**IN THE NATIONAL GREEN TRIBUNAL**

**SOUTHERN ZONE, CHENNAI**

**ORIGINAL APPLICATION NO. 111/2020**

**IN THE MATTER OF**:

Tribunal on its own motion Suo Motu based on the news item in Tamil Newspaper Dinamalar Chennai Edition dt. 13.07.2020, **"Frothing of Chemical Foam in the River Thenpennai"**

Versus

Principal Secretary to Government
Public Works Department, Chennai & Ors. …Respondents

**INDEX**

| | | |
|---|---|---|
| 6. | **ANNEXURE R-5**<br>Copies of letters submitted by the Five Regional Officers of KSPCB. | **166-189** |
| 7. | **ANNEXURE R-6**<br>Copy the Indian Institute of Science, Bangalore Report | **190-200** |
| 8. | **ANNEXURE R-7**<br>Copy pending appeal vide SLP(C) No. 16055 of 2021 | **201** |
| 9. | **ANNEXURE R-8**<br>True Copy of the report furnished by BWSSB dated 23.09.2025, 13.10.2025 and 03.11.2025 | **202-216** |

**Filed by**

**Date: 13.11.2025**

**Darpan KM**
**Standing Counsel**
**State of Karnataka**
**K-6, Lower Ground Floor**
**Lajpat Nagar – 3, New Delhi – 110 024**
**darpan.advocate@gmail.com | +91 98991 25060**

**IN THE NATIONAL GREEN TRIBUNAL**

**SOUTHERN ZONE, CHENNAI**

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Principal Secretary to Government
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**FURTHER ACTION TAKEN REPORT ON BEHALF OF THE CHIEF SECRETARY TO THE STATE OF KARNATAKA**

**MOST RESPECTFULLY SHOWETH**:

1. That the instant Original Application pertains to pollution of Dakshina Pinakini/Thennepannai River. The instant report is being filed in continuation of the earlier Action Taken Report dated 21.08.2025 filed by the answering Respondent in the instant matter.

**Action taken by the BWSSB**

2. **Re: Interim measures being taken by the BWSSB to deal with the sewage until December 2025** – It is submitted that the soak pits/ septic tanks are not long term measures, thus after

(Dr. SHALINI RAJNEESH)
Chief Secretary

completion and commissioning of STPs within a span of 6 months, 30,000 households can be taken into the UGD system.

3. **Re: Work Orders and Progress with Respect to the Upcoming STPs** – It is submitted that the construction of 12 upcoming STPs of 225 MLD capacity in both Hebbal and K&C Valley by BWSSB is under progress and works will be completed as per the timeline indicated earlier. The progress report with respect to construction of STPs at Hebbal and K&C Valley by BWSSB is annexed herewith as **Annexure R-1.** List of proposed 6 STPs by BWSSB is annexed herewith as **Annexure R-2.**

**Re: Toxic Foam Discharge into the Dam**

4. It is submitted that the matter was disposed of on 13.07.2022 after examining the action taken report filed *inter alia* by the concerned departments of the State of Karnataka. The matter was again taken up on 06.11.2024, owing to reports of formation of foam in the river.

5. It is submitted that action has been taken by various departments of State of Karnataka thereafter, which have been placed on record by way of the earlier reports dated 01.04.2025 and 20.08.2025 filed by the Respondents before this Hon'ble Tribunal.



(Dr. SHALINI RAJNEESH)
Chief Secretary

Copies of reports are enclosed as **Annexure R-3** and **Annexure R-4.**

**Compliance by KSPCB**

6. It is humbly submitted that following the action taken by the KSPCB, there has been no discharge of effluent into the river or into lakes which feed the river from industries located in the catchment area of the river. Copies of letters submitted by the Five Regional Officers of KSPCB are annexed as **Annexure R-5**.

**Compliance by BWSSB**

7. Studies carried out by the IISc on the incidence of foaming due to sewage ingress into Bellandur lake revealed that the main cause of foaming is predominantly due to the presence of undecomposed domestic detergents along with some naturally growing non-pathogenic bacteria.

8. In the presence of adequate oxygen, these detergents will rapidly get decomposed by naturally occurring resident bacterial populations and therefore, may not be construed to be caused by toxic substances. Copy of the IISc report is annexed as **Annexure R-6**.

9. It is submitted that as BWSSB conveys and treats the domestic sewage through closed network system, it does not come in



(Dr. SHALINI RAJNEESH)
Chief Secretary

contact with the atmosphere leading to any odour or septicity of sewage. Further, action is taken by BWSSB to give domestic connections to those who were discharging sewage into SWD/lakes. There is no discharge resulting in toxic foam from domestic sewage.

10. It is submitted that the construction of 25 MLD capacity STP at Varthur JICA Phase III is proposed based on the topography of the contributing catchment area. The proposed STP site is bowl shaped and most suitable for construction of STP. Further, sewage flow from all the catchment gravitates to connect to the STP. Accordingly, the sewage network (laterals and sub-mains) are laid considering the proposed location of STP with construction of 15 MLD ISPS at Hagadur.

11. However, as submitted above, the construction of 25 MLD capacity STP at Varthur under JICA Phase III is essential, which has not yet started due to the legal dispute *vis a vis* the land to be utilized for the STP, pending before the Hon'ble Supreme Court of India, vide SLP(C) No. 16055 of 2021. (Writ Appeal No. 3897/2019 (W.P: 23812/2016) dtd. 23.04.2021 judgement of Hon'ble High Court, Karnataka is being questioned by petitioner before Hon'ble Supreme Court of India). The copy of the Pending Appeal vide



(Dr. SHALINI RAJNEESH)
Chief Secretary

SLP(C) No. 16055 of 2021 is annexed as **Annexure R-7**. Once the Varthur STP is commissioned, the sewage generated in Mahadevpura zone can be treated in a complete manner, which is a major catchment of Dakshina Pinakini river along with completion of works proposed under Long term measures, which is same as **Annexure R-2.**

12. True Copy of the report furnished by BWSSB dated 23.09.2025, 13.10.2025 and 03.11.2025 is annexed herewith as **Annexure R-8.**

13. The above information is hence placed on record for the consideration of this Hon'ble Tribunal.

(Dr. SHALINI RAJNEESH)
Chief Secretary
**CHIEF SECRETARY**
**GOVERNMENT OF KARNATAKA**

**FILED BY DARPAN KM**
**STANDING COUNSEL**
**STATE OF KARNATAKA**

**DATE: 13.11.2025**

**IN THE NATIONAL GREEN TRIBUNAL**

**SOUTHERN ZONE, CHENNAI**

**ORIGINAL APPLICATION NO. 111/2020**

**IN THE MATTER OF**:

Tribunal on its own motion Suo Motu based on the news item in Tamil Newspaper Dinamalar Chennai Edition dt. 13.07.2020, **"Frothing of Chemical Foam in the River Thenpennai"**

Versus

Principal Secretary to the Government
Public Works Department, Chennai & Ors. ...Respondents

**AFFIDAVIT**

I, Dr. Shalini Rajneesh, wife of Dr. Rajneesh Geol, aged about 57 years, working as Chief Secretary to the Government of Karnataka, having office at Vidhana Soudha, Bengaluru,56000, Karnataka, do hereby affirm and state on oath as under:

1. That I am working as Chief Secretary to the Government of Karnataka, and in my official capacity and as verifiable from the official records maintained with the Government of Karnataka, as also the information provided by various Departments of the Government of Karnataka. I am familiar with the facts of the case and hence I am swearing to this affidavit.

2. That I have gone through the accompanying Report, drafted on my instructions. I say that the contents thereof are true and correct to the best

Shalini

(Dr. SHALINI RAJNEESH)
Chief Secretary

of my knowledge and belief. Annexures are true copies of their respective originals.

**DEPONENT**
(Dr. SHALINI RAJNEESH)
Chief Secretary

**VERIFICATION:**

I, the above named deponent, do hereby verify that the contents of my affidavit are true and correct to the best of my knowledge and belief, no part of which is false and nothing material has been concealed therefrom.

Verified at Bengaluru on this 12th day of November, 2025.

