



The River Rejuvenation Committee **Government of Goa**

**Name of the work: Preparation of Action Plan for
Rejuvenation of Polluted Stretches of Rivers in Goa**



Action Plan Report on Bicholim River

March 2019

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Abbreviations:

BOD	Bio-Chemical Oxygen Demand
CPCB	Central Pollution Control Board, New Delhi
DO	Dissolved Oxygen Content
DMA	Directorate of Municipal Administration, Panjim Goa
GSPCB	Goa State Pollution Control Board, Panjim Goa
FC	Faecal Coliform
MBGL	Meters below ground levels
MLD	Million liters per Day
NEERI	National Environmental Engineering Research Institute Nagpur
NGT	National Green Tribunal
NWMP	National Water Quality Monitoring Programme.
PWD	Public Work Department of Goa State
SEAC	State Level Environment Expert Appraisal Committee
SEIAA	State level Environment Impact Assessment Authority.
SIDCGL	Sewerage Infrastructure Development Corporation of Goa Limited, Panjim Goa.
TC	Total Coliform
ULB	Urban Local Body
WRD	Water Resources Department of Goa

References

- Salinity report by GSPCB, Panjim Goa.
- Annual parameters monitoring by GSPCB (from 2015 till 2018).
- Integrated Coastal Zone Management of Coastal Zone in Goa – Council of Scientific & Industrial Research July 2013.

Executive Summary:

The Bicholim River is the interstate river originates in Maharashtra state, on the Northern part of the Goa state. The river enters in the state of Goa on hilly terrain of Curchirem, after travelling 16 km before it meets Valvanti River. The river flows through areas like Sarvona, Karapur and Bicholim before it discharges into Valvanti River. The total basin area of Valvanti River is 98 Sq. Km. out of which 45 Sq. Km. basin area within Goa State and average runoff of 210.20 MCM.

The Goa State Pollution Control Board (GSPCB) monitors the water quality of River Bicholim at Barazan Nagar, Bicholim. The NGT / CPCB has declared this stretch of the River from Bicholim to Curchirem as a polluted stretch. The length of the polluted stretch of the river is about 10km and the same is identified as non-tidal stretch. The said monitoring by GSPCB is carried out on a monthly basis throughout the year under the National Water quality Monitoring Programme (NWMP) as per directions of CPCB This Stretch of the River Bicholim between Bicholim to Curchirem is classified as Class-C (for drinking water source after conventional treatment and disinfection). On the basis of GSPCB reports. Central Pollution Control Board (CPCB) has classified Bicholim River Stretch (Stretch from Bicholim to Curchirem with length of 10 km) under Priority V, having BOD between 4.8 mg/lit.

The Monitoring reports for the period April 2015 to December, 2018 at Barazan Nagar location, Bicholim for the parameters of DO, BOD and Total Coliform (TC) have been taken into consideration for the preparation of Action Plan. The observed DO levels in the polluted river stretch between Curchirem to Bicholim are well above the desired level of 5 mg/l required for bathing .water quality. The observed BOD levels in the polluted river stretch between Curchirem to Bicholim are well below the desired level of 3 mg/l. The observed TC levels in the identified polluted river stretch are exceeding the desired levels of 5000 MPN/ 100ML for bathing water quality.



Image 1 Bicholim River

During the survey conducted for identification of pollution sources, it has been observed that the untreated domestic sewage outfalls mainly on Eastern & western bank of the river contribute to the values of total coliform in the polluted stretch.

The proposed action plan for Bicholim River on the basis of observations and monitoring reports including necessary actions to be implemented:

A. Source Control: The source control includes the industrial pollution control and treatment and disposal of domestic sewage, as detailed below;

a) Industrial Pollution Control: The source identification studies were conducted during the month of January and February 2019. There are medium and small scale industries located in western banks of Bicholim River. There are no industrial pollutants / discharge observed in this stretch.

b) Channelization, treatment, utilisation and disposal of treated domestic sewage:

The physical survey was carried out during January and February 2019, the domestic untreated sewage discharge is observed from the areas like Bicholim & Curchirem on Eastern Bank and Bicholim, Lamgaon & Maulinguem the Western bank of the River.

Discharges from individual houses directly into the River and also into storm water drains/Nallahs leading to the River where observed on the Eastern & Western Bank on the downstream during the physical survey. The Bicholim Municipal Council, Directorate of Panchayat and Directorate of health services will initiate the following action through village panchayat and the health officers after carrying out details survey.

