



SILSAKO BEEL

Action Plan for Silsako Beel- Priority I

1 BASIC INFORMATION ABOUT THE STRETCH

Silsako Beel is spread over an area of 1000 Bighas of land as per the revenue records. The notified area of Silsako Beel as per the Guwahati Waterbodies (Preservation and Conservation) Act 2008 has been mapped in Geographical Information Systems (GIS) by GMDA and ASTEC. The report was submitted to GDD, DC (Kamrup (Metro)) in July 2015. As per the report, there is no existing physical demarcation of the water body and it is encroached at several stretches. Few evictions drives had been undertaken but not completed. The siltation that has occurred has reduced the retention capacity of the lake which acts a reservoir for storm water of the city. This water body/ wetland ecosystem is seasonally flooded with storm water runoff from the surrounding hilly terrain .Silsako Beel provides a natural setting with an emergent urban edge. It has the potential to become an active recreational facility in the city, while leveraging the natural setting to address the storm water management system for the city

1.1 Basic river stretch/ length:

The Beel is having a length of approx. 5 Km and average width of 250 m which is presented in **Fig 1**.

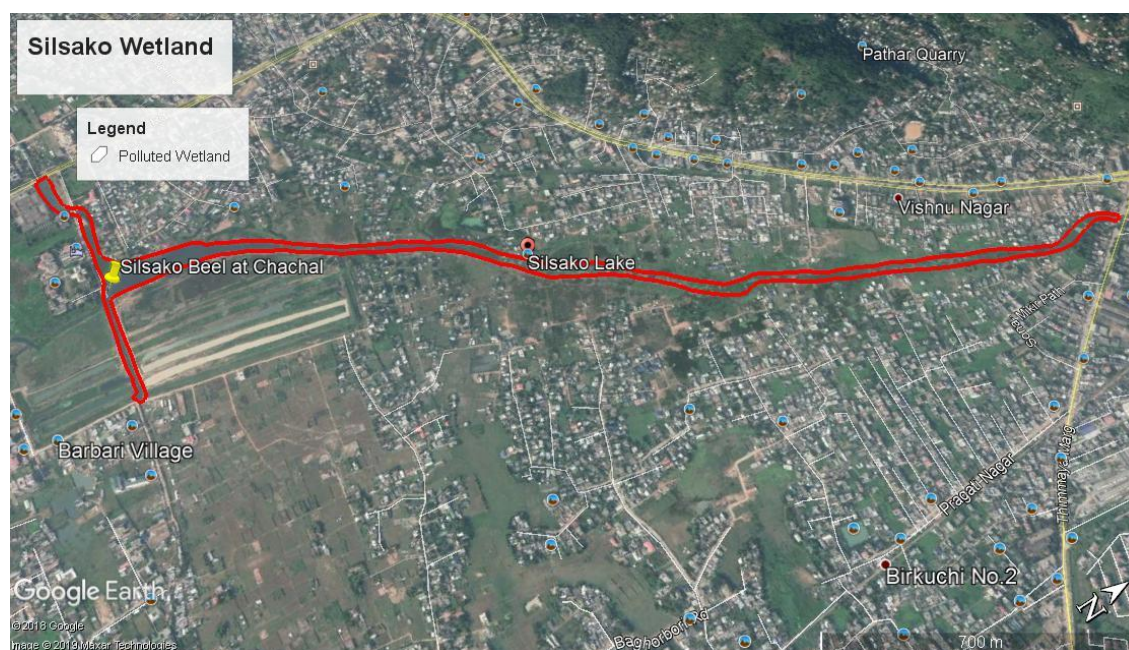


Fig 1: Map showing the Silsako polluted wetland

1.2 Major towns located on the bank between the stretches including population, water consumption details:

The Beel runs through the heart of the Guwahati city surrounded by villages like Satgaon, Hengrabari, Mathgharia.

Revenue dags of three villages namely Hengrabari, Satgaon and No 1 Mathgharia falls under the notified category for Silsako Beel as per the Guwahati Water bodies (Preservation & Conservation) Act 2008.

