hospital, NH-37, Guwahati		80	-	62	Consent Granted	Functional				**Nil**	
6	Akangsha Hospital, NH-37, Guwahati		30	-	22	Consent Granted	Functional				**Nil**	
7	Jyoti Industry, Pamohi, Garchuk	Green	3	-	2.3	Consent Granted	Functional				**Nil**	
8	JNS Enterprise, Pamohi, Garchuk		5	-	3.2	Consent Granted	Functional				**Nil**	
9	Maheswari Industries, Khanamukh, Guwahati		-	-	ZLD	Consent Granted	Functional				**Nil**	
Total			**258**	-	**193.5**	-	-				**24**	

Following are the suggestions for control of industrial pollution control

- The industry that will extract groundwater for manufacturing process should not operate unless they possess valid permission for groundwater extraction from Central Ground Water Authority.
- No industries should discharge their effluent directly into drains without treatment, rather they should reuse their treated effluent/sewage.
- Direction to be issued to the units which are not complying to the effluent discharge norms as per Section 5 of the Environment (Protection) Act, 1986, by PCBA for ensuring compliance to the discharge norms.

6. Identification, Channelisation, Treatment and Utilization of Treated Domestic Sewage

6.1. Major towns located on the bank

Guwahati is the only city located around 10 kms away from Deepar beel. However, the villages around Deepar Beel has a total population of approximately 5000 population and 1200 numbers of households most of which belong to lower income groups living under the poverty line and depend directly or indirectly on the wetland's natural resources. The major villages identified across the catchment areas are Chakardeo, Pamohi, Sakardhum Mikir, MatiaPahar, Deochotal, Maghuwapara, Banghara Than, Dharapur Chariali, Gorchuk, Boragaon etc. These villages discharge sewage of approximately 540 KLD which is very minimal and can be managed by adopting stringent remedial actions.

6.2. Town wise estimation of quantity of sewage generated and existing sewage treatment capacities

Guwahati is the major city responsible for discharging of sewage, as the Deepar Beel serves as the storm water reservoir and usually filled up with rain water generally by the end of June along with the city sewage through the Mora Bharalu rivulet. An estimated 540 KLD of sewage is generated from the catchment area of Deepar Beel.

6.3. Identification of towns for installing sewerage system and sewage treatment plants.

Deepar beel is the only major storm water storage basin and acts as the natural storm water reservoir for the Guwahati city through the Mora bharalu rivulet. Mora bharalu river is a channel that is abandoned by the river Bharalu at Fatasil Ambari and meets Basistha Bahini river at Pamohi which eventually confluence with Deepar Beel. The length of the Mora Bharalu rivulet from Fatasil Ambari till the confluence with Deepar Beel is 13.5 kms and runs through Fatasilambari, Bishnupur, Kalapahar colony, Dhirenpara, Manpara, Subhash Pally, Garchuk and Pamohi.

Hence the untreated Guwahati city sewage received by the wetland through the Mora Bharalu channel plays a major role in polluting the wetland. Sewage Treatment Plant has already been proposed for Guwahati city along the bank of River Bharalu at three points having total capacity of 75 MLD namely at Jonali point, another near the confluence of Borsola with Bharalu River at Sarabbhati area and the last one at just before confluence with Brahmaputra river at Bharalumukh.

In this regard, Action Plan for Bharalu river has already been prepared along with the treatment capacity and cost estimate of the three proposed STPs.

Table II: Sewage generation and gaps in treatment

S.N	Area	Population as per 2011 census	Water Consumption (KLD) @135lpcd	Sewage Generation (KLD)	No. of STPs proposed	Existing Treatment capacity (KLD)	Gaps in KLD
1	DeeparBeel	5000	675	540	Nil	Nil	540

Table III: Total gap in projected population and sewage generation till 2035

S.N	Area	Projected Population till 2025	Water Consumption (KLD) @135lpcd	Sewage Generation (KLD)	No. of STPs proposed	Existing Treatment capacity (KLD)	Gaps in KLD
1	DeeparBeel	6860	926.1	740.9	Nil	Nil	740.9

The villages situated in the bank of the Deepar Beel wetland are small and medium localities and there is no further scope and land availability for future settlement in the catchment area.