- 1) Disconnection of the direct discharge into the river/storm water drain/Nallahs.
- 2) Installation of Bio toilets along the river stretch.
- 3) Construction of septic tank and soak pits by residential houses and monitoring the frequent cleaning the septic tanks in order to avoid untreated domestic sewage discharge in to the natural drains.
- 4) Prohibition for washing clothes at Bicholim by the Bicholim Municipal Council.

B. River Catchment / Basin Management: Controlled ground water extraction and periodic quality assessment.

i. Periodic monitoring of ground water resources and regulation of ground water extraction by industries particularly over exploited and critical zones:

The Central Ground Water Board has carried out survey of Aquifer System in the State of Goa in Sept. 2013. After studying the aquifer report, it is observed that the ground water table along the Bicholim river stretch is 2 m to 5 m below the ground level during Post monsoon season. The water table lowers down in summer by 0 to 2 M in summer. As the ground water table is high within the Bicholim river basin, there are no such actions proposed for improvement of the ground water table¹.

C. Flood plain Zone:

i. Regulating activity in flood plain zone:

During the physical survey, domestic untreated sewage disposal in the River and the Storm Water drains / Nallahs leading to the River in Bicholim Town .The Bicholim Municipal Council, Directorate of Panchayat and Directorate of health services will initiate action through the Village panchayat and Health Officer concerned to ensure that the domestic sewage is diverted to septic tank and soak pit.

ii. Management of Municipal, Plastic Hazardous Bio-Medical & Electrical and Electronic Waste:

The Local bodies are collecting segregated non bio-degradable waste which is sent to the Goa Waste Management Corporation (GWMC) and subsequently transported to the baling station at Saligao within the state except waste from Bicholim Municipal Council, which has its own solid waste management facility including windrows composting, baling and a landfill. Considering the shortfall in the present system, an

¹ Aquifer System of Goa, Central Ground Water Board Sept. 2013

additional shed for storage of non-biodegradable waste during monsoon and windrows composting for treatment of biodegradable waste. The baled non-biodegradable waste is thereafter transported to cement plants in Karnataka for co incineration.

The remaining Panchayat are predominantly having single dwelling units and there is no major issue disposal of biodegradable waste. GWMC will expand their SWM facility at Saligao from present 125 tons per day to 250 + 20% (=300 TPD) within a year which will treat and dispose the waste generated by the local bodies in these areas.

However, improvement in the house to house collection of segregated waste and necessary installation of transfer station for non-biodegradable waste would be completed within period of 6 months. Necessary direction for the same will be issued by the Directorate of Panchayat.

iii. Greenery Development – Plantation Plan:

It was observed during the Physical survey that there are extensive coconut, orchards, and other local species along both the banks of the River.

D. Ecological / Environmental Flow (E-Flow):

- i. Issues relating to E- Flow:** The Polluted stretch of the Bicholim River between Curchirem and Bicholim is non- perennial stretch. The Water resources department has constructed K. T. Weir / Bandhara for Field Irrigation. The data received from WRD Department is enclosed in the table below;

Table 1 Details of the Irrigation Schemes on Bicholim River²

Sr. No.	Location of the K.T. Weir / Bandhara	Location of the Lift Irrigation Scheme	Use
1.	Kudchire II Bandhara	Near Mahadev Temple	Field Irrigation and Ground water recharge
2.	Kudchire II Bandhara	Near vehicular bridge	Ground water recharge and
3.	Maulingem Bandhara	Maulingem	Lift Irrigation Scheme
4.	Wavti Bandhara	Maulingem	Ground water recharge
5.	Vathadev Bandhara	Bicholim	Lift Irrigation Scheme
6.	Bicholim Bridge (upstream)	Bicholim	Ground water recharge
7.	Bicholim Bridge (Gaonkarwada, proposed)	Gaonkarwada, Bicholim	Ground water recharge

The Bicholim River originates in the State Maharashtra and then enters the State of Goa. The Mhadei Water Dispute tribunal has passed an award on 14th August 2018 in which the State of Maharashtra have been directed to insure sufficient flows in order to maintain the E-flow in the River Bicholim basin in Goa State. Further the water is release from 7 Bandhara's during the lean season to maintain the E-flow throughout the year.

- ii. **Irrigation practices:** The River is non-perennial and the K.T. weir are constructed at frequent intervals. The water from these Bandhara / K.T. Weirs are exclusively used to recharge the ground water and at two locations at Maulinguem and Vatadev for irrigation purpose. There is a minimal flow in the River during the month of April and May. The K. T. weir is proposed at Gaonkarwada in Bicholim in order to stop the ingress of Saline Water.