**DEPONENT**
(Dr. SHALINI RAJNEESH)
Chief Secretary

SWORN BEFORE ME
13/11/2025
CHANDRASHEKARAIAH. S
Advocate & Notary
No. 917, Kempegowda Nilaya
3rd Cross, Muthumayaswamy Extension
Sunkadakatte, Bangalore-560091

Book.... 6 Page.76.....
Reg. No.1897 Date.13/11/2025

# Annexure R-1

| List of Under Construction STPs (BWSSB) Annexure A | | | | | | |
|---|---|---|---|---|---|---|
| Sl. No. | STP location | Proposed capacity (MLD) | Amount in crore | Technology used | Proposed date of completion of work | Status of the project |
| 1 | Kaggadasapura | 5 | 26.38 | SBR | 31.12.2025 | Earlier location was downstream side of lake i.e., 2.5 Acre land due to local objection and as per direction of Hon'ble High Court STP location was shifted and land located only 1.18 Acre and near mouth of storm water drain as such monsoon period entire plant flooded and contractor unable to carryout the work during monsoon period. But now 70% work completed and balance 30% will be completed by December 2025 |
| 2 | Varthur | 25 | 95.25 | EA | - | After clearance of court case pending in Hon'ble Supreme Court and High Court, the construction work will be taken up |
| 3 | Bilishivale | 17 | 61.61 | SBR | 30.04.2026 | Under progress |
| 4 | Doddabetta hally | 7 | 36.30 | SBR | 31.12.2025 | The civil structures along with electro- mechanical installation of STPs at Jakkur-7MLD, Doddabettahally-7MLD & Yelahanka Kere- 6 MLD under JICA V stage will be completed by the end of December-2025 and STP will be commissioned in full manner by the mid of 2026. |
| 5 | Jakkur | 7 | 31.27 | SBR | 31.08.2025 | |
| 6 | Yelahanka | 6 | 38.29 | SBR | 31.12.2025 | |
| 7 | Jakkur-down stream | 10 | 29.33 | SBR | 31.12.2026 | Works are under progress and the same will be completed by the end of December 2026. |
| 8 | Byrahikanne | 13 | 49.68 | SBR | 31.12.2026 | |
| 9 | Anjanapura | 5 | 28.20 | SBR | 31.12.2026 | |
| 10 | Rachenahalli | 10 | 32.85 | SBR | 31.03.2026 | Works are under progress and the same will be completed by the end of March 2026 |
| 11 | Horamavu | 60 | 149.55 | IFAS | 31.12.2026 | Works are under progress and the same will be completed by the end of December 2026 |
| 12 | Hebbal | 60 | 139.40 | IFAS | 28.02.2027 | Works are under progress and the same will be completed by the end of February 2027 |
| Total | | 225.00 | 718.11 | | | |

CE(WWM-East)
BWSSB

CE(WWM-West)
BWSSB

CE(P)
BWSSB

# Annexure R-2

| List of proposed STPs (BWSSB) Annexure C | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sl. No.** | **STP location** | **Proposed capacity (MLD)** | **Amount in crore** | **Technology used** | **Date of commencement** | **Date of completion** | **Status of the project** |
| 1 | Kogilu | 15 | 39.97 | Sequential Batch Reactor (SBR) | 25-08-2025 | 24-02-2028 | The work orders for the construction of 6 STPs along with UGD network of various capacities totalling to 98 MLD proposed under World Bank fundered Karnataka Water Security Resiliance Programme is issued and copies of the same is enclosed for reference. As recently, the work orders are issued the contractors are engaged in mobilization of men and materials and soil investigation/geo-technical |
| 2 | Channasandra | 20 | 48.18 | Sequential Batch Reactor (SBR) | 25-08-2025 | 24-02-2028 | |
| 3 | Sowlkere | 28 | 59.02 | Sequential Batch Reactor (SBR) | 29-08-2025 | 28-02-2028 | |
| 4 | Chikkabegur | 15 | 39.97 | Sequential Batch Reactor (SBR) | 29-08-2025 | 28-02-2028 | |
| 5 | Hulimavu | 15 | 39.97 | Sequential Batch Reactor (SBR) | 25-08-2025 | 24-02-2028 | |
| 6 | Ibblur | 5 | 15 | Sequential Batch Reactor (SBR) | 25-08-2025 | 24-02-2028 | |
| **Total** | | **98.00** | **227.11** | | | | |

CE(P)
BWSSB

CHAIRMAN
BWSSB

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e-mail :cep@bwssb.gov.in

Telephone: 080-22945108

**BANGALORE WATER SUPPLY AND SEWERAGE BOARD**
**Office of the Chief Engineer (Project)**
Cauvery Bhavan III Floor, Bangalore 560009

No. BWSSB/CE (P) /ACE(P)-1/ 987 /2025-26 Dt: 22/08/2025.

## NOTICE TO PROCEED WITH THE WORK

To,
M/s. Enviro Infra Engineers Limited
201, Second Floor, RG Metro Arcade,
Rohini Sector 11, Delhi-110085
Delhi (India).

Sir,

Sub: Design, Engineering, Construction and Commissioning of Wastewater Treatment Plants with Tertiary Treatment Facility and Intermediate Sewage Pumping Station along with Operation & Maintenance thereof for Ten years for Byatarayanapura Zone (DBO mode) in 110 village areas (Phase II) under Karnataka Water Security and Disaster Resilience Program (KWSDRP) – (Contract package No. BWSSB CE-P/KWSDRP/WBS-II-A).

Ref:
1. IFT No. BWSSB/CE(P)/ACE(P)-1/ACE(P)-1/110/2025-26,Dtd: 24.04.2025
2. Indent No. BWSSB/2025-26/WT/WORK_INDENT2252
3. Approval of Board in its meeting held on 15.07.2025
4. LOA No.BWSSB/CE(P)/ACE(P)-1/ACE(P)-1/814/2025-26 Dtd: 23.07.2025.
5. BG No: 027GT02252130011 Date: 01.08.2025- Rs. 2,70,00,000/-.
6. Agreement No.:22/2025-26 Date: 22.08.2025.

*******

Pursuant to furnishing the requisite security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement in respect of "Design, Engineering, Construction and Commissioning of Wastewater Treatment Plants with Tertiary Treatment Facility and Intermediate Sewage Pumping Station along with Operation & Maintenance thereof for Ten years for Byatarayanapura Zone (DBO mode) in 110 village areas (Phase II) under Karnataka Water Security and Disaster Resilience Program (KWSDRP) – (Contract package no. BWSSB CE-P/KWSDRP/WBS-II-A)", you are hereby informed to proceed with the execution of the said work in accordance with the Contract Documents and as per the directions of EE (P)-2.

Kogelu STP

The details of work are as follows:

| | | |
|---|---|---|
| 1 | Sanctioned Estimate cost | Rs. 92.05 Crores (vide CER No.02/2025-26 date:24.04.2025) |
| 2 | Amount put to Tender excluding GST | Rs.71,69,63,260/- |
| 3 | Evaluated cost excluding GST | Rs.67,81,00,000/- (Rupees Sixty-Seven Crore Eighty One Lakh only)<br>Capital Cost- Rs.53,81,00,000/-<br>Opex Cost- Rs.14,00,00,000/- for 10 years<br>GST will be paid in accordance with contract conditions as per actual. |
| 4 | Percentage at which work is to be executed | 5.42 %below the amount put to tender |
| 5 | Contract duration | 30 months (including monsoon) |
| 6 | Date of Commencement | 25.08.2025 |
| 7 | Date of Completion | 24.02.2028 |
| 8 | O & M period (Work A) | 10 years from the Taking-Over certificate. |
| 9 | Head of Account | "CE-KWSDRP-SWPL for the year 2025-26" |

You are hereby requested to start the work immediately and complete the same by fulfilling the tender specifications, satisfactorily and hand over to the Board in a complete manner within the stipulated period.