Guwahati Metropolitan Development Authority (GMDA) under Guwahati Development Department, Govt of Assam has made a comprehensive assessment of land encroached within the Silsako Beel. Government had initiated many eviction drives in the past to remove such encroachments and undertaken huge dredging operations to enhance the storage capacity of the Silsako Beel as this could contribute as storage detention basin to mitigate urban flooding of Guwahati city.

Total population residing on either side of the Beel is approximately 3,92,000 and water consumptions stands at around 52.9 MLD. The details of sewage generation and the gaps in treatment is presented at **Table I**

Table I: Sewage generation and gaps in treatment at present

S.N	Area (sq.km)	Population as per 2011 census (Catchment villages of Silsako wetland)	Water Consumption (KLD) @135 lpcd	Sewage Generation (KLD)	No. of STPs	Existing Treatment capacity (KLD)	Gaps in KLD
1	Silsako wetland	392000	52920	42336	NIL	NIL	42336

Table II: Total gap in projected population and sewage generation till 2030

S.N	Area	Projected Population till 2030	Water Consumption (KLD) @135 lpcd	Sewage Generation (KLD)	No. of STPs Proposed	Existing Treatment capacity (KLD)	Gaps in KLD
1	Silsako wetland	417000	56295	45036	01 Capacity 45 MLD	NIL	45036

At present the Silsako beel catchment area is over populated. There is no any land availability for future human settlement and expansion within the periphery of the catchment area.

1.3 Stretch of river perennial or non perennial/ flow available/ water uses in the stretch

The Beel is primarily Non-perennial in nature However, during monsoon combined sewage flows through the Beel & Dry weather sewage flows into the Beel throughout the Year

2. WATER QUALITY OF RIVER STRETCH/ DRAINS CONTRIBUTING POLLUTION/ GROUND WATER

2.1 Drains contributing to pollution

A major City Drain carrying combined sewage has been constructed recently by PWD, Govt of Assam diverting portion of the flow of Bahini river which runs through the city into the Silsako Beel. Moreover, a major drain carrying combined sewage from Meghalaya Catchment is also out falling into the Silsako Beel. Apart from these two, many road side carrying combined sewage are out falling into the Beel.

2.2 Latest water quality and current as per assessment targeted

Pollution Control Board, Govt of Assam makes water quality assessment of all water bodies falls within Guwahati Municipal Area. The water quality test has been carried out at Silsako Beel at one

location since July 2017 under NWMP. The summary of water quality parameters for the month of April are as follows in **Table III**

Table III: Analysis report of Silsako Beel at Chachal- April 2019

Parameter	Value
D.O. (mg/L)	NIL
pH	7.2
Cond(μ S/cm)	535
BOD(mg/L)	46.2
COD(mg/L)	170.4
NO ₃ -N (mg/L)	0.8
TSS (mg/L)	120
Turbidity (NTU)	12
p-Alkalinity (mg/L)	0
m-Alkalinity (mg/L)	82
Hardness (mg/L)	112
Calcium as CaCO ₃ (mg/L)	74
Magnesium as CaCO ₃ (mg/L)	38
Chloride as Cl ⁻ (mg/L)	48
Sulphate as SO ₄ ⁻² (mg/L)	56.8
Phosphate as PO ₄ (mg/L)	0.3
TKN (mg/L)	11.6
NH ₄ -N (mg/L)	3.78
Total Dissolved Solids (mg/L)	322
TFS (mg/L)	80
Fluoride (mg/l)	0.54
Boron (mg/l)	0.056
Na (mg/L)	65.8
K (mg/L)	18.3
Total Iron (mg/L)	0.36
Lead (mg/L)	0.038
Zinc (mg/L)	0.057
Copper (mg/L)	0.003
Total Chromium (mg/L)	BDL
Nickel (mg/L)	0.030
Cadmium (mg/L)	0.004
Mercury (mg/L)	BDL
Arsenic(mg/L)	BDL
Total Coliform (MPN/100ml)	4400
Faecal Coliform (MPN/100ml)	2800

2.3. Characteristics of the river and the major drains

Several Municipal Drains as mentioned above are connected to the Silsako Beel, carrying sewage/ waste / storm water and discharges directly into the Beel. Major contributor of waste water flow is through the drains coming through Chachal Area & Panjabari Area. Silsako Beel receives waste water through several inlets.