² Water Resource Department, Government of Goa.

Action Plan Strategies:

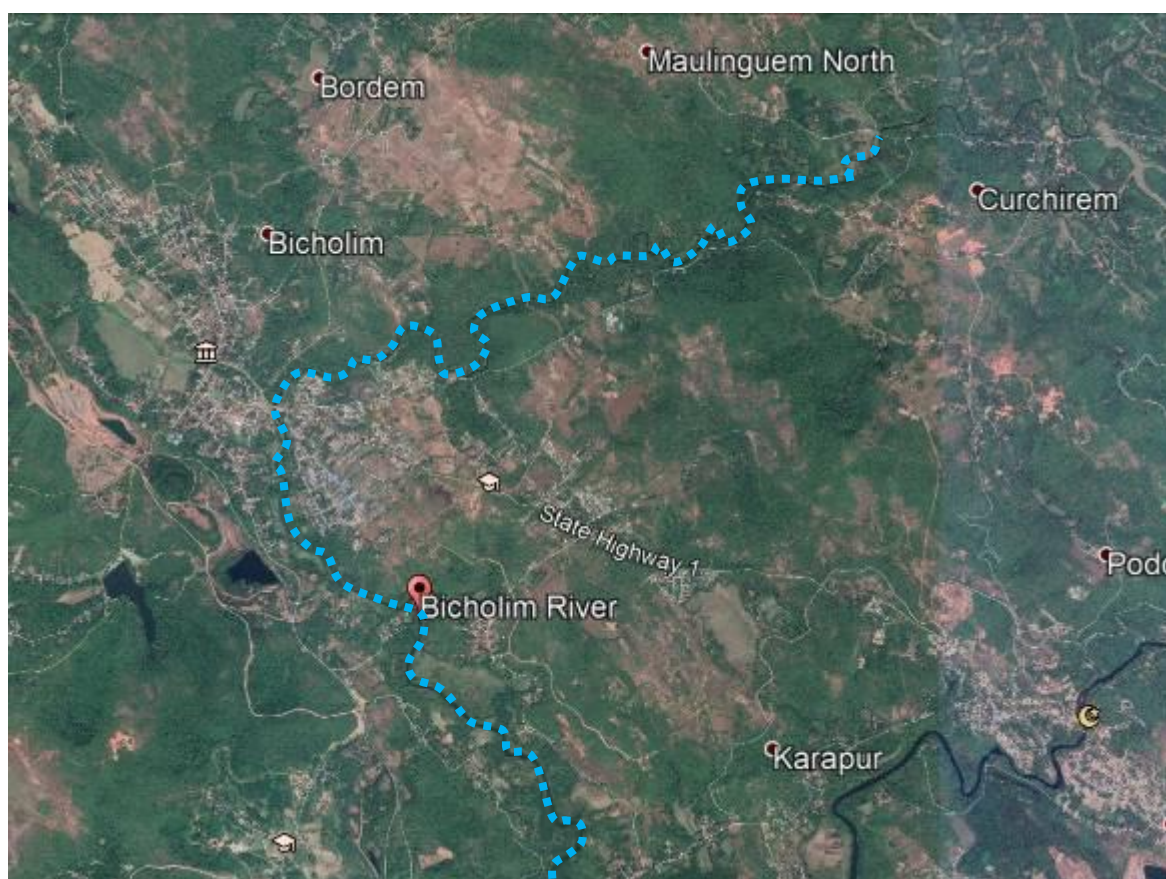
The action plan strategies based on the sampling analysis of the GSPCB, site survey and observations are listed below. These strategies are classified on the basis of the existing proposal in place, recommended upgradation in order to achieve the desired objective on short term and long term basis.