As per the contract conditions stipulated under Contract Data, you are hereby informed to submit the performance security deposit amount equivalent to 5% of total O &M Price for 10 years starting from the date of completion of the works (date of issue of the Taking-Over Certificate) before commencement of O & M period. Further, additional security for unbalanced O & M tender in accordance with Clause 25.5 of ITT and Clause 44 of the Conditions of Contract amounting to Rs. 6,75,85,152/- need to be furnished.

You are requested to contact EE (P)-2 Division, BWSSB, Bangalore for further needful.

Thanking you

Yours faithfully

**Chief Engineer (Project)**
**BWSSB**

1. Copy submitted to Hon'ble Chairman for kind information.
2. Copy submitted to EIC for kind information.
3. Copy to EE(P)-2 Division along with Approved BOQ, Bid Documents, Original BG along with confirmation & Agreement copy for information and necessary action.
4. Copy to M/s. TCE LTD-NJSEI-JV for information and necessary action.

Kogilu

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e-mail :cep@bwssb.gov.in

Telephone: 080-22945108

**BANGALORE WATER SUPPLY AND SEWERAGE BOARD**
**Office of the Chief Engineer (Project)**
Cauvery Bhavan III Floor, Bangalore 560009

No. BWSSB/CE (P) /ACE(P)-2/ 988 /2025-26 Dt: 22/08/2025.

## NOTICE TO PROCEED WITH THE WORK

To,
M/s. Enviro Infra Engineers Limited
201, Second Floor, RG Metro Arcade,
Rohini Sector 11, Delhi-110085
Delhi (India).

Sir,

Sub: Design, Engineering construction and commissioning of wastewater Treatment Plants with Tertiary Treatment Facility, Solar Panels along with Operation & Maintenance thereof for ten years (Works-A) and procurement and construction of Rising Main, main sewers and laterals including machine holes and lift sewage pumping stations (Works-B) hybrid mode for Mahadevapura zone in 110 village areas(Phase-II) under Karnataka Water Security and Disaster Resilience Program(KWSDRP)-(Contract package No. BWSSB CE-P/KWSDRP/WBS-V).

Ref:
1. IFT No. BWSSB/CE(P)/ACE(P)-1/ACE(Cst-DCW)/110/2025-26, Dtd: 24.04.2025
2. Indent No. BWSSB/2025-26/WT/WORK_INDENT2251
3. Approval of Board in its meeting held on 15.07.2025
4. LOA No.BWSSB/CE(P)/ACE(P)-2/815/2025-26 Date: 23.07.2025.
5. BG No: 027GT02252130009 Date: 01.08.2025- Rs. 5,49,00,000/-.
6. Agreement No.: 23/2025-26 Date: 22.08.2025.

*******

Pursuant to furnishing the requisite security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement in respect of "Design, Engineering construction and commissioning of wastewater Treatment Plants with Tertiary Treatment Facility, Solar Panels along with Operation & Maintenance thereof for ten years (Works-A) and procurement and construction of Rising Main, main sewers and laterals including machine holes and lift sewage pumping stations (Works-B) hybrid mode for Mahadevapura zone in 110 village areas(Phase-II) under Karnataka Water Security and Disaster Resilience Program(KWSDRP)-(Contract package No. BWSSB CE-P/KWSDRP/WBS-V)", you are hereby informed to proceed with the execution of the said work in accordance with the Contract Documents and as per the directions of EE (P)-4.

Channasandra STP

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The details of work are as follows:

| | | |
|---|---|---|
| 1 | Sanctioned Estimate cost | Rs.167.47 Crores (vide CER No.06/2025-26 date:24.04.2025) |
| 2 | Amount put to Tender excluding GST | Rs.127,74,01,964/- |
| 3 | Evaluated cost excluding GST | Rs.119,70,19,006/-(Rupees One Hundred Nineteen Crores Seventy Lakh Nineteen Thousand Six only)<br>Capital Cost- Rs.109,70,19,006/-<br>Opex Cost- Rs.10,00,00,000/- for 10 years (For Work A only).<br>GST will be paid in accordance with contract conditions as per actual. |
| 4 | Percentage at which work is to be executed | 6.29% below the amount put to tender |
| 5 | Contract duration | 30 months (including monsoon) |
| 6 | Date of Commencement | 25.08.2025 |
| 7 | Date of Completion | 24.02.2028 |
| 8 | O & M period (Work A) | 10 years from the Taking-Over certificate. |
| 9 | Head of Account | "CE-KWSDRP-SWPL for the year 2025-26" |

You are hereby requested to start the work immediately and complete the same by fulfilling the tender specifications, satisfactorily and hand over to the Board in a complete manner within the stipulated period.

As per the contract conditions stipulated under Contract Data (Work A), you are hereby informed to submit the performance security deposit amount equivalent to 5% of total O &M Price for 10 years starting from the date of completion of the works (date of issue of the Taking-Over Certificate) before commencement of O & M period. Further, additional security for unbalanced O & M tender in accordance with Clause 25.5 of ITT and Clause 44 of the Conditions of Contract amounting to Rs. 13,02,68,000/- need to be furnished.

You are requested to contact EE (P)-4 Division, BWSSB, Bangalore for further needful.

Thanking you

Yours faithfully

Chief Engineer (Project)
BWSSB

1. Copy submitted to Hon'ble Chairman for kind information.
2. Copy submitted to EIC for kind information.
3. Copy to EE (P)-4 Division along with Approved BOQ, Bid Documents, Original BG along with confirmation & Agreement copy for information and necessary action.
4. Copy to M/s. TCE LTD-NJSEI-JV for information and necessary action.

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e-mail :cep@bwssb.gov.in

Telephone: 080-22945108

**BANGALORE WATER SUPPLY AND SEWERAGE BOARD**
**Office of the Chief Engineer (Project)**
Cauvery Bhavan III Floor, Bangalore 560009

No. BWSSB/CE (P) /ACE(P)-2/ 1603 /2025-26 Dt: 28 /08/2025.

**NOTICE TO PROCEED WITH THE WORK**

To,
M/s. Eco-Protection Engineers Pvt. Ltd- M/s. TECTON
Engineering & Construction (India) Pvt. Ltd. (JV)
No. 943, 54th Street, TVS Colony
Anna Nagar West Ext.
Chennai-600101

Sir,

Sub: Design, Engineering construction and commissioning of wastewater Treatment Plants with Tertiary Treatment Facility and Intermediate Sewage Pumping Station along with Operation & Maintenance thereof for ten years (Works-A) and procurement and construction of Rising Main, main sewers and laterals including machine holes and lift sewage pumping stations(Works-B) hybrid mode for Bommanahalli zone in 110 village areas(Phase-II) under Karnataka Water Security and Disaster Resilience Program(KWSDRP)-(Contract package No. BWSSB CE-P/KWSDRP/WBS-IV).

Ref: 1. IFT No. BWSSB/CE(P)/ACE(P)-1,2/TA/141/2025-26 Dtd.29.04.2025
2. Indent No. BWSSB/2025-26/WT/WORK_INDENT2256
3. Approval of Board in its meeting held on 15.07.2025
4.LOA No. BWSSB/CE(P)/ACE(P)-2/832/2025-26 Date: 28.07.2025.
5. BG No: 0734725BG0B00154 Date: 05.08.2025- Rs. 8,26,00,000/-.
6. Agreement No.: 26/2025-26 Date:28.08.2025.

*******

Pursuant to furnishing the requisite security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement in respect of "Design, Engineering construction and commissioning of wastewater Treatment Plants with Tertiary Treatment Facility and Intermediate Sewage Pumping Station along with Operation & Maintenance thereof for ten years (Works-A) and procurement and construction of Rising Main, main sewers and laterals including machine holes and lift sewage pumping stations(Works-B) hybrid mode for Bommanahalli zone in 110 village areas(Phase-II) under Karnataka Water Security and Disaster Resilience Program(KWSDRP)-(Contract package No. BWSSB CE-P/KWSDRP/WBS-IV)", you are hereby informed to proceed with the execution of the said work in accordance with the Contract Documents and as per the directions of EE (P)-3.