6.4. Water Quality of Deepar Beel

The water quality of Deepar Beel is monitored at two locations as given in the table below in **Table IV**

Table IV: Monitoring locations details

S.No	Sampling Location	Coordinates
1	Deepor Beel near Dharapur Chariali	26°8'6.72" N 91°37'32.4" E
2	Deepor Beel near IASST, Boragaon	26°6'50.2" N 91°39'49.3" E

The change in the water quality of Deepar Beel in terms of BOD value in mg/l for the period 2016-2020 is presented below in **Table V**

Table V: BOD value in mg/l of Deepar Beel for the year 2016-2020

Deepor Beel near Dharapur Chariali										Deepor Beel near IASST, Boragaon									
Year	BOD	Year	BOD	Year	BOD	Year	BOD	Year	BOD	Year	BOD	Year	BOD	Year	BOD	Year	BOD	Year	BOD
Jan-16	2.7	Jan-17	3.0	Jan-18	3.6	Jan-19	2.7	Jan-20	2.1	Jan-16	4.2	Jan-17	2.8	Jan-18	4.4	Jan-19	2.6	Jan-20	2.8
Feb-16	0.8	Feb-17	6.9	Feb-18	3.6	Feb-19	4.1	Feb-20	3.8	Feb-16	2.0	Feb-17	2.8	Feb-18	6.0	Feb-19	4.6	Feb-20	3.6
Mar-16	1.8	Mar-17	3.4	Mar-18	4.6	Mar-19	4.8	Mar-20	3.3	Mar-16	3.6	Mar-17	3.3	Mar-18	4.0	Mar-19	4.2	Mar-20	3.4
Apr-16	2.0	Apr-17	4.2	Apr-18	5.6	Apr-19	4.8			Apr-16	3.0	Apr-17	2.4	Apr-18	4.6	Apr-19	4.6		
May-16	2.9	May-17	3.3	May-18	4.8	May-19	4.4			May-16	11.4	May-17	3.1	May-18	5.5	May-19	4.2		
Jun-16	3.3	Jun-17	6.5	Jun-18	5.3	Jun-19	3.9			Jun-16	5.4	Jun-17	7.2	Jun-18	4.8	Jun-19	3.8		
Jul-16	2.2	Jul-17	2.6	Jul-18	5.0	Jul-19	3.5			Jul-16	6.0	Jul-17	2.9	Jul-18	8.5	Jul-19	3.5		
Aug-16	2.6	Aug-17	2.9	Aug-18	7.0	Aug-19	3.4			Aug-16	7.5	Aug-17	2.9	Aug-18	8.2	Aug-19	3.2		
Sep-16	10.6	Sep-17	3.8	Sep-18	5.0	Sep-19	3.0			Sep-16	5.4	Sep-17	3.6	Sep-18	4.8	Sep-19	3.1		
Oct-16	5.3	Oct-17	2.9	Oct-18	4.7	Oct-19	3.3			Oct-16	5.0	Oct-17	3.1	Oct-18	2.6	Oct-19	3.1		
Nov-16	3.5	Nov-17	4.8	Nov-18	11	Nov-19	3.4			Nov-16	3.8	Nov-17	4.6	Nov-18	12.0	Nov-19	3.2		
Dec-16	3.4	Dec-17	5.4	Dec-18	3.6	Dec-19	3.4			Dec-16	2.2	Dec-17	4.8	Dec-18	3.6	Dec-19	3.6		

The detail analytical data of the Deepar Beel at two locations for the month of March 2020 are presented in **Table VI**

Table VI: Latest analysis report of Deepar Beel at two locations- March 2020

Parameter	Deepor Beel near Dharapur Chariali	Deepor Beel near IASST, Boragaon
D.O. (mg/L)	10.2	10.1
pH	8.0	7.7
Cond(µS/cm)	210	209
BOD(mg/L)	3.3	3.4
COD(mg/L)	18.0	17.5
NO_3 -N (mg/L)	1.6	1.3
TSS (mg/L)	60	56
Turbidity (NTU)	03	02
p-Alkalinity (mg/L)	Nil	Nil
m-Alkalinity (mg/L)	92	96
Hardness (mg/L)	42	38
Calcium as $CaCO_3$(mg/L)	28	26
Magnesium as $CaCO_3$ (mg/L)	14	12
Chloride as Cl- (mg/L)	12	10
Sulphate as SO_4^{-2} (mg/L)	25.0	26.2
Phosphate as PO_4 (mg/L)	0.34	0.38
TKN (mg/L)	1.30	1.26
NH_4-N (mg/L)	0.56	0.54
Total Dissolved Solids (mg/L)	120	118
TFS (mg/L)	30	28
Fluoride (mg/l)	0.66	0.64
Boron (mg/l)	0.016	0.013
Na (mg/L)	22.3	22.2
K (mg/L)	5.3	5.8
Total Iron (mg/L)	0.31	0.25
Lead (mg/L)	BDL	BDL
Zinc (mg/L)	0.052	0.043
Copper (mg/L)	0.003	0.004
Total Chromium (mg/L)	BDL	BDL
Nickel (mg/L)	BDL	BDL
Cadmium (mg/L)	BDL	BDL
Mercury (mg/L)	BDL	BDL
Arsenic(mg/L)	BDL	BDL
Total Coliform (MPN/100ml)	730	360
Faecal Coliform (MPN/100ml)	300	Nil