Sr. No.	Action Strategy	River Stretch	Agency	Time Frame
1.	<p>Disconnection of direct discharges of domestic sewage into the Bicholim. River/storm water drains/ nallah.</p> <ul style="list-style-type: none"> ➤ Disconnection of the direct discharge into the river/storm water drain/Nallah. ➤ Installation of Bio toilets <p>Construction of septic tank and soak pits by residential houses and monitoring the frequent cleaning the septic tanks in order to avoid untreated domestic sewage discharge in to the natural drains.</p>	<p>Curchirem to Bicholim</p> <ul style="list-style-type: none"> a) Curchirem b) Bicholim Municipal Council c) Ona-Maulinguem d) Karapur-Sarvan e) Amona f) Pilgao 	<p>Directorate of Panchayat and Directorate of Health, ULB.</p>	6 months
2.	<p>a)Improvement to collection system, and erection of material recovery facilities / storage shed for non-biodegradable waste in the Municipal Council, village Panchayat areas along the banks of Bicholim River.</p> <p>b)Improvement and up gradation of the existing Solid Waste Management facility of Bicholim Municipal Council ;</p>	<ul style="list-style-type: none"> a) Curchirem b) Bicholim Municipal Council c) Ona-Maulinguem d) Karapur-Sarvan e) Amona f) Pilgao 	<p>Respective ULB & Village Panchayat and Directorate of Panchayat</p>	<p>12 months</p> <p>6 months</p>
3.	Expansion of Saligao Waste Management facility from 125 tons	<ul style="list-style-type: none"> a) Curchirem b) Bicholim 		9 months

Sr. No.	Action Strategy	River Stretch	Agency	Time Frame
	per day to 250 + 20%	Municipal Council c) Ona-Maulinguem d) Karapur-Sarvan e) Amona f) Pilgao		
4.	The State of Goa has identified site for construction of Common Biomedical waste at Kundaim Industrial Estate. The National Environmental Engineering Research Institute (NEERI, Nagpur) has conducted the EIA study. The study report has been submitted to the SEIAA /SEAC seeking Environmental Clearance for the facility. The facility expected to be commissioned and operation within next 18 months. In the meanwhile the Healthcare facilities have their own treatment facilities such as Autoclave, Deep burial pit and encapsulation pit, needle burners etc.	The Common Bio-medical waste treatment facility at Kundaim will treat all the Bio-medical waste generated in the State of Goa.	Goa Waste Management corporation	18 months
5.	The Goa Waste Management Corporation and Producer Responsibility organization are collecting the E-waste generated throughout the State and the E waste is there after transported to authorized recyclers in other states.	The complete State of Goa	Goa Waste Management Corporation	Ongoing

Introduction:

The Bicholim River is the interstate river originates in Maharashtra on the Northern part of the Goa state. The river enters in the state of Goa on hilly terrain of Curchirem, after travelling 16 km before it meets Valvanti River. The river flows through areas like Sarvona, Karapur and Bicholim before it discharges into Valvanti River. The total basin area of the River is 98 Sq. Km. out of which 45 Sq. Km. basin area within Goa State and average runoff of 210.20 MCM.



Map 1 Map showing the Bicholim River Stretch in State.

The Goa State Pollution Control Board (GSPCB) monitors the water quality on a monthly basis throughout the year in Bicholim River under the Central Pollution Control Board Programme at Barazan Nagar Bicholim. On the basis of GSPCB reports, Central Pollution Control Board (CPCB) has classified Bicholim River (Stretch from Curchirem to Bicholim) under priority V, having BOD level range between 4.8 mg/lit.



Map 2 Bicholim –Polluted Stretch from Curchirem to Bicholim

During the Physical Survey it has been observed that there are Coconut plantations along both the bank of the River. There are residential houses located on the bank of the River on the Eastern Bank and Western Bank. Direct discharge of untreated domestic sewage into the River and storm water drains / nallah leading to the river were observed during the Physical Survey.



Image 2 Barrage / Bandhara on Bicholim River.

a) Objectives:

The Hon'ble National Green Tribunal in the Original Application No 673 of 2018, vide its Order dated 20th September, 2018 directed the State Governments to prepare an Action Plan within two months for bringing all the polluted river stretches to be fit at least for bathing purposes (i. e. BOD < 3 mg/L and TC < 5000 MPN/100 ml for C- Class rivers as per Environment Protection act 1986) within 6 months from the date of finalisation of the action plans.

In the said order the Hon'ble National Green Tribunal has directed that the Action Plan should cover aspects pertaining to Source control, Industrial Pollution Control, Channelization treatment, utilisation and disposal of treated domestic sewage, river catchment/ basin management /control, ground water extraction and periodic quality assessment, flood plain zone , ecological / environmental flow (e-flow) and such other issues may be found relevant for restoring water quality to the prescribed standards. The Hon'ble National Green Tribunal in their order has further directed to take into account the Model Action Plan for Hindon River, already prepared by CPCB while preparing the Action plans for other polluted river stretches.