Sowlkere & Chikkabegur (Single work order)
STP's

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The details of work are as follows:

| | | |
|---|---|---|
| 1 | Sanctioned Estimate cost | Rs.232.05 Crores (vide CER No.06/2025-26 date:24.04.2025) |
| 2 | Amount put to Tender excluding GST | Rs.179,12,46,564/- |
| 3 | Evaluated cost excluding GST | Rs.185,14,59,790/- (Rupees One Hundred Eighty Five Crore Fourteen Lakh Fifty Nine Thousand Seven Hundred and Ninety only)<br>Capital Cost - Rs. 165,14,59,790/-<br>Opex Cost - Rs.20,00,00,000/- for 10 years (For Work A only).<br>GST will be paid in accordance with contract conditions as per actual. |
| 4 | Percentage at which work is to be executed | 3.36 % above the amount put tender |
| 5 | Contract duration | 30 months (including monsoon) |
| 6 | Date of Commencement | 29.08.2025 |
| 7 | Date of Completion | 28.02.2028 |
| 8 | O & M period (Work A) | 10 years from the Taking-Over certificate. |
| 9 | Head of Account | "CE-KWSDRP-SWPL for the year 2025-26" |

You are hereby requested to start the work immediately and complete the same by fulfilling the tender specifications, satisfactorily and hand over to the Board in a complete manner within the stipulated period.

As per the contract conditions stipulated under Contract Data (Work A), you are hereby informed to submit the performance security deposit amount equivalent to 5% of total O & M Price for 10 years starting from the date of completion of the works (date of issue of the Taking-Over Certificate) before commencement of O & M period. Further, additional security for unbalanced O & M tender in accordance with Clause 25.5 of ITT and Clause 44 of the Conditions of Contract amounting to Rs. 24,96,80,000/- need to be furnished.

You are requested to contact EE (P)-3 Division, BWSSB, Bangalore for further needful.

Thanking you

Yours faithfully

Chief Engineer (Project)
BWSSB

1. Copy submitted to Hon'ble Chairman for kind information.
2. Copy submitted to EIC for kind information.
3. Copy to EE (P)-3 Division along with Approved BOQ, Bid Documents, Original BG along with confirmation & Agreement copy for information and necessary action.
4. Copy to M/s. TCE LTD-NJSEI-JV for information and necessary action.action.

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e-mail:cep@bwssb.gov.in

Telephone: 080-22945108

**BANGALORE WATER SUPPLY AND SEWERAGE BOARD**
**Office of the Chief Engineer (Project)**
Cauvery Bhavan III Floor, Bangalore 560009

No. BWSSB/CE (P) /ACE(P)-2/ 975 /2025-26 Dt: 21/08/2025.

## NOTICE TO PROCEED WITH THE WORK

To,
M/s. VA TECH WABAG Limited
"WABAG House", No. 17, 200 Feet Thoraipakkam,
Pallavaram Main Road, Sunnambu,
Kolathur, Chennai-600117.

Sir,

Sub: Design, Engineering, Construction and Commissioning of Wastewater Treatment Plants with Tertiary Treatment Facility, Biogas Generation & Solar Sludge Drying Bed and Intermediate Sewage Pumping Station along with Operation & Maintenance Thereof for Ten years [Works - A] and Procurement and Construction of Rising Main, Main Sewers and laterals including Machine holes and Lift Sewage Pumping Stations [Works – B] Hybrid Mode for Bommanahalli Zones in 110 village areas (Phase II) under Karnataka Water Security and Disaster Resilience Program (KWSDRP) - (Contract Package No. BWSSB CE-P/KWSDRP/WBS-III).

Ref:
1. IFT No. BWSSB/CE(P)/ACE(P)-1,2/TA/141/2025-26,Dtd: 29.04.2025
2. Indent No. BWSSB/2025-26/WT/WORK_INDENT2255
3. Approval of Board in its meeting held on 15.07.2025
4. LOA No. BWSSB/CE(P)/ACE(P)-2/828/2025-26 Dtd: 25.07.2025.
5. BG No: 1810IGPER021825 Date: 28.07.2025, Rs. 16,57,00,000/-.
6. Agreement No.: 21 Date: 21/08/2025

*******

Pursuant to furnishing the requisite security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement in respect of "Design, Engineering, Construction and Commissioning of Wastewater Treatment Plants with Tertiary Treatment Facility, Biogas Generation & Solar Sludge Drying Bed and Intermediate Sewage Pumping Station along with Operation & Maintenance Thereof for Ten years [Works - A] and Procurement and Construction of Rising Main, Main Sewers and laterals including Machine holes and Lift Sewage Pumping Stations [Works – B] Hybrid Mode for Bommanahalli Zones in 110 village areas (Phase II) under Karnataka Water Security and Disaster Resilience Program (KWSDRP) (Contract Package No. BWSSB CE-P/KWSDRP/WBS-III)", you are hereby informed to proceed with the execution of the said work in accordance with the Contract Documents and as per the directions of EE (P)-3.

VA TECH WABAG LIMITED

CHIEF ENGINEER (PROJECT) BWSSB

Hubanavu & Ibbluu (STP's) — single order

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The details of work are as follows:

| | | |
|---|---|---|
| 1 | Sanctioned Estimate cost | Rs.470.20 Crores (vide CER No.04/2025-26 date: 24.04.2025) |
| 2 | Amount put to Tender excluding GST | Rs. 362,42,17,771/- Crores |
| 3 | Evaluated cost excluding GST | Rs.380,39,60,300/-(Rupees Three Hundred Eighty Crore Thirty-Nine Lakh Sixty Thousand and Three Hundred only)<br>Capital Cost- Rs.331,39,60,300/-<br>Opex Cost- Rs.49,00,00,000/- for 10 years (For Work A only).<br>GST will be paid in accordance with contract conditions as per actual. |
| 4 | Percentage at which work is to be executed | 4.95% above the amount put to tender |
| 5 | Contract duration | 30 months (including monsoon) |
| 6 | Date of Commencement | 25.08.2025 |
| 7 | Date of Completion | 24.02.2028 |
| 8 | O & M period (Work A) | 10 years from the Taking-Over certificate. |
| 9 | Head of Account | "CE-KWSDRP-SWPL for the year 2025-26" |

You are hereby requested to start the work immediately and complete the same by fulfilling the tender specifications, satisfactorily and hand over to the Board in a complete manner within the stipulated period.

As per the contract conditions stipulated under Contract Data (Work A), you are hereby informed to submit the performance security deposit amount equivalent to 5% of total O &M Price for 10 years starting from the date of completion of the works (date of issue of the Taking-Over Certificate) before commencement of O & M period. Further, additional security for unbalanced O & M tender in accordance with Clause 25.5 of ITT and Clause 44 of the Conditions of Contract amounting to Rs. 28,23,61,000/- need to be furnished.

You are requested to contact EE (P)-3 Division, BWSSB, Bangalore for further needful.

Thanking you

Yours faithfully

Chief Engineer (Project)
BWSSB

1. Copy submitted to Hon'ble Chairman for kind information.
2. Copy submitted to EIC for kind information.
3. Copy to EE(P)-3 Division along with Approved BOQ, Bid Documents, Original BG along with confirmation & Agreement copy for information and necessary action.
4. Copy to M/s. TCI-LTD-TPL-JV for information and necessary action.

# Annexure R-3 18

**IN THE NATIONAL GREEN TRIBUNAL**
**SOUTHERN ZONE, CHENNAI**
**ORIGINAL APPLICATION NO. 111/2020**

**IN THE MATTER OF:**

Tribunal on its own motion Suo Motu based on the news item in Tamil Newspaper Dinamalar Chennai Edition dt. 13.07.2020, **"Frothing of Chemical Foam in the River Thenpennai"**

Versus

Principal Secretary to Government
Public Works Department, Chennai & Ors. ...Respondents

## AFFIDAVIT

I, Dr. Shalini Rajneesh, wife of Dr Rajneesh Goel aged about 57 years, working as the Chief Secretary to the Government of Karnataka, having office at Vidhana Soudha, Bengaluru, 560001, Karnataka do hereby affirm and state on oath as under:

1. That I am working as Chief Secretary to the Government of Karnataka and in my official capacity and as verifiable from official records maintained with Government of Karnataka, as also the information provided by various departments of Government of Karnataka, I am familiar with the facts of the case and hence I am swearing to this affidavit.