The above data indicated that the BOD value has failed to meet the standard criteria in most of the occasions. The BOD value which indicates organic load generally increases due to the waste generated from the activity of the residents in the form of domestic household waste through different drains and channels. This consistent exceedance of BOD value may be due to the untreated city sewage received by the wetland through the Mora Bharalu rivulet at confluence with Deepar Beel at Pamohi. The dumping of municipal solid wastes in its close proximity at Boragaon by the Guwahati Municipal Corporation (GMC) has also pushed the wetland's pollution to alarming levels. The problem gets aggravated during the monsoons, with rainwater sweeping large amounts of garbage from the dumping site to the Beel. Hence this constant failure to meet the standard criteria may be due to solid waste dumping site at Boragaon and the untreated city sewage as the Guwahati city does not have a Sewage Treatment facility for the waste.

However, Action Plan for Bharalu river has already been prepared and approved by CPCB along with the treatment capacity and cost estimate of the three proposed STPs.

6.5. Drains contributing to pollution

No drains were observed to be directly connected to the beel. However, Deepar beel is the only major storm water storage basin and acts as the natural storm water reservoir for the Guwahati city through the Morabharalu rivulet. Morabharalu river is an abandoned channel by the river Bharalu at Fatasil Ambari and meets Basistha Bahini river at Pamohi and eventually confluence with Deepar Beel. The length of the Mora Bharalu rivulet from Fatasil Ambari is 13.5 kms and runs through Fatasil ambari, Bishnupur, Kalapahar colony, Dhirenpara, Manpara, Subhash Pally, Garchuk and Pamohi.

6.6. Characteristics of the major drains

The morabharalu rivulet which joins the Basistha Bahini river mainly carries sewages. The water quality of the Mora Bharalu rivulet is presented in Table VII below.

Table VII: Water quality of the Mora Bharalu rivulet (March 2020)

Parameter	Value
D.O. (mg/L)	4.8
pH	7.2
Cond(µS/cm)	168
BOD(mg/L)	4.8
COD(mg/L)	28.3
NO_3 -N (mg/L)	2.4

Parameter	Value
TSS (mg/L)	44
Turbidity (NTU)	06
p-Alkalinity (mg/L)	Nil
m-Alkalinity (mg/L)	96
Hardness (mg/L)	54
Calcium as $CaCO_3$(mg/L)	36
Magnesium as $CaCO_3$ (mg/L)	18
Chloride as Cl- (mg/L)	8
Sulphate as SO_4^{-2} (mg/L)	16.2
Phosphate as PO_4 (mg/L)	0.26
TKN (mg/L)	1.72
NH_4-N (mg/L)	0.56
Total Dissolved Solids (mg/L)	106
TFS (mg/L)	24
Fluoride (mg/l)	0.32
Boron (mg/l)	0.021
Na (mg/L)	12.3
K (mg/L)	5.2
Total Iron (mg/L)	0.21
Lead (mg/L)	BDL
Zinc (mg/L)	0.038
Copper (mg/L)	BDL
Total Chromium (mg/L)	BDL
Nickel (mg/L)	BDL
Cadmium (mg/L)	BDL
Mercury (mg/L)	BDL
Arsenic(µg/L)	BDL
Total Coliform (MPN/100ml)	15000
Faecal Coliform (MPN/100ml)	2000

6.7. Flow details of the major drains contributing to river pollution

The Discharge has also been measured at Mora Bharalu river and it is around 0.32 – 0.71 m^3/sec respectively

6.8. Sewage generation from the towns located on the banks of the polluted river

The wetlands is generally fed by the Basistha Bahini river along with sewage from Mora Bharalu rivulet. During monsoon the sluice-gate of Bharalu river is closed as the Brahmaputra flows above the water level of the Bharalu channel and the city water is diverted to Deepor Beel via the Mora bharulu.