The water body has been receiving silt, sewage and solid waste and the water quality has deteriorated beyond limits. Luxuriant growth of water hyacinths, weeds are visible in the water spread area of the Beel. The quality of the water is very poor. Heavy deposit of silt/sludge has been accumulated on the bed of the Beel for years. The details of water quality of the major drains are presented below in **Table IV**

Table IV: Analysis report of the major drains contributing to pollution in the Silsako Beel

Parameter	Drain 1 (Chachal drain)	Drain 2 (Panjabari drain)
D.O. (mg/L)	NIL	NIL
pH	7.4	7.3
Cond(μ S/cm)	584	566
BOD(mg/L)	48.0	52.0
COD(mg/L)	166.6	174.8
NO ₃ -N (mg/L)	2.8	2.6
TSS (mg/L)	120	126
Turbidity (NTU)	10	12
p-Alkalinity (mg/L)	NIL	NIL
m-Alkalinity (mg/L)	142.0	164.0
Hardness (mg/L)	152.0	150.0
Calcium as CaCO ₃ (mg/L)	110.0	102.0
Magnesium as CaCO ₃ (mg/L)	42.0	48.0
Chloride as Cl ⁻ (mg/L)	52.0	48.0
Sulphate as SO ₄ ⁻² (mg/L)	54.2	48.4
Phosphate as PO ₄ (mg/L)	1.0	1.2
TKN (mg/L)	14.8	13.6
NH ₄ -N (mg/L)	4.4	3.8
Total Dissolved Solids (mg/L)	374.0	360.0
TFS (mg/L)	92.0	88.0
Fluoride (mg/l)	0.52	0.64
Boron (mg/l)	0.054	0.046
Na (mg/L)	62.3	60.3
K (mg/L)	19.2	17.4
Total Iron (mg/L)	1.2	1.6
Lead (mg/L)	0.039	0.043
Zinc (mg/L)	0.049	0.047
Copper (mg/L)	0.004	0.031

Parameter	Drain 1 (Chachal drain)	Drain 2 (Panjabari drain)
Total Chromium (mg/L)	BDL	BDL
Nickel (mg/L)	0.043	0.031
Cadmium (mg/L)	0.004	0.004
Mercury (mg/L)	BDL	BDL
Arsenic(mg/L)	BDL	BDL
Total Coliform (MPN/100ml)	6400	7500
Faecal Coliform (MPN/100ml)	2300	3900

2.4 Ground water quality in the polluted river stretch

2.4.1 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 V**

Table V: 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.	<ul style="list-style-type: none"> ➤ The roof top rainwater harvesting is practiced in Government buildings, School and Offices. ➤ Industries should be encouraged for roof top rain water harvesting.
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

2.5.2 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.