2. That I have gone through the accompanying Report, drafted on my instructions. I say that the contents thereof are true and correct to the best of my knowledge and belief. Annexures are true copies of their respective originals.

Shalini

**DEPONENT**

**VERIFICATION:**

I, the above named deponent do hereby verify that the contents of my affidavit are true and correct to the best of my knowledge and belief, no part of which is false and nothing material has been concealed therefrom.

Verified at Bengaluru on this 1st day of April, 2025.

Shalini

**DEPONENT**

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**IN THE NATIONAL GREEN TRIBUNAL**
**SOUTHERN ZONE, CHENNAI**
**ORIGINAL APPLICATION NO. 111/2020**

**IN THE MATTER OF:**

Tribunal on its own motion Suo Motu based on the news item in Tamil Newspaper Dinamalar Chennai Edition dt. 13.07.2020, **"Frothing of Chemical Foam in the River Thenpennai"**

Versus

Principal Secretary to Government
Public Works Department, Chennai &Ors. ...Respondents

**ACTION TAKEN REPORT ON BEHALF OF THE CHIEF SECRETARY TO THE STATE OF KARNATAKA**

**MOST RESPECTFULLY SHOWETH:**

1. That the instant Original Application pertains to pollution of Dakshina Pinakini/Thennepannai River. In this regard, the action taken on behalf of the State of Karnataka is as follows:

2. **Re: Flow Measurements:** It is submitted that KSPCB has identified 15 new locations for rigourous monitoring of qualitative analysis of water flowing in the Dakshina Pinakini river and drains leading to the river. The details of new locations including geo coordinates along with responsible organizations for monitoring the flow is annexed as **Annexure-I.** It is

submitted that monitoring in the new locations is being carried out once in a month.

3. **Performance Study of STPs**: It is submitted that BWSSB has entrusted the work of performance evaluation of STPs (BNR removal studies) to Indian Institute of Science, (IISc) Bangalore. The IISc after detailed evaluation of STPs has submitted its report on 04-02-2022, with recommendations to BWSSB. True Copy of the report regarding performance evaluation of STPs is annexed herewith as **Annexure -II**.

4. It is submitted that BWSSB has submitted a copy of the report along with action taken on the recommendations. The catchment of Thenpennai has around 16 STPs. All these 16 STPs were functioning and compliant as per the existing norms, however in view of the new stringent norms prescribed by NGT in terms of 7 parameters, 4 STPs are compliant as per new norms. 12 STPs are being upgraded and the upgradation will be completed by December 2025. True copy of status report along with timelines submitted by BWSSB is attached as **Annexure –III.**

5. **Sewerage Network**: It is submitted that to cater to the needs of the 110 villages & other un-sewered areas in the Dakshina

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Pinakini river catchment area, BWSSB has taken up constructions of 12 new STPs of total capacity 225 MLD and will be completed by December 2025. List of STPs under construction is enclosed as **Annexure-IV**.

6. Further the BWSSB has proposed to construct 10 new STPs with proposed capacity of 313 MLD; Government has accorded administrative approval for 04 STP's and tender is in progress. For remaining 06 STP's, an estimate of Rs. 1200.00 crores is prepared. List of proposed STPs is annexed herewith as **Annexure-V**.

7. The status of progress on compliance of the direction of Hon'ble NGT compared to 2020 is as follows:

| **Activity** | **As per 2020** | **As on March 2025** |
|---|---|---|
| Number of STPs | 16 | 26 |
| Capacity of STP (MLD) | 550 | 832.44 |
| Sewer lines in Kilometer | 5435 | 6285 |
| No. of Households connected to UGD | 13,71,925 | 16,13,372 |

8. **Water Quality Monitoring and Analysis**: With respect to water quality of the water flowing in River Thenpennai, it is submitted that KSPCB is monitoring the river water quality at Mugular

been issued by the Regional Offices, KSPCB and one industry was found discharging effluent into the storm water drain, for which the Board has issued closure directions under the provisions of the Water (Prevention and Control of Pollution) Act, 1974, and the Air (Prevention and Control of Pollution) Act, 1981. Additionally, a criminal complaint has been lodged having number CC 21/2024 (1065/2013) in the XLI Addl Chief Judicial Magistrate, Bengaluru City. Furthermore, after 2020, the Board has identified 201 new industries/organizations in the catchment area of the Dakshina Pinakini River, all of which are compliant with the Karnataka State Pollution Control Board's norms.

The Regional Offices of the KSPCB have conducted a total of 559 inspections of industries/organizations in the Thenpennai River Basin, from April 2024 to February 2025, for the non-compliances observed, Show Cause Notices to 260 organisations have been issued by the Regional Offices of the KSPCB.

11. **Environmental Compensation for STPs**: It is submitted that KSPCB has levied EC for 513 organisations under OA No.125/2017 falling in the catchment area of Bellandur Lake. As of February 2025, an amount of Rs.4.165 Cr has been collected

Bridge once in a month regularly. As per the analysis report of the river water quality meets the Class "E" (Irrigation, industrial cooling, controlled waste disposal) category, as per the classification set by the Central Pollution Control Board (CPCB). A quick analysis of the samples in the Mugulur bridge for a period 11 months, indicates an improving trend in BOD in February 2025 – 36 mg/l as compared to April 2024 – 71 mg/l. It is also observed that there is an improving trend in total Phosphate reduction. The total Phosphates in February 2025 - 0.67 mg/l as compared to April 2024 which 4.6 mg/l, which is the main cause for frothing of the river. True Copy of analysis report is annexed herewith as **Annexure-VI**.

9. **Random Verification of Industries/Establishments:** It is submitted that random verification of Industries is a continuous process. As per the March 2025 report from the Regional Offices of KSPCB, there are 531 industries/ organizations in the catchment area of Dakshina Pinakini River. In the year 2020, the KSPCB identified 330 industries/organizations in the catchment area of the Dakshina Pinakini River, out of which, 272 industries/ organizations have complied with norms of the Board. Out of the remaining 58, 19 organizations are discharging sewage to BWSSB existing UGD sewer with permission from the BWSSB and remaining 27 industries/organizations have been closed (on their own); 11 were found to be non-compliant and Show Cause Notices have

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out of Rs.289.2 Cr Environmental Compensation levied. 18 organizations have approached Hon'ble Courts. The KSPCB is in the process of recovering balance amount of EC. Final notice is issued for recovering of balance EC and further action will be initiated.

12. **Installation of Continuous Online Water Quality Monitoring Station:** Based on this Hon'ble Tribunal order dated 28.06.2021 in the present Original Application, the CPCB issued directions for compliance under Section 18(1)(b) of the Water (Prevention and Control of Pollution) Act, 1974, instructing the KSPCB to install a Continuous Online Water Quality Monitoring Station at the interstate river boundary in Karnataka to ensure that improved water quality reaches Tamil Nadu.

13. In compliance with CPCB directions, the KSPCB has executed an agreement with M/s. Greenvironment Innovation and Marketing India Pvt. Ltd. on 19.03.2022 to provide services for a solar-powered IoT-based River Monitoring System. The equipment was operational from 07.04.2022 to 06.09.2022. However, after 06.09.2022, the equipment was damaged due to floods and ceased functioning. Consequently, the KSPCB terminated the agreement in January 2024. The KSPCB has floated tenders for procuring the Real-Time Water Quality

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Monitoring System (RTWQMS) for installing at Mugalur Bridge to ensure continuous monitoring. The process will be completed in 2 months' time.

14. Until the installation of the RTWQMS at Mugulur Bridge is completed, the KSPCB has directed its Regional Office to manually monitor the river water quality once in 15 days.