Vide the said order the Hon'ble NGT directed that the four member committee comprising of Director Environment, Director Urban Development, Director Industries and Member Secretary, State Pollution Control Board shall be the Monitoring Committee for the execution of the Action Plan. The Committee shall be called "River rejuvenation Committee (RRC)" and will function under the overall supervision & co-ordination of the principal Secretary of the concern state. The action plan shall include components like identification of polluting sources including functioning / status of STP's, ETP's CETP, and solid wastes management processing facilities, quantification and characterisation of solid waste, trade & sewage generated in the catchment areas of polluted river stretch. The action plan should address issues related to, ground water extraction, adopting good irrigation practices, protection and management of flood plain zones, rain water harvesting, ground water charging, maintaining minimum environmental flow of rivers & plantation on both sides of the river.

The Hon. NGT has directed that setting of bio-diversity Park on flood plains by removing encroachments shall be considered as an important component of river rejuvenation. The action plan is expected to focus on proper interception and diversion of sewage carrying drains to the sewage treatment plant and emphasis should be on utilisation of treated sewage so as to minimise extraction of ground or surface water.

The Hon'ble NGT has directed to ensure that the action plan should have definite or specific timelines for execution steps. The State Government is required to set up a special

environment surveillance task force in terms of this order. The said task force has to ensure that no illegal mining takes place in river bed of such polluted stretches. The river rejuvenation committee is directed to have web site inviting public participation from educational, religious institutions and commercial establishment. The achievement and failure may also be published on such website. The Committee may consider suitably rewarding those contributing significantly to the success of the project.

The RRC's will have the authority to recover the cost rejuvenation in Polluter pays Principal from those whose may be responsible for the pollution, to the extent found necessary. In this case principal laid down by this tribunal in the said order. Voluntary donations, CSR contribution voluntary services and private participation may be considered in consultation with the RRC.

1. Brief about Bicholim River:

1.1. River Bicholim:

The Bicholim River is the interstate river originates in Maharashtra on the Northern part of the Goa state. The river enters in the state of Goa on hilly terrain of Curchirem, after travelling 16 km before it meets Valvanti River. The river flows through areas like Sarvona, Karapur and Bicholim before it discharges into Valvanti River. The total basin area of the River is 98 Sq. Km. out of which 45 Sq. Km. basin area within Goa State and average runoff of 210.20 MCM.

The salinity mapping was carried out by GSPCB under NWMP and there are no saline stretch (tidal affected stretch) observed on the Bicholim River notified polluted stretch.

1.2. Water Quality of River Bicholim:

For the purpose of conceptualising the plan of action for the polluted river stretch of Bicholim River the data of water quality monitoring carried out by GSPCB for three seasons was considered from year 2015 to 2018 as under

- a) Pre monsoon (January - May)
- b) Monsoon (June – September)
- c) Post Monsoon (October - December)

The sampling results of GSPCB at locations mentioned in the table below have been considered.

Table 2 NWMP locations along the Bicholim River³

Location	Co-ordinates	
	Latitude	Longitude
Barazan Nagar Bicholim	15°35'4.71"N	73°57'2.31"E

The map showing the locations of the sampling point is attached herewith.

³ Annual Sampling Stations by GSPCB



Map 3 Bicholim –Polluted Stretch from Curchirem to Bicholim

1.3. Water Sampling Results:

The sampling results of the GSPCB for the period 2015 to 2018 was analysed to decide the Action plan strategies.

Table 3 Bicholim River parameters at Barazan Nagar Bicholim ⁴

Sr. No.	Year Parameters	2015	2016	2017	2018	Range
Pre - Monsoon (January to May)						
1.	DO (mg/l)	4.7-6.8	9.1- 10.0	5.6-10.1	7.8-13.0	4.7 – 13.0
2.	BOD (mg/l)	2.3 - 4.0	1.0 -3.1	1.3- 2.3	2.5 – 3.6	1.0 – 4.0
3.	Total Coliform (MPN/100ml)	22000	13000-11000	17000-35000	11000-17000	11000 - 35000
Monsoon (June to September)						
1.	DO (mg/l)	6.2 – 6.5	6.7 – 7.0	6.0 – 6.8	6.9- 7.3	6 – 7.3
2.	BOD (mg/l)	0.4 – 0.6	1.5 – 1.9	1.2 – 1.3	1.2 – 1.7	0.4 – 1.9
3.	Total Coliform (MPN/100ml)	11000	7900 - 22000	13000	23000-28000	7900 - 28000
Post - Monsoon (October to December)						
1.	DO (mg/l)	7.7-10.3	9.0-9.6	7.3-10.7	7.1-8.0	7.1 – 10.7