2.5.3 Ground water Quality of Satgaon area (catchment of Silsako Beel) under NWMP

**Table VI: Ground water Quality of Satgaon area (catchment of Silsako Beel) under NWMP
May 2019**

Parameter	Value
pH	7.7
Cond(μ S/cm)	317
BOD(mg/L)	2.5
COD(mg/L)	8.0
NO ₃ -N (mg/L)	1.5
TSS (mg/L)	28.0
Turbidity (NTU)	05
p-Alkalinity (mg/L)	NIL
m-Alkalinity (mg/L)	120.0
Hardness (mg/L)	100.0
Calcium as CaCO ₃ (mg/L)	78.0
Magnesium as CaCO ₃ (mg/L)	22.0
Chloride as Cl ⁻ (mg/L)	20.0
Sulphate as SO ₄ ⁻² (mg/L)	8.2
Phosphate as PO ₄ (mg/L)	0.7
Total Dissolved Solids (mg/L)	200.0
TFS (mg/L)	46.0
Fluoride (mg/l)	0.16
Boron (mg/l)	0.008
Na (mg/L)	66.0
K (mg/L)	10.8
Total Iron (mg/L)	0.62
Lead (mg/L)	BDL
Zinc (mg/L)	0.328
Copper (mg/L)	0.005
Total Chromium (mg/L)	BDL
Nickel (mg/L)	BDL
Cadmium (mg/L)	BDL
Mercury (mg/L)	BDL
Arsenic(mg/L)	0.004
Total Coliform (MPN/100ml)	NIL
Faecal Coliform (MPN/100ml)	NIL

2.5.4 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 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.

2.6 Flood Plain Zone

The following are the identified flood prone area for the polluted river stretch

Name of River	Flood plain areas
Silsako Beel	Hengrabari, Satgaon and No 1 Mathgharia

2.6.1. Regulating activities in the Flood Plain Zone

The 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

2.6.2. Greenery development - Plantation Plan

State has initiated afforestation in the degraded forestland, also raising roadside plantation besides creating check dams/embankments in the river catchment areas to combat erosion and soil conservation.

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

- Raise plantation along the river bank to control the flow run off water directly to the river
- Bamboo species to be raised as it is a good soil binder thereby stabilize the banks of the river from erosion
-

2.6.3 Irrigation practices in the river/Utilisation of treated sewage

The irrigation practices has not been proposed or initiated so far

Further, the treated water can be used for various low-grade or secondary purposes as per the following

- The treated water can be used for irrigation of community sports grounds and gardens.
- It can also be used for roadside de-dusting in order to minimise the impact of PM₁₀ and PM_{2.5}.
- It can be used for roadside gardening.
- It can also be used for curing during construction works.
- Treated sewage can be supplied to industries for non-potable uses.

2.6.4 Achievable Goals

Designated Best use	Class of Water	Criteria
Propagation of Wild life and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more Free Ammonia (as N) 1.2 mg/l or less

2.7 Health status of the public in the catchment of polluted river stretch

No serious health hazard is envisaged.

3 INVENTORY OF SOURCES OF POLLUTION AND GAPS IDENTIFICATION

3.1 Municipal Sources/ Sewage Management

3.1.1 Sewage generation from the towns located on the banks of the polluted river

There is no dedicated sewerage network for collection of sewage generated from every household. Generally, individual household having septic tanks for collection of sewage and the outlet of the septic tank is then connected with the nearby storm water drain. The drains direct the sewage to the Beel as well as to the river.

3.1.2 No. of sewage treatment plants present and treatment capacity, actual sewage treatment and the gaps in treatment

No Sewage Treatment Plant exists for Silsako Catchment. The city wide programs for sewage collection and treatment under JICA funding to be implement by Jal Board, Govt of Assam are critical to the long term health of the lake.

3.2. No. of STPs proposed and capacities

An STP is proposed of 45 MLD capacities separately for Silsako Beel. However, as mentioned above, the city wide programs for sewage collection and treatment under JICA funding to be implement by Jal Board, Govt of Assam shall be critical for improving the water quality of the Beel. Actions required for the improvement of the influent water quality are proposed to be undertaken as part of the water quality improvement actions are outlined below:

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

Drain Improvement- Significant step for improving drains will be enhancing the water channel by lining the drain channel with stone. This lining of stone will be done with open joints to assure the percolation of water in ground and hence improving ground water level. The drain improvement also includes the 'management of riparian zone'. This is the area towards north east of project management zone. The intention behind provision of this zone is to achieve natural filtration and purification of the contaminated water coming from surrounding areas. The main drainage network entering the lake areas will be redeveloped as properly constructed drains which can be easily cleaned and de-silted. It is proposed to take about 250 m of drain length measured from the mouth of the drain, to be taken in for improvement and reconstruction, as per site conditions. Drain improvement is necessary for the removal of silt and other sediments from the incoming flow in order to maintain the lake's holding capacity. The design of the drain is based on strategic sloping to manipulate invert levels for optimal sediment detention, preventing excessive deposition of silt and other fine particles in the lake. Due to the volume of silt in the incoming flow, a wet detention pond with a maximum holding capacity of 350 KL is included in the drain improvement plan. The detention pond would be constructed at least 25 -30m away from the discharge point of the drain, allowing adequate drainage area before the overflow is discharged into the lake.