15. **Action Taken by BDA**: It is submitted that as of February 2025, out of Rs.100.3 Crore allocated by BDA, the BDA has made significant progress in rejuvenation of Bellandur Lake with 70% of the physical progress, 88% of the financial progress and 30% of physical progress has been made on the wetland construction achieved. Out of the total 12.26 km perimeter of the lake, chain link fencing has been installed for 11.26 km. Due to an ongoing Court case pertaining to Ambedkar Nagar area, located to the north of the lake yard, wire fencing has been installed in the entire periphery, except for a 1.00 km stretch. With respect to Varthur Lake, 97% of physical progress and 94.46% of financial progress have been achieved out of Rs.53.8 Crore financial allocation. To prevent encroachment on the lake land, 8.06 km of chain link fencing has been constructed around the lake's perimeter. Additionally, approximately 17.22 lakh cubic meters of accumulated silt have

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been removed from the lake. The dredging work has been completed, and 98% of physical progress has been made on the wetland construction. True copy of the BDA report is annexed herewith as **Annexure-VII**.

16. The CPCB, has identified the Dakshina Pinakini River along Mugalur as a Polluted River Stretch with Priority I (BOD > 30 mg/L). An action plan for the rejuvenation of the Dakshina Pinakini River is under preparation by the Deputy Commissioner (DC) of Bengaluru Urban and Bengaluru Rural districts in consultation with concerned stake holders and will be submitted in two months time. The Ministry of Jal Shakti, Government of India, is reviewing the progress of rejuvenating polluted river stretches under OA 673/2018.

17. The above information is hence placed on record for this Hon'ble Tribunal's consideration.

**CHIEF SECRETARY**
**GOVERNMENT OF KARNATAKA**

**FILED BY**

**DARPAN KM**
**STANDING COUNSEL**
**STATE OF KARNATAKA**

**Date:01.04.2025**

ANNEXURE-I

| Sl. No. | Name of the Flow monitoring location (Dakshina Pinakini River Basin) | River/ drain | Water Quality monitoring department | Flow monitoring department (BBMP/Irrigation dept.) | Co-ordinates of the location |
|---|---|---|---|---|---|
| 1 | Venkatagirikote Lake | Lake | KSPCB | Zilla Panchayath | 13 326583 N<br>77 725305 E |
| 2 | Budigere Lake | Lake | KSPCB | Zilla Panchayath | 12 970657 N 77 783604 E |
| 3 | Hoskote Lake | Lake | KSPCB | Zilla Panchayath | 13 065682 N<br>77.770628 E |
| 4 | Check Dam Near Samethanahalli Lake | River | KSPCB | Minor Irrigation Department | 12 970657 N<br>77 783604 E |
| 5 | Inlet of BWSSB STP Koraluru | Drain | KSPCB | BBMP | 12.99648 N<br>77 77675 E |
| 6 | Rampura/Huvinene/ Maragondanahalli Lake | Towards West | KSPCB | BBMP Department | 13° 02' 54 38" N<br>77° 40' 47 74" E |
| 7 | Yelemallappa Shetty Lake | Towards North West | KSPCB | Irrigation Department | 13° 02' 28 79" N<br>77° 43' 09 11" E |
| | | Towards West | KSPCB | Irrigation Department | 13° 01' 16 06" N<br>77° 43' 14 73" E |
| 8 | K R Puram Lake | Towards West | KSPCB | BBMP Department | 13° 00' 58 94" N<br>77° 41' 43 31" E |
| 9 | Channasandra Bridge | Channasandra Main Road | KSPCB | Irrigation Department | 12° 59' 05.78" N<br>77° 46' 36 16" E |
| 10 | Mugaluru Bridge, Mugaluru, Sarjapura Hobli, Anekal Taluk, Bengaluru Urban District | River | KSPCB | Irrigation Dept. | N - 12.89318<br>E- 77.82773 |
| 11 | Near Agara Lake Gate No.01 | Drain | KSPCB | BBMP | 12 916389 N,<br>77 638333 E |
| 12 | Y-Junction Srinivagilu Koramangala | Drain | KSPCB | BBMP | 12 929000N,<br>77 643111 E |
| 13 | Up-Stream of Jakkur Lake,Nehru Nagar, Bengaluru-560064. | Rajakaluve | KSPCB | BBMP | Lat. 13 094348,<br>Long 77.607528 |
| 14 | Up Stream of Rachenahalli Lake, Near JNU Institute, Nrarampuru Cross Road, Thanisandra, Bengaluru - 560064 | Rajakaluve | KSPCB | BBMP | Lat. 13 067760,<br>Long 77.612207 |
| 15 | Thanisandra Main road Brigade, Near Element Mall, (Rajacaluve Common Point- II & N Valley, Jakkur & Rachenahalli Valley Flow), Nagavara, Bangalore-560045 | Rajakaluve | KSPCB | BBMP | Lat 13 045618,<br>Long 77.627286 |

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ನೀರನ್ನು ಮಿತವಾಗಿ ಬಳಸಿ

"ಕಾವೇರಿ" ಕೃಷ್ಣರಾಜಪುರ
eenewater@bwssb.gov.in

# BANGALORE WATER SUPPLY AND SEWERAGE BOARD

Office of the Executive Engineer, STP - Hebbal Valley, Opp. Nagavara Lake, BDA Outer Ring Road, Bengaluru- 560024

No. BWSSB /ESH/SH2/AE/ 1093 /2021-22

Date: 04/02/2022
Received 15/2/22

To

ACE WWM-3(STP-K Valley) / EE (STP V Valley)
EE (STP-A Valley) / EE (STP-C Valley)

AE-1

Sub: Work of conducting studies towards the upgradation of the existing Twenty (20) Sewage Treatment Plants of BWSSB, to meet the effluent discharge standards as directed by the Hon'ble National Green Tribunal – Regarding BNR Removal Studies - Final Report Submission from IISC

Ref:
1. Agreement executed with IISC No. 25 Dt: 07.12.2020
2. W. O No.BWSSB/CE(WWM)/ACE(WWM)/TA/1871/2020-21 Dt: 10.12.2020
3. No. BWSSB/CE(WWM)/ACE(WWM)-1/DCE(WWM)/TA-1/650/2021-22 Dt: 02.08.2021
4. No. BWSSB/ESH/SH2/AE/426/2021-22 Dt: 16/08/2021
5. IISC Ltr Dated 12.11.2021
6. No. BWSSB/ESH/SH2/AE/747 /2021-22 Dt: 23/11/2021
7. IISC Ltr Dated 04.02.2022

********

With reference to the above, in continuation to the letter issued vide ref(6), it is to inform that M/s IISC have submitted the final report on BNR Removal Studies as per their scope of work towards Work of conducting studies towards the upgradation of the existing Twenty (20) Sewage Treatment Plants of BWSSB, to meet the effluent discharge standards as directed by the Hon'ble National Green Tribunal as per the agreement and work order issued vide ref(1 & 2).

Hence, the final report is herewith attached for perusal and hereby requested to report any observations from your end within 7 days for further necessary action. The same final report will be submitted to Competent Authority for approval if no observations are submitted.

Encl: Final Report from M/s IISC

EE (STP)-HV
BWSSB

Copy submitted to CE (WWM)/ACE(WWM)-2 for kind information

Copy to AEE STP/HV-2 for information and necessary action

Office of the Chief Engineer (WWM)
6085
7/2/22
BWSSB, Bangalore

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Assistant Professor
Prof. H N Chanakya
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Phone : 91-80 2293 2814
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04th of February 2022

## BNR Removal Studies – Revised Final Report Submission

To
The Chief Engineer (WWM)
BWSSB
Bangalore

Dear Sir

Ref : 1) No. BWSSB/CE(WWM)/ACE(WWM) /TA/187/2020-21 dated 10/12/2020
2) MoU Agreement No. 25/2020-21 Dated 07-12-2020
3) No Cost extension letter dated August 11th 2021

In continuation with the above reference documents, please find attached the final report on BNR Removal Studies

Please do let me know if you need any other information from our side.