⁴ GSPCB Sampling under NWMP

Sr. No.	Year Parameters	2015	2016	2017	2018	Range
2.	BOD (mg/l)	2.0-4.2	1.9-2.2	1.3-1.4	2.1-3.6	1.3 – 4.2
3.	Total Coliform (MPN/100ml)	4900-17000	7900-11000	13000 - 11000	13000	4900 - 17000

The DO in Bicholim River at Barazan Nagar, Bicholim during pre-monsoon season varies from 4.7 mg/l to 13.0 mg/l and 6 mg/l to 7.3 mg/l during monsoon and 7.1 mg/l to 10.7 mg/l in post monsoon.



Image 3 Water Sample collection at Bicholim River.

The BOD at Barazan Nagar, Bicholim during pre-monsoon season varies from 1.3 mg/l to 4.0 mg/l and 0.4 mg/l to 1.9 mg/l during monsoon and 1.3 mg/l to 4.2 mg/l in post monsoon.

The TC in Varanzan Nagar during pre-monsoon season varies from 11000 MPN/ 100ml to 35000 MPN/ 100ml and 7900 MPN/ 100ml to 28000 MPN/ 100ml during monsoon and 4900 MPN/ 100ml to 17000 MPN/ 100ml in post monsoon.

1.4. Data Analysis and interpretation:

The results of the water sampling carried out by Goa state Pollution Control Board at Barazan Nagar on Bicholim River, from April 2015 to December 2018, in respect of DO, BOD and Total coliform have been considered for preparation of action plan.

The Report of Monitoring for the period April 2015 to December, 2018 of GSPCB at Barazan nagar for the parameters of DO, BOD and Total Coliform have been taken into consideration for the preparation of Action Plan.

- **Dissolved Oxygen (DO)**

The observed DO levels in the polluted river stretch between Barazan Nagar as can be seen from the GSPCB monitoring reports are well above the desired level of 5 mg/l required for bathing water quality.

- **Biochemical Oxygen Demand (BOD)**

The observed BOD levels in the polluted river stretch Varanzan Nagar as can be seen from the GSPCB monitoring reports are well below the desired level of 3 mg/l required for bathing water quality, except at few occurrence, the higher BOD levels are recorded in Post monsoon.

- **Total Coliforms**

The observed TC levels in the polluted river stretch between Curchirem to Bicholim as can be seen from the GSPCB monitoring reports are above the desired levels of 5000 MPN/ 100ML for bathing water quality (as per Env. Protection act 1986). The reports for last five years have been studied to define the pollutions source in the polluted stretch between Curchirem and Bicholim in view of the presence of Total Coliform levels observed during these Studies.

1.5. Action Plan Strategies:

This Bicholim river stretch is polluted stretch **under Priority V** as identified by the CPCB. The action plan is limited to the Regulatory interventions proposed in order to restore the Water Quality to the desired bathing water quality standards notified by the CPCB. The Action Plan has been prepared to achieve Total coliform < 5000 MPN/ 100 ml in the River.

1.6. Major Concerns:

The polluted river stretches in Bicholim River falls under **priority V**. The parameters like Dissolved oxygen and Bio-chemical Oxygen Demand is meeting prescribed statutory requirement but the levels of Total Coliforms (TC) exceeds the prescribed limits.

2. Source Control:

The reconnaissance survey was conducted along with the GSPCB officials for the polluted stretch during the month of January and February 2019. The objective of this study is to analyse the sources of pollutants.

a) Industrial Pollution Control

The source identification studies were conducted during the month of January and February 2019. There are medium and small scale industries located in western banks of Bicholim River. The effluent treatment facility is proposed in decentralised manner and the GSPCB is monitoring the parameters. There are no industrial pollutants / discharge observed in this stretch.

b) Channelization, treatment, utilisation and disposal of treated domestic sewage:

The reconnaissance survey was carried out during the month of January, February 2019, for identification of the sources of pollution of River Bicholim.

i. Sources of Pollutants:

The polluted river stretch (Curchirem to Bicholim) was physically surveyed along both the banks of river during month of January and February for identification of sources of pollution. During the physical survey the discharge of untreated domestic sewage through nallah/ storm water drains was observed mainly on the Eastern & Western Bank of the river at Bicholim, Lamgaon Maulingem & Curchirem. It was also observed during the Survey that, there are discharges from individual houses directly into the river and in some cases storm water drains leading to the River. The main challenge in this River Stretch is to control the levels of Total Coliforms.