3.3 Drainage System/ sewerage network present/ proposed

Presently in Guwahati city, there is no separate sewerage network. All the existing Storm Water drains carries the sewages coming from households and then out falling into the major Rivers, Beels including Silsako Beel and then out falling into the Brahmaputra River. Under JICA, funding, A comprehensive citywide sewerage network plan with STPs in Guwahati city is envisaged and is in feasibility stage. However, Govt of Assam under GMDA has proposed the following measures for improving the water quality of Silsako Beel.

Constructed Wetland

The drain flowing into the lake carries a high concentration of sewage effluents into the lake from the settlements along the south eastern portions of the lake, which results in harmful contamination of the water, affecting the lake's aquatic eco-system. A constructed wetland with a de-silting mechanism, installed in the natural flow path of the drain would provide tertiary level treatment to the water before it enters the lake. This would not only preserve the lake's natural biological life, but also provide an aesthetically pleasing addition to the lake's ecosystem

Mechanical Aeration of lake

To improve water quality of the lake, installation of mechanical aerators is proposed which, using a combined system of low-energy compressors and diffusers, would improve water quality of the lake and arrest degradation caused by sewage draining into the lake. The diffusers cause laminar inversion of lake water which allows atmospheric oxygen to dissolve in the water, and methane and nitrogen to escape. The oxidation helps to reduce algae, weeds, remove organic bottom muck, improve fish growth and health, reduce water weeds, reduce foul odours and reduce disease bacteria. Additionally, the increased amount dissolved oxygen, improves the overall numbers of fish and plant materials in the lake. It is also a good way to cut down on fish kills and it helps to properly control the weeds and algae. In addition, the quality of the lake's water will improve, reducing any required treatment expenses. Therefore Aerators can be used to achieve water quality improvement of the water bodies in this project.

Lake Bottom Muck Removal

When oxygen is depleted in a water body, anaerobic bacteria partially break down the sediment. The anaerobic bacteria also release nitrogen in the form of ammonia into the water column. Ammonia feeds weeds and algae, and is toxic to fish at levels greater than 3.0 mg/l. Also released are methane, nitrogen gas and carbon dioxide. These also are toxic to aerobic bacteria, insects and fish. Carbon dioxide and methane kill fish at levels greater than 30 mg/l. So the causes of organic sediment (muck) accumulation, unpleasant odor and fish kills in lakes are a lack of oxygen

Dredging vs. Aeration for Lake Muck Removal

Although dredging can deepen a lake and contribute to increase the flood retention capacity making it more difficult for submerged vegetation to grow, dredging does nothing for water

quality, nothing for algae, little to reduce odor and nothing to prevent fish kills or improve fish health and growth and unable to make clean lake bottom

Aeration Technology

Aeration of the lake can be accomplished by different methods including mixing by machines, water agitation or air injection. An aerator pumps out compressed air that reaches the diffusers stationed in the lake area. Enzymes and bacteria are then added to the water to help remove the lake muck. This system will circulate, de-stratify and aerate the water column

Short term measures

- 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.

3.4 Industrial Pollution control

Classified industrial units are observed with infrastructural facilities (ETPs, STPs) within the periphery of 500 m of the polluted river stretch along with few small scale industrial establishments. 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

The classified industry details situated at the radius of the polluted river stretch is presented at **Table VI**

Table VI: Details of the Industrial Pollution Control (Silsako Beel)

Sl. No	Name of the Industry	Category	Total Water Consumption (KLD)		Waste water generation in KLD	Without consent / Directions issued	ETPs	CETPs		OCEMS	Gaps KLD
			GW	Supplied Water				Existing	Proposed		
1	Hotel Ginger, VIP Road, Ghy.	Green	40	No	32	Not applied. Direction issued	Functional	NA	NA	NA	Nil

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.