Sincerely

Dr. Lakshminarayana Rao
CST, IISc

Prof. H N Chanakya
CST, IISc

Prof. M S Mohan Kumar
(Former Prof.) CE, IISc

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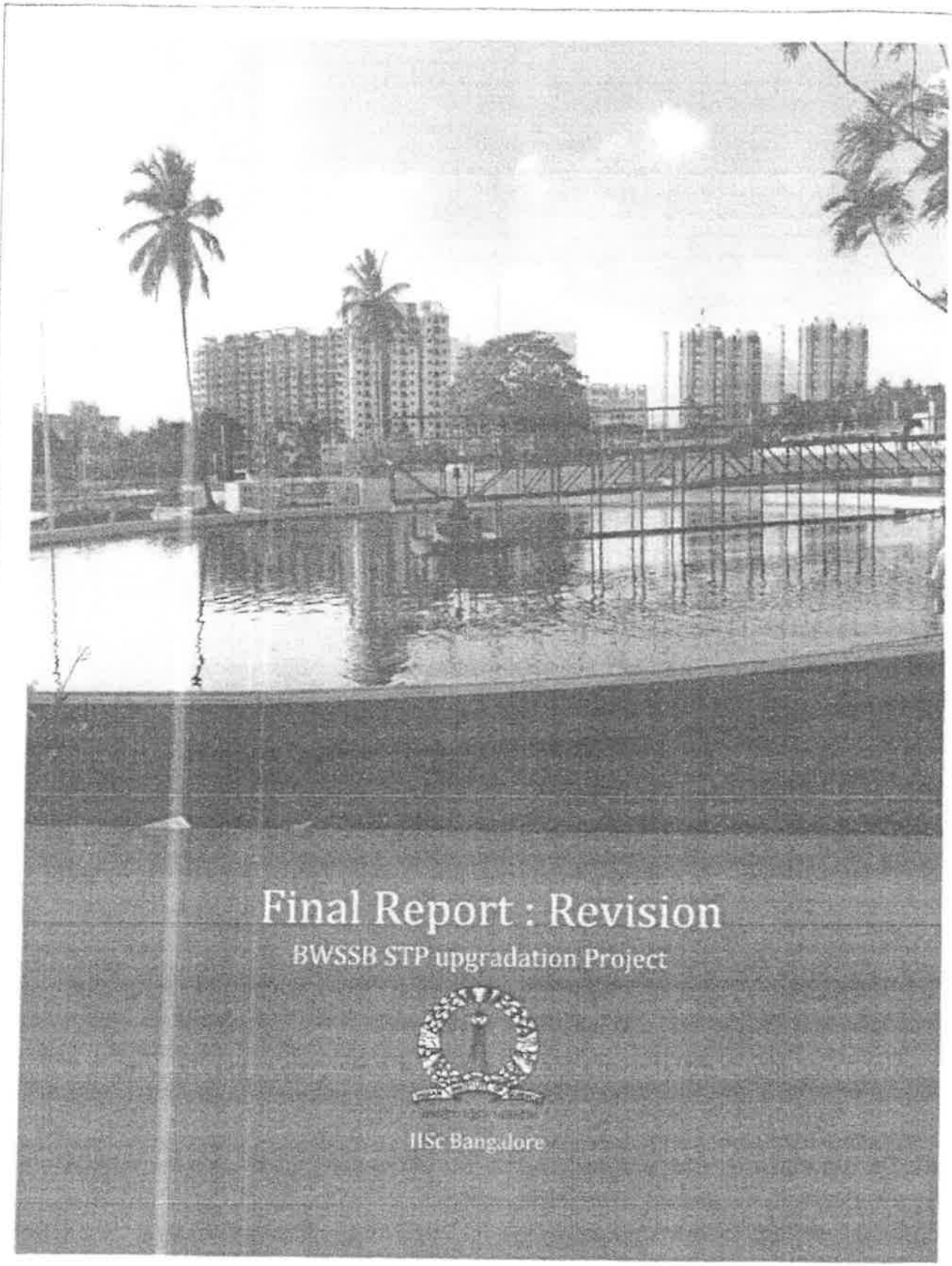

# Final Report : Revision

## BWSSB STP upgradation Project

IISc Bangalore

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## Executive Summary

To meet the new effluent discharge standards given by the Honorable National Green Tribunal (NGT), an effort is undertaken by the Bangalore Water Supply and Sewerage Board (BWSSB) to upgrade 17 old sewage treatment plants of Bengaluru. IISc team was engaged to inspect and recommend suitable modifications to the current treatment process to meet the required standards. The responsibilities included technical visits to all Sewage treatment plant (STP) sites to understand the process, detailed water quality analysis of samples taken from the STPs, giving recommendations based on the water quality analysis, and modeling to ensure effluent meets NGT standards. As part of this effort, technical site visits were carried out to all the 17 STPs, and samples were collected at all sites. A process simulation model was developed for each STP and the model was validated with "as-is" condition. Using the simulated model, process modifications were suggested to achieve BNR standards in the short term. The IISc team also has suggested certain recommendations to meet the BNR standards in the long run.

Out of 17, STPs studied, 8 STPs namely 1) K & C valley (60 MLD), 2) Bellandur Amani kere (90 MLD), 3) Horamavu Agara (20 MLD), 4) Nagasandra phase -2 (20 MLD), 5) Chikkabanavara (5 MLD), 6) Doddabele (20 MLD), 7) Rajacanal P-I and 8) Rajacanal P-II are meeting the NGT-BNR standards. Rajacanal P-I and P-II, previously did not meet the NGT-BNR standards. After implementing the suggestions given by IISc team on one stream out of two in each of the plants; the effluent water quality improved and meets the NGT standards. Further, 6 STPs namely 1) Mailasandra phase -1 (75 MLD), 2) Kempabudhi (1MLD), 3) Kadugodi ( 6 MLD), 4) Halasuru ( 2MLD), 5) Yelemallappa Chettikere (15 MLD) and 6) Mallathahalli (5 MLD) were marginally under performing. Three of the STPs namely 1) Kadubeesanahalli (50 MLD), 2) Nagasandra phase -1 (20 MLD) and 3) K R Puram phase -1 (20 MLD) were poorly performing in terms of NGT standards. Process modifications for both the marginally performing and poorly performing STPs based on simultaneous nitrification and denitrification principle have been recommended by the IISc team as a short-term measure. Also, the IISc team has recommended long-term measures to ensure compliance of discharge effluents from all these STPs. Maintenance of chlorine contact tanks is an issue across all STPs, and it is decreasing the quality of effluent. Effective chlorination and dichlorination cycles for each of these STPs should be implemented. Continuous monitoring for the 17 STPs is necessary to ensure long-term compliance with NGT standards.

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## 1.0 BACKGROUND

To meet the new effluent discharge standards given by National Green Tribunal (NGT), an effort is undertaken by the Bangalore Water Supply and Sewerage Board (BWSSB) to upgrade old sewage treatment plants. IISc team was engaged to inspect and recommend suitable modifications to the current treatment process to meet the required standards. The responsibilities included technical visits to all Sewage treatment plant (STP) sites to understand the process, detailed water quality analysis of samples taken from the STPs, giving recommendations based on the water quality analysis, and modeling to ensure effluent meets NGT standards. As part of this effort, technical site visits were carried out to all the STPs, and samples were collected at all sites.

**List of STPs:**

1. K & C valley (60 MLD)
2. Bellandur Amani kere (90 MLD)
3. Kadubeesanhalli phase -1 (50 MLD)
4. Kadugodi (6 MLD)
5. Halasuru (2 MLD)
6. Rajacanal phase -1 (40 MLD)
7. Rajacanal phase -2 (40 MLD)
8. Horamvu Agara (20 MLD)
9. K R Puram phase -1 (20 MLD)
10. Yelemallappa Chettikere (15 MLD)
11. Nagasandra phase -1 (20 MLD)
12. Nagasandra phase -2 (20 MLD)
13. Mallathahalli (5 MLD)
14. Chikkabanavara (5 MLD)
15. Mailasandra phase -1 (75 MLD)
16. Kempabudhi (1MLD)
17. Doddabele (20 MLD)

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The team was informed that Madiwala STP was under maintenance and hence was not operational; similarly, V Valley STP is under up-gradation and hence not operating. Further, the team was informed that the Kengeri STP was included in the list unintentionally. Therefore these three STP locations were not visited.