Construction of septic tank and soak pits by residential houses and monitoring the frequent cleaning the septic tanks in order to avoid untreated domestic sewage discharge in to the natural drains and washing clothes in the Bicholim River.

3. River Catchment Management:

The total basin area of the River is 98 Sq. Km. out of which 45 Sq. Km. basin area within Goa State and average runoff of 210.20 MCM⁵. The polluted stretch of the river is about 10 Kms between Curchirem and Bicholim. There are pre-dominantly agricultural fields and orchards along both the banks of the River Bicholim and sub urban areas along the entire stretch of the river.

i. Periodic monitoring of ground water resources and regulation of ground water extraction by industries particularly over exploited and critical zones:

The central Ground Water Board has carried out survey of Aquifer System in the State of Goa in Sept. 2013. After studying the aquifer report, it is observed that the ground water table along the Bicholim river stretch is 2 m to 5 m below the ground level during Post monsoon season. The water table lowers down in summer by 0 to 2 M in summer. As the ground water table is high within the Bicholim river basin, there are no such actions proposed for improvement of the ground water table⁶.

4. Flood Plain Zone:

i. Regulating activity in flood plain zone:

During the physical survey conducted in Jan. & Feb. 2019, no encroachments have been identified. The Health department/ Village Panchayat will address the issue of direct sewage discharge into the river in case of individual houses by ensuring construction of septic tanks and soak pits and disconnection of direct discharge.

ii. Management of Municipal, Plastic, Hazardous, Bio-Medical & Electrical and Electronic Waste:

The Local bodies are collecting segregated non bio degradable waste which is sent to the Goa Waste Management Corporation (GWMC) and subsequently transported to the baling station at Saligao within the state except waste from Bicholim Municipal Council, which has its own solid waste management facility including windrows composting, baling and a landfill. Considering the shortfall in the present system to be upgraded by

⁵ NIO studies ICZM July 2013. P. No. 125

⁶ Aquifer System of Goa, Central Ground Water Board Sept. 2013

construction of additional shed for storage of non-biodegradable waste during monsoon, windrows composting. The baled non-biodegradable waste is thereafter transported to cement plants in Karnataka for co incineration.

The remaining Panchayat are predominantly having single dwelling units and there is no major issue disposal of biodegradable waste. GWMC will expand their SWM facility at Saligao from present 125 tons per day to 250 +20 % within a year which will treat and dispose the waste generated by the local bodies in these area.

However improvement in the house to house collection of segregated waste and necessary installation of transfer station for non-biodegradable waste would be completed within period of 6 months. Necessary direction for the same will be issued by the Directorate of Panchayat.

The State of Goa has identified site for construction of Common Biomedical waste at Kundaim Industrial Estate. The National Environmental Engineering Research Institute (NEERI, Nagpur) has conducted the EIA study. The study report has been submitted to the SEIAA /SEAC seeking Environmental Clearance for the facility. The facility expected to be commissioned and operation within next 18 months. In the meanwhile the Healthcare facilities have their own treatment facilities such as Autoclave, Deep burial pit and encapsulation pit, needle burners etc.

The Goa Waste Management Corporation and Producer Responsibility organisation are collecting the E-waste generated throughout the State and the E waste is there after transported to authorised recyclers in other states.

5. Greenery Development- Plantation Plan:

It was observed during the Physical survey that there are extensive coconut, orchards, and other local species along both the banks of the River.

6. Ecological / Environmental Flow (E-Flow):

- i. **Issues relating to E- Flow:** The Polluted stretch of the Bicholim River between Curchirem and Bicholim is non- perennial stretch. The Water resources department has constructed K. T. Weir / Bandhara for Field Irrigation. The data received from WRD Department is enclosed in the table below;

Table 4 Details of the Irrigation Schemes on Bicholim River

Sr. No.	Location of the K.T. Weir / Bandhara	Location of the Lift Irrigation Scheme	Use
	Kudchire II Bandhara	Near Mahadev Temple	Field Irrigation and Ground water recharge
2.	Kudchire II Bandhara	Near vehicular bridge	Ground water recharge and
3.	Maulingem Bandhara	Maulingem	Lift Irrigation Scheme
4.	Wavti Bandhara	Maulingem	Ground water recharge
5.	Vathadev Bandhara	Bicholim	Lift Irrigation Scheme
6.	Bicholim Bridge (upstream)	Bicholim	Ground water recharge
7.	Bicholim Bridge (Gaonkarwada, proposed)	Gaonkarwada, Bicholim	Ground water recharge

The Bicholim River originates in the State Maharashtra and then enters the State of Goa. The Mhadei water dispute tribunal has passed an award on 14th August 2018 in which the State of Maharashtra have been directed to insure sufficient flows in order to maintain the E-flow in the River Bicholim basin in Goa State. Further the water is release from 7 Bandhara's during the lean season to maintain the E-flow throughout the year.