Dumping of municipal solid wastes in its close proximity at Boragaon by the Guwahati Municipal Corporation (GMC) has also pushed the wetland's pollution to alarming levels. Hence the major threats of the beel is as follows

- Solid waste disposal by GMC at Boragaon
- Drainage of city's municipal and industrial waste from point and nonpoint sources

6.9. Number of Sewage treatment plants present and treatment capacity, and gaps

There is no any sewage treatment plant at present.

6.10. Number of STPs proposed and capacity

Government of Assam has already proposed to set up three (03) numbers of STPs in the Guwahati city.

In this regard, Action Plan for Bharalu river has already been prepared and approved by CPCB along with the treatment capacity and cost estimate of the three proposed STPs.

As the untreated city sewage enters the wetland through the Mora bharalu river with its origin at Fatasil ambari, hence separate STP would not be required in the vicinity of the wetland.

6.11. Interception and diversion of drains /in situ treatment given

Three (03) numbers of STPs have been proposed with interceptor drains for in situ treatment before outfall.

In this regard, Action Plan for Bharalu river has already been prepared and approved by CPCB along with the treatment capacity and cost estimate of the three proposed STPs.

6.12. Drainage system/ sewerage network present/proposed

Encroachment has blocked the natural drainage pattern of the Deepor Beel causing the water level imbalance in the Beel. Natural drainage of local origin like Basistha Bahini, morabharalu and kalmani are responsible for draining off majority of the city sewage.

There is no sewerage system at present. Three numbers of STPs along with interceptor drains for collection of the sewage of the basin has been proposed at Guwahati city. All the sewage of the catchment area of the

river/wetland shall be collected by interceptor drains and shall be treated in the proposed STPs before outfall in to the river/wetland.

6.13. Treatment and Disposal of Septage and controlling Open Defecation

Some of the households in the villages are equipped with ordinary septic tanks and most of the local dwellers have kuccha latrines.

Following remedial actions will be taken in consideration of treatment and disposal of sewage

- Every households should be recommended to have individual drainage that should be connected to soak pits or stagnated pool.
- To shift the municipal solid waste ground situated at Boragaon to a different location
- The discharge should be trapped by strainers before draining off to the river.
- Prohibition of direct disposal of solid waste in the banks of the wetland.
- Public awareness to control open defecation and understand the sanitary hygiene.
- Local administration should provide proper pucca toilets for the individuals or atleast community toilets through the IHHL scheme under Swachh Bharat Mission.

6.14. Short Term Measures

- Periodical cleaning of Deepor Beel.
- In- situ treatment of sewage by Bioremediation.
- Dosing of microbes near the drain outfall of all the drains.
- Strict vigilance of the industries to check that no industrial effluent is out falling in the drains

7. Controlled Ground water Extraction and quality Assessment

About 49% of the households rely on tube well to obtain potable water. Very few numbers of the population owns earthen well whereas some of them depends on both supplied water as well as concrete well.

The details of estimated ground water resource in Kamrup district is presented below in **Table VIII**

Table VIII: Estimation of ground water resource in the Kamrup district

Ground water extraction details	Ground water	Irrigation Practices	Ground water recharging mechanism	Rain water harvesting
Gross Ground Water Draft	1487.29 mcm	Minor and medium irrigation schemes such as DTW and STW	Recharging of groundwater are done by creation of Pond/lakes under government schemes.	The roof top rainwater harvesting is practiced.
Net Ground Water Availability	715.97 mcm			
Stage of Ground Water Development	43%			
Existing draft for Irrigation Use	586 mcm			
Future provision for Domestic & Industrial Use	105.16 mcm			

The Kamrup district is still under 'Safe' category and sufficient resources are still available for future development

7.1. Status of Ground Water

The water quality is found to be well within the permissible limit for drinking, irrigation and industrial purposes. Due to slightly higher content of iron in some sporadic patches of the area and fluoride content exceeding permissible limit in some pockets in and around Guwahati City, water needs to be treated before being used for drinking purpose.

However, as per the data generated from PCBA, the ground water quality around the Deepar Beel area is found to be within the permissible limit and safe for domestic and irrigation purposes.