4 Identification of major sources required to be controlled based on pollution load

4.1 Waste management status

Table VII: Waste management status and proposed actions

Sl. No	Type	Status	Proposed actions	Authority
1	Industrial Waste	<ul style="list-style-type: none"> ➤ No industrial waste dumped on land or discharged into water bodies/river. ➤ Industrial wastes are managed by industries itself ➤ Authorisation have been granted to different industries in line with Water act 1974, Hazardous Waste (Management, Handling and Transboundary Movement) Rule, 2008 as amended. ➤ Regular monitoring by PCBA to ensure that the terms and conditions are strictly adhered in accordance with the prescribed standards. 	Direction issued to the industries to identify the non-point sources and arrest contamination of storm water.	Pollution Control Board Assam

Sl. No	Type	Status	Proposed actions	Authority
2	Municipal waste	<ul style="list-style-type: none"> ➤ Municipal Body has incorporated collection of Municipal Solid Waste ward wise from the generation point for treatment and disposal. ➤ Dumping is carried out unscientifically in the open space. ➤ No proper segregation of bio-degradable and non-biodegradable waste ➤ No proper segregation of dry and wet waste ➤ Lack of scientific disposal facilities/infrastructure technology like decentralized composting or bio-methanation plant, waste to energy plant, solid waste management plant. 	<p>Municipal Body is in process of inducting the following activity</p> <ul style="list-style-type: none"> ➤ Engaged NGOs for the 31 wards under Guwahati Municipal Corporation area that have a total manpower of 450 workers who operate a total of 480 Tricycles and 64 Auto Tippers all around the city. ➤ Awareness campaigns <p>Processing and disposal of waste</p>	Municipal Body
3	Plastic Waste	<ul style="list-style-type: none"> ➤ Dumping is carried out unscientifically in the open space along with the municipal waste. ➤ No proper segregation of bio-degradable and non-biodegradable waste ➤ No proper segregation of dry and wet waste ➤ Lack of scientific disposal facilities/infrastructure technology like decentralized composting or bio-methanation plant, waste to energy plant, solid waste management plant. 		Municipal Body /Pollution Control Board Assam
4	Hazardous Waste	<ul style="list-style-type: none"> ➤ Hazardous waste are managed by hazardous waste generating industries itself by disposing the same through 		Pollution Control Board Assam

Sl. No	Type	Status	Proposed actions	Authority
		<p>authorised recycler, secured landfill area, Bio-remediation etc.</p> <ul style="list-style-type: none"> ➤ Lack of TSDF facility for commonly utilization by hazardous waste generating industries 		
5	Bio-medical Waste	<ul style="list-style-type: none"> ➤ Segregation at the source under Biomedical waste Management Rules, 1998 as amended ➤ The segregated waste is transported and then incinerated by Fresh Air Waste Management Services Pvt. Ltd at Common Biomedical Waste Treatment Facility, Panikheti (only for the districts of Kamrup(M), Nalbari, Morigaon and Nagaon. ➤ The HCFs have installed ETP for treatment of liquid waste generated 	Direction issued to all HCF unit to implement the BMW Rules, 2016 as amended in all HCF Units. (As per guidelines of CPCB)	HCF units/Pollution Control Board Assam
6	E –waste	<ul style="list-style-type: none"> ➤ Annual return in (Form-3) is submitted by E-Waste generating units to PCBA from time to time for onwards transmission to CPCB ➤ Most of the e-waste generator have sent their e-waste to their respective manufacturer. ➤ There is no authorised recycler, refurbisher, dismantler etc. available to ensure environmentally sound management of E-waste. ➤ There is no “facility” wherein the process of dismantling, recycling, and disposal of e-waste are carried out. 	Few entrepreneur approached PCBA for registration and authorisation as Recycler	Pollution Control Board Assam

4.1.1 Solid waste management

Guwahati Municipal Corporation (GMC) is the agency primarily responsible for the MSW management of the city. MSW includes waste generated from households, slums, commercial establishments, hotels, restaurants, markets, hospitals/nursing homes, institutions/offices, marriage halls, parks, drain cleaning and street sweepings, and construction and demolition sites.