7. Action Plan Strategies:

The action plan strategies based on the sampling analysis of the GSPCB, site survey and observations are listed below. These strategies are classified on the basis of the existing proposal in place, recommended up gradation in order to achieve the desired objective on short term and long-term basis.

Sr. No.	Action Strategy	River Stretch	Agency	Time Frame
1.	<p>Disconnection of direct discharges of domestic sewage into the Bicholim. River/storm water drains/ nallah.</p> <ul style="list-style-type: none"> ➤ Disconnection of the direct discharge into the river/storm water drain/Nallah. ➤ Installation of Bio toilets <p>Construction of septic tank and soak pits by residential houses and monitoring the frequent cleaning the septic tanks in order to avoid untreated domestic sewage discharge in to the natural drains.</p>	<p>Curchirem to Bicholim</p> <ul style="list-style-type: none"> a) Curchirem b) Bicholim Municipal Council c) Ona-Maulinguem d) Karapur-Sarvan e) Amona f) Pilgao 	<p>Directorate of Panchayat and Directorate of Health, ULB.</p>	6 months
2.	<p>a)Improvement to collection system, and erection of material recovery facilities / storage shed for non-biodegradable waste in the Municipal Council, village Panchayat areas along the banks of Bicholim River.</p> <p>b)Improvement and up gradation of the existing Solid Waste Management facility of Bicholim Municipal Council ;</p>	<ul style="list-style-type: none"> a) Curchirem b) Bicholim Municipal Council c) Ona-Maulinguem d) Karapur-Sarvan e) Amona f) Pilgao 	<p>Respective ULB & Village Panchayat and Directorate of Panchayat</p>	<p>12 months</p> <p>6 months</p>

Sr. No.	Action Strategy	River Stretch	Agency	Time Frame
3.	Expansion of Saligao Waste Management facility from 125 tons per day to 250 + 20%	g) Curchirem h) Bicholim Municipal Council i) Ona-Maulinguem j) Karapur-Sarvan k) Amona l) Pilgao		9 months
4.	The State of Goa has identified site for construction of Common Biomedical waste at Kundaim Industrial Estate. The National Environmental Engineering Research Institute (NEERI, Nagpur) has conducted the EIA study. The study report has been submitted to the SEIAA /SEAC seeking Environmental Clearance for the facility. The facility expected to be commissioned and operation within next 18 months. In the meanwhile the Healthcare facilities have their own treatment facilities such as Autoclave, Deep burial pit and encapsulation pit, needle burners etc.	The Common Bio-medical waste treatment facility at Kundaim will treat all the Bio-medical waste generated in the State of Goa.	Goa Waste Management corporation	18 months
5.	The Goa Waste Management Corporation and Producer Responsibility organization are collecting the E-waste generated throughout the State and the E waste is there after transported to authorized recyclers in other states.	The complete State of Goa	Goa Waste Management Corporation	Ongoing

7.1. Conclusion & Remark:

- i. The stretch of River Bicholim from Curchirem and Bicholim having length of **10 Kms is categorized as Priority V**. The parameters such as DO and BOD are well within the CPCB prescribed standards. The only cause of concern is high levels of Total Coliform which is mostly due to the discharge of domestic sewage through nallah, storm water drains including direct discharge from residential houses into the River.
- ii. The Bicholim River originates in the State Maharashtra and then enters the State of Goa. The Mhadei water dispute tribunal has passed an award on 14th August 2018 in which the State of Maharashtra have been directed to insure sufficient flows in order to maintain the E-flow in the River Bicholim basin in Goa State. Further the water is release from 7 Bandhara's during the lean season to maintain the E-flow throughout the year.
- iii. The action plan strategies have been elaborated above and will be implemented by concerned stake holder departments/ corporations by taking necessary action for disconnection of direct discharges of domestic sewage and improvement in the collection and storage of the Solid Waste in the concerned Panchayat.
- iv. The implementation and execution of the proposed action plan will be monitored by the River Rejuvenation Committee constituted by the order of the Hon'ble National Green Tribunal.