Table IX: Latest analysis report of Ground water from MSW dumping site at Boragaon

Parameter	Value
pH	7.2
Cond(µS/cm)	174
BOD(mg/L)	1.4
COD(mg/L)	4.8

Parameter	Value
NO_3 -N (mg/L)	2.2
TSS (mg/L)	6
Turbidity (NTU)	2
p-Alkalinity (mg/L)	Nil
m-Alkalinity (mg/L)	184
Hardness (mg/L)	58
Calcium as $CaCO_3$(mg/L)	40
Magnesium as $CaCO_3$ (mg/L)	18
Chloride as Cl- (mg/L)	8
Sulphate as SO_4^{-2} (mg/L)	8.4
Phosphate as PO_4 (mg/L)	0.06
Total Dissolved Solids (mg/L)	114
TFS (mg/L)	30
Fluoride (mg/l)	0.34
Boron (mg/l)	0.011
Na (mg/L)	22.4
K (mg/L)	5.6
NH_4-N	0.14
TKN	0.46
Total Iron (mg/L)	1.8
Lead (mg/L)	BDL
Zinc (mg/L)	0.422
Copper (mg/L)	0.004
Total Chromium (mg/L)	BDL
Nickel (mg/L)	BDL
Cadmium (mg/L)	BDL
Mercury (mg/L)	BDL
Arsenic(µg/L)	BDL
Total Coliform (MPN/100ml)	Nil
Faecal Coliform (MPN/100ml)	Nil

7.2. Remedial Actions

The following remedial actions will be taken in consideration of contaminated ground water sources, controlled ground water extraction and periodic quality assessment

- Ground water of deeper aquifers should be analyzed for periodic assessment of element like Arsenic, Fluoride, Iron etc.
- Alternate sources of drinking water should be explored and prioritized.

- Awareness campaigns about health hazards due to intake of excessive Arsenic, Fluoride are the need of the time.
- Role of pesticides used for agricultural activity should be carefully observed.
- Survey should be conducted regarding ground water uses by different categories such as domestic, Industries etc and also to identify the over exploited and critical areas in the river/wetland stretches with respect to ground water extraction.
- Effective management of industrial effluent or sewage for preventing contamination of ground water sources.
- The industry that will extract groundwater for manufacturing process should not operate unless they possess valid permission for groundwater extraction from Central Ground Water Authority.
- Strict vigilance and conducting inspection of the industries to rule out any forceful treated effluent injection in to ground water resources.
- Roof top rain water harvesting techniques should be encouraged for industrial, commercial or individual households and community.

8. Flood Plain Zone

The following are the identified flood prone area for Deepar Beel

Name	Flood plain areas
DeeparBeel	Chakardeo, Pamohi, Sakardhum Mikir, Matia Pahar, Deochotal, Maghuwapara, Banghara Than

8.1. Regulating activities in the Flood Plain Zone

Further following activities need to be regulated in the flood plain zones.

S.No	Action points	Responsible authority
1	Plantation in the flood plain zone	Forest Department
2	Checking Encroachment	Local administration
3	Demarcation of the flood plain zone	Water Resource Department
4	Prohibition of disposal of all kinds of wastes	District Administration

8.2. Waste management status

Table X: Management of Industrial, Municipal, Biomedical, Plastic and Electronics Waste

Type	Status	Proposed actions	Authority	Time Targeted
Industrial Waste	a) Authorisation have been granted to different industries in line with Water act 1974, Hazardous Waste (Management, Handling and Transboundary Movement) Rule, 2008 as amended. b) Regular monitoring by PCBA to ensure that the terms and conditions are strictly adhered in accordance with the prescribed standards.	a) Direction issued to the industries to identify the non-point sources and arrest contamination of storm water. b) Closure notice has been issued to the industries on the ground of not having ETPs c) Further visited the industries and ensured closure	**Pollution Control Board Assam**	**3 Months (April 2020 – June 2020)**
Municipal waste	a) Dumping is carried out unscientifically in the open space at Boragaon Dumping ground b) Lack of unscientific disposal facilities/infrastructure technology like decentralized composting or bio-methanation plant, waste to energy plant, solid waste management plant. c) The individual households adopt insitu management like burial/composting in their premises.	Municipal Body is in process and inducted the following activity a) To shift the municipal solid waste plant at the Beel which is causing a huge trash dump near it. b) Awareness generation regarding the solid waste management rules	**Guwahati Municipal Corporation**	**3 Months (April 2020 – June 2020)**