GMC has allocated its majority of staff and resources for the collection and disposal of MSW, however due to lack of community awareness and lack of proper solid waste management planning and explosive growth of population in Guwahati has aggravated the solid waste management problem. Additionally, there has been a lack of community sensitization efforts and public awareness towards waste minimization, segregating waste, and disposing of it in proper receptacles. Increasing use of plastic and packaged products also contribute significantly to MSW. Prior to the existing Boragaon Landfill site, A landfill site was situated in the periphery of Silsako Beel, Which have been shifted now to Boragaon. For the period before the final removal of the landfill, it is envisaged that the area needs to be sealed by an impermeable barrier to prevent contaminated water from further infiltrating into the wetland. The contained water can then be diverted into a Reverse Osmosis filtration plant for removal of toxic nutrients. The clean effluent can then be recycled back into the lake. A site has been allocated for the location of this Reverse Osmosis Plant.

4.1.2 Gaps identified in waste management

- Lack of community awareness
- Proper segregation of waste at source
- Insufficient no of secondary collection system
- Lack of scientific sanitary landfill.

Presently, around 235200 Kg/day of gaps has been identified for municipal solid waste management as they are dumped unscientifically in the Boragaon dumping site

5 Any other Information

5.1 Remedial plans for control of ground water contamination

Provision of Constructed Wetland, Adoption of Aeration Technology and Removal of silt and sludge from the bed of the Beel will reduce the contamination to the ground water.

5.2 Remedial plans for health impacts in the catchment of polluted river stretch

Provision of proposed Ecological Management Zoning plan would improve the quality of Life within the periphery of Silsako Beel

5.3 Identified organizations responsible for preparation and execution of the action plans

Guwahati Development Department will be responsible for the preparation and execution of the action plan.

5.4 Monitoring mechanism proposed for implementation of action plans

Guwahati Development Department, Govt. of Assam will be the parent body for implementation of the following action plans through its various agencies as mentioned below in **Table VIII**

Table VIII: Action Points

Type	Action Plan	Responsible Authority	Time Targeted	Budget Estimate (In crores)
Beel Conservation/ Sewage Management	➤ Removal of Encroachment to protect the Beel and conservation of Ecology	Revenue Department/ District Administration	To be decided by the Government	It will be submitted by the concerned authority after field verification.
	➤ Construction of STP ➤ Improvement of Water quality by adopting natural Constructed Wetland, Aeration Technology.	Guwahati Metropolitan Development Authority/ Guwahati Smart City Ltd under GDD	3 years	66.5
	➤ Cleaning/ Desilting of Beel	Guwahati Metropolitan Development Authority under GDD	2 years	0.55
Solid Waste Management	City wise proper management of solid waste along scientific disposal landfill site	Guwahati Municipal Corporation under Guwahati Development Department	Continuous	It was already included in the solid waste management plan of Greater Guwahati. Budget was submitted to Government for sanction.
Water Quality Assessment	Assessment of water quality of the polluted stretches on monthly basis has already been commencing	Pollution Control Board Assam	Monthly basis	NIL
Total				67.05 crore

5.5 Public mass awareness etc.

Public awareness campaign for proper solid waste management shall be undertaken by GDD. Public shall be sensitized on good solid waste management practice through social media, print media, electronic media etc.

Members of River Rejuvenation Committee (RRC)



for Secretary to the Govt of Assam
Environment & Forest Department



Secretary to the Govt of Assam
Urban Development Department



Commissioner
Industries and Commerce Assam



Member Secretary
Pollution Control Board Assam