Type	Status	Proposed actions	Authority	Time Targeted
Plastic Waste	Dumping is carried out unscientifically in the open space along with the municipal waste.	Letter is being sent intermittently by PCBA to the Municipal Board to segregate and collect plastic waste and initiate necessary steps to channelize the waste to authorized agencies for recycling and reprocessing	**ULBs/Guwahati Municipal Corporation/Pollution Control Board Assam**	**Continuous**
Hazardous Waste	No Hazardous Waste generating industrial units are located on the bank of the Deepar Beel wetland	Awareness campaign regarding health and other issues related to Hazardous waste	**Pollution Control Board Assam**	**Continuous**
Bio-medical Waste	a) Segregation at the source under Biomedical waste Management Rules, 1998 as amended b) The segregated waste is transported and then incinerated by Fresh Air Waste Management Services Pvt. Ltd at Common Biomedical Waste Treatment Facility, Panikheti	a) Direction issued to all HCF unit to implement the BMW Rules, 2016 as ammended in all HCF Units. (As per guidelines of CPCB) b) Four more Common Biomedical Waste Treatment Facility (CBWTF) are proposed for the other towns of the State as one CBWTF is permitted at a radius of 70 kms,	**HCF units/Pollution Control Board Assam**	**Continuous**
E –waste	a) Annual return in (Form-3) is submitted by E-Waste generating units to PCBA from time to time for onwards transmission to CPCB b) Most of the e-waste generator have sent their e-waste to their respective manufacturer. c) There is no authorised recycler, refurbisher, dismantler etc.	Few entrepreneur approached PCBA for registration and authorisation as Recycler	**Pollution Control Board Assam**	**Continuous**

Type	Status	Proposed actions	Authority	Time Targeted
	available to ensure environmentally sound management of E-waste. d) There is no "facility" wherein the process of dismantling, recycling, and disposal of e-waste are carried out.			

8.3. Bio Medical waste generation and Gaps in treatment

Table IX: Bio Medical waste generation and gaps in treatment (Deepar Beel wetland)

Sl No	Name of the HCF units	Category	BMW Generation (Kg/Day)	Treatment facility	Gaps in Treatment
1	Excelcare Hospital, NH-37, Guwahati	Orange	75	**Common Bio Medical Waste Treatment Facility (CBWTF) at Panikhaiti by Fresh Air**	**No Gaps in Bio Medical Waste in the catchment area of the wetland**
2	Akangsha Hospital, NH-37, Guwahati	Orange	30		
Total			105		

8.4. Gaps identified in waste management

Presently, around 3000 Kg/Day of gaps has been identified from the villages of Deepar Beel and 574200 Kg/Day from the Guwahati city alone.

8.5. Gaps in Industrial waste Management

No hazardous waste generating industrial units are located on the bank of the Deepar Beel wetland.

8.6. Greenery development - Plantation Plan

State Government has initiated afforestation in the degraded forestland and also raising roadside plantation

The following remedial actions has to be initiated in consideration of greenery development

- Raise plantation along the river/wetland bank to control the flow run off water directly to the wetland
- Mass awareness among the public not to harvest the vegetation from the catchment area for their personal and commercial purpose and encourage them to plant local plants on the catchment area.

8.7. Proposal for Biodiversity Park

At present there is no any land availability for establishment of Biodiversity Park in the catchment area of the wetland.

9. Environmental Flow (E-Flow)

9.1. Stretch of river perennial or non- perennial/flow available/water usage in the stretch

The entire wetland is perennial. The wetland maintain a steady flow all throughout the period, however during dry period a major drop in the flow is observed. The maximum depth is 4m and during the dry season it drops to about 1 m.

9.2. Irrigation practices in the river

Any kind of irrigation practices are not proposed or initiated yet though some part of the catchment area is used for agricultural purposes.

9.3. Achievable Goals

Primary water Quality Criteria for Bathing water (water used for organised outdoor bathing)

Criteria	**Rational**
1. Fecal Coliform MPN/100 ml: 500 (desirable) 2500 (Maximum Permissible)	To ensure low sewage contamination. Fecal coliform and fecal streptococci are considered as they reflect the bacterial pathogenicity.
2. Fecal Streptococci MPN/100 ml: 100 (desirable) 500 (Maximum Permissible)	The desirable and permissible limits are suggested to allow for fluctuation in environmental conditions such as seasonal change, changes in flow conditions etc.
3. pH: : Between 6.5 -8.5	The range provides protection to the skin and delicate organs like eyes, nose, ears etc. which are directly exposed during outdoor bathing
4. Dissolved Oxygen: 5 mg/l or more	The minimum dissolved oxygen concentration of 5 mg/1 ensures reasonable freedom from oxygen consuming organic pollution immediately upstream which is necessary for preventing production of anaerobic gases (obnoxious gases) from sediment.

5. Biochemical Oxygen demand 3 day,27°C: 3 mg/l or less	The Biochemical Oxygen Demand of 3 mg/1 or less of the water ensures reasonable freedom from oxygen demanding pollutants and prevent production of obnoxious gases";

10. Identified organisations responsible for preparation and execution of the action plans

Organisations responsible for preparation and execution of the action plans are as follows:

- Secretary to the Govt. of Assam, Environment and Forest department
- Secretary to the Govt. of Assam, Urban Development department
- Commissioner, Industries and Commerce, Assam
- Member Secretary, Pollution Control Board Assam
- Commissioner, Guwahati Municipal Corporation
- Commissioner to the Govt. of Assam, Water Resource Department
- Divisional Forest officer, Social Forestry, Basistha, Guwahati -29

11. Monitoring mechanism proposed for implementation of action plans

The water quality assessment and evaluation of impacts is necessary to understand the state aquatic body at various stages of the project implementation and post implementation of the project. Therefore the water quality assessment and evaluation of the project achievements is essential component for the long term benefit of the project. The monitoring and evaluation also indicate for taking corrective measure at appropriate time. The ill effects may be controlled by taking step at right time for right cause. The monitoring and evaluation schedule and plan is proposed, which is under.

11.1 Water Quality Stations (WQS):

The water quality monitoring will include following parameters, which shall be monitored at monthly interval or as and when required. The one complete unit to be purchased and identified parameters to be monitored at defined sampling stations.

The sampling stations are:

- Morabharalu after confluence with Deepar Beel
- Mid point of DeeparBeel
- Khanamukh before joining Brahmaputra

The parameters to be monitored are as follows.

1	pH	6	Bio-Chemical Oxygen Demand (BOD)
2	Turbidity	7	Faecal coliform
3	Conductivity	8	Total coliform
4	Temperature		
5	Dissolved Oxygen (DO)		

Most of the parameters will be monitored manually and will be incorporated in database.

12. Public Mass awareness etc.

Any river/wetland conservation project to be implemented successfully, public awareness is of utmost importance. Unless the public are made aware about the irreversible damage and pollution caused by indiscriminate littering and dumping of waste and garbage in drain and water bodies connected to Deepar Beel, the project cannot be implemented in true sense of the word to achieve conservation. Some members of the communities are already aware that there is a need for river/wetlandconservation programme and that they will be benefitted. Hence, it should be ensured with the following points

- The communities are effectively involved in all the stages of the project cycle from conceptualization, to preparation, to finalization, to implementation and finally O & M.
- Public Awareness & Public Participation should be affront-end activity of the project
- The entire programme of conservation should be conceived, formulated, implemented, monitored and evaluated in close consultation with the stake holding communities.
- Therefore, education and awareness programmes are key to the sustainability of the various components implemented as part of the river/wetland restoration project.

13. Action Plan

Table X: Action points

Type	Action Points	Implementation Status	Responsible Authority	Time Targeted	Cost Estimate (In crores)
Industries	a) Strict observation/ monitoring of industrial effluent/waste water discharge strictly for compliance. b) Stringent action against non-complying industrial units c) No industry should operate or continue manufacturing process unless they possess valid permission for ground water extraction from Central Ground Water Authority (CGWA) d) Small service providing units like street food selling vendors, laundry etc. should not be allowed to dispose solid, liquid or semi-liquid wastes directly into the drains or sewers. e) Set up online monitoring system in the major industries. f) To stress all the industrial units to adopt cleaner technology and take appropriate measures for reduction	a) Closure notice has been issued to the industries on the ground of not having ETPs. b) Further visited the industries and ensured closure	**Pollution Control Board Assam**	**3 Months (August, 2019 To October, 2019)**	**Nil**

Type	Action Points	Implementation Status	Responsible Authority	Time Targeted	Cost Estimate (In crores)
	of effluent, recycling and reuse of treated water g) Directions has been issued for Zero Liquid Discharge (ZLD) in the major polluting industrial units				
Interception and treatment of raw sewage	a) The quality of waste water flowing in the drains of identified polluted stretch have to be analysed and studied to assess the drain wise characteristics of waste water. b) To trap the discharge using strainers before falling into river. c) Local administration should provide pucca latrines to all the households through Individual Households Latrines (IHHL) Scheme under Swachh Bharat Mission.	a) Government of Assam has directed Guwahati Municipal Corporation to prepare a DPR for installation of STPs with a capacity of 75 MLD in the Guwahati city in pursuance to the Action Plan prepared for Bharalu river b) A meeting has been convened with the concerned stakeholders regarding initiation of insitu treatment of sewage by bioremediation	**PCBA/ Municipal Corporation/ ULBs/ District Administration/ Water Resource Department**	**2 Years (August,2019 to July, 2021)**	**1**

Type	Action Points	Implementation Status	Responsible Authority	Time Targeted	Cost Estimate (In crores)
Ground Water Assessment	a) Conducting survey regarding ground water usage by category wise such as domestic, community, industries etc. and also identification of over exploited and critical blocks in the river stretches with respect to the ground water extraction. b) Carry out assessment of ground water survey in the catchment area of the identified polluted stretch once in a year to ensure quality. c) All the industries should have valid NOC from CGWA. d) To promote roof top rain water harvesting by the industrial, commercial including individual households thereby recharging the ground water.		**PCBA/CGWA**	**Continuous**	**0.5**
	e) Directions to be issued that no industries should inject their treated effluent for ground water recharging.			**6 Months (February,2020 to July, 2020)**	

Type	Action Points	Implementation Status	Responsible Authority	Time Targeted	Cost Estimate (In crores)
Flood Plain Zone	a) Conservation of the river through watershed management. b) Cleaning of the river bed and bank. c) Afforestation on both the banks to prevent soil erosion d) Recreational activities to be promoted. e) Erection of pathway of the river banks. f) Prohibition of disposal of municipal, plastic, biomedical and other wastes in the polluted stretch of the river bank g) Demarcation of the flood plain zone.		**Soil Conservation Department/Water Resource/ Municipal Corporation /Forest Department/ Tourism Department/PWD Assam/District Administration**	**6 Months (February,2020 to July, 2020)**	**1**
	h) Checking /removal of encroachment in the flood plain zone of the polluted river stretch		**Revenue Department/District Administration**	**To be decided by the Government**	
	The plan for the polluted stretches of the river may be implemented in a time bound manner by fragmenting activities as a) Modification of consent conditions in and around the polluted stretches.		**Pollution Control Board Assam**	**3 Months (August,2019 to October, 2019)**	**Nil**

Type	Action Points	Implementation Status	Responsible Authority	Time Targeted	Cost Estimate (In crores)
	b) Surveillance of sources of pollution in contrast to the norms.				
	c) The monitoring committee may convene meeting of Stakeholder organizations on Quarterly basis with under the chairmanship of Chief Secretary		**Pollution Control Board**	**Quarterly basis**	**Nil**
	d) Assessment of water quality of the polluted stretches on monthly basis has already been commencing			**Monthly Basis**	
Solid Waste	a) Directions to be issued to shift the municipal solid waste plant at the Beel which is causing a huge trash dump near it and to identify an alternative place for the plant b) Prohibition of direct disposal of solid waste in the banks of the wetland. c) Frequent Surface cleaning by removal of debris, plastics etc.		**Guwahati Municipal Corporation/ Water Resource Department**	**3 Months (November, 2019 to January, 2020)**	**0.4**
	d) Proposals to be sent for execution and proper management of solid waste of the MSW dumping site at		**Guwahati Municipal Corporation**	**To be decided by the Government**	**-**

Type	Action Points	Implementation Status	Responsible Authority	Time Targeted	Cost Estimate (In crores)
	Boragaon near Deepar Beel.				
Environmental Flow	a) Flow measurement of the river should be carried out by the concerned department and the record has to be maintained b) Fresh water flowing through escape channels/small barrages should be checked. The river can be of good potential for irrigation practices and should be carried out by the farmers		**Water Resource Department**	**Continuous**	**0.1**
Public Awareness	a) Awareness programs to highlight the issues related with the direct discharge of solid waste and open defecation. b) Mass awareness to conserve water.		**Environment & Forest Department /UDD/GMC**	**Continuous**	**0.1**
Total Budget Estimate					**3.1 crores**

Members of River Rejuvenation Committee (RRC)

Secretary to the Govt of Assam
Environment & Forest Department

Secretary to the Govt of Assam
Urban Development Department

23/7/19

Commissioner
Industries and Commerce Assam

Member Secretary
Pollution Control Board Assam