## 2.0 METHODOLOGY:

1. All STP sites were visited. Information about the plant capacity, treatment process, new construction/ rehabilitation, and possible issues was obtained at each location. The treatment facility at each location was visually inspected to assess its functioning.
2. Water samples were collected at each site and analyzed. Based on the analyzed effluent, the STPs were classified into three categories: 1) STPs meeting NGT-BNR standards, 2) Marginally underperforming STPs, and 3) Poorly performing STPs.
3. For STPs requiring intervention, 'as is' models were created using Biowin. The 'as is' models were validated using collected water quality data. The validated models were optimized at full flow.

## 3.0 PROCEEDINGS OF THE PROJECT

- Trip reports for all site visits were submitted.
- A report with details of 6 STPs meeting NGT-BNR standards was submitted.
- A report with details of 11 STPs requiring intervention was submitted.
- A presentation was given in the presence of the Chairman of BWSSB and all BWSSB executives and assistant engineers.

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- Some clarifications were sought by the BWSSB team after the final presentation. A final report with the clarifications and all of the above-mentioned reports attached as appendices was submitted.

In response to the request from the BWSSB team, this document is generated with data consolidated from the previously submitted reports for better clarity. The BWSSB team implemented some changes based on the recommendations given by IISc at a few STP locations. The results of these changes are also included in this report.

The analysis of collected samples showed that six out of the seventeen STPs studied are were operation optimally and conforming to NGT standards and the other eleven were not conforming to NGT-BNR standards. Three out of the eleven STPs were performing extremely poorly, and the other eight were borderline. The poorly performing plants included Kadubeesanhalli, K R Puram, and Nagasandra phase - I. At two borderline STPs (Rajacanal phase I and II), measures suggested in Final report -B were implemented and as a result, they are currently operating optimally. Therefore they are described in a separate category.

## 4.0 FINAL RECOMMENDATIONS FOR STPS MEETING NGT-BNR STANDARDS:

### *4.1: Nagasandra phase 2: 20 MLD*

#### *4.1.1: Standard Operating Procedure recommended by IISc:*

- The current operational procedures are adequate for achieving BNR removal as per NGT standards.
- Continue the current operational cycle, which includes 2 hrs of filling and aeration, 1hr of settling, and 1 hr of decantation. Continuous monitoring should be done to assure the NGT standards are met in the long term.

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- At the current operating conditions, the plant can achieve adequate nutrient removal for a daily average flow of up to 20MLD, which is the plant's design capacity.
- A recommendation would be to keep an eye on the sludge settling and increase the settling time accordingly.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

### *4.2: Chikkabanavara: 5 MLD*

#### *4.2.1: Standard Operating Procedure recommended by IISc:*

- The current operational procedures are adequate for achieving BNR removal as per NGT standards.
- Continue with the current operational cycle, which includes 1.5hr of filling and aeration, 0.5 hrs of settling, and 1 hr of decanting. Continuous monitoring should be done to assure the NGT standards are met with long term
- Currently, two out of three SBR basins are being operated on 3hr cycles. The plant can achieve adequate nutrient removal at the current operating conditions for a daily average flow of up to 5.5MLD.

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- If the incoming flow goes beyond this value, the third basin will have to be used, and operations will have to be altered to 3 basin/3hr conditions.
- A recommendation would be to reduce aeration time and increase settling time.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

### *4.3: Horamavu: 20 MLD*

#### *4.3.1: Standard Operating Procedure recommended by IISc:*

- The current operational procedures are adequate for achieving BNR removal as per NGT standards.
- Continue the current operational cycle, which includes 2 hrs of filling and aeration, 1hr of settling, and 1 hr of decantation. Continuous monitoring should be done to assure the NGT standards are met with in the long term.
- The plant is currently operating almost at its design capacity and cannot take on more load.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.

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- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

***4.3.2: Amendment to the standard operating procedure:***

- A project report with detailed cost estimates of electromechanical replacements, civil structure strengthening, and other permanent measures required should be prepared.

### *4.4: Doddabele: 20 MLD*

#### *4.4.1: Standard Operating Procedure recommended by IISc:*

- The current operational procedures are adequate for achieving BNR removal as per NGT standards.
- Continue the current operational cycle, which includes 0.5 hrs of filling and mixing, 0.75hrs of filling and aeration, 1.75 hrs of aeration, 0.5 hrs of mixing, 0.5 hrs of settling, and 2hrs of decanting. Continuous monitoring should be done to assure the NGT standards are met with in the long term.
- The plant is currently operating almost at its design capacity and cannot take on more load.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.

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- If the incoming flow goes beyond this value, the third basin will have to be used, and operations will have to be altered to 3 basin/3hr conditions.
- A recommendation would be to reduce aeration time and increase settling time.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

### *4.3: Horamavu: 20 MLD*

#### *4.3.1: Standard Operating Procedure recommended by IISc:*

- The current operational procedures are adequate for achieving BNR removal as per NGT standards
- Continue the current operational cycle, which includes 2 hrs of filling and aeration, 1hr of settling, and 1 hr of decantation. Continuous monitoring should be done to assure the NGT standards are met with in the long term.
- The plant is currently operating almost at its design capacity and cannot take on more load.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.

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- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

***4.3.2: Amendment to the standard operating procedure:***

- A project report with detailed cost estimates of electromechanical replacements, civil structure strengthening, and other permanent measures required should be prepared.

### *4.4: Doddabele: 20 MLD*

***4.4.1: Standard Operating Procedure recommended by IISc:***

- The current operational procedures are adequate for achieving BNR removal as per NGT standards.
- Continue the current operational cycle, which includes 0.5 hrs of filling and mixing, 0.75hrs of filling and aeration, 1.75 hrs of aeration, 0.5 hrs of mixing, 0.5 hrs of settling, and 2hrs of decanting. Continuous monitoring should be done to assure the NGT standards are met with in the long term.
- The plant is currently operating almost at its design capacity and cannot take on more load.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.

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- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

*4.4.2: Amendment to the standard operating procedure:*

- The plant is currently operating at full capacity. The STP is likely to receive more sewage shortly. Therefore, it is recommended that provisions for increasing the plant's capacity be made to receive and treat the additional sewage.

*4.4.3: Feasibility report for up-gradation of the plant capacity from 20 to 40 MLD:*

**Introduction:**

Doddabele is a 20 MLD sewage treatment plant under the jurisdiction of the Bangalore Water Supply and Sewage Board. The operation and maintenance of the plant began in June-2018 and uses Sequential Batch Reactor (SBR) technology to treat incoming sewage.

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Design flow parameters for the 20 MLD SBR Doddabele STP:

| Sr. No. | Design Parameters | Capacity |
|---|---|---|
| 1 | Average Flow | 20.00 MLD |
| 2 | Peak Factor | 2.25 |
| 3 | Peak Flow | 45 MLD |

Design raw sewage and treated effluent quality parameters:

Table 1: Design influent and effluent water quality parameters for Doddabele 20 MLD STP

| Parameters | Raw Sewage | Treated Sewage | Unit |
|---|---|---|---|
| pH | 6.5 – 7.5 | 6.5 - 8.0 | |
| BOD5 | 350.00 | <15 | mg/L |
| COD | 800.00 | <250 | mg/L |
| TSS | 450.00 | <30 | mg/L |
| Ammonical Nitrogen ($NH_4$-N) | 45 | <1 | mg/L |
| Total Nitrogen | - | - | mg/L |
| Total Phosphorous | 7 | <1 | mg/L |
| Fecal Coliform | - | <200 | MPN/100m$^l$ |

**Project Objective:**

As per the revised/latest NGT standards the effluent water quality standards have become stricter. Although the plant is currently achieving the revised treated effluent standards set by NGT most of the time, but there will be slight variation in these parameters occasionally since the plant is not designed to

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achieve revised parameters. Hence it is necessary to re-design the plant to ensure that the treated effluent quality always meets the NGT norms.

The plant is currently operating at full capacity. However, it is likely to receive more sewage than its design capacity as the volume of the total sewage generated in the V.Valley catchment area is expected to increase shortly (as per the data provided by EE(WWM) division). Hence, the capacity of the existing STP also needs to be increased from 20 MLD to 40 MLD to treat the additional sewage generated in the V Valley catchment area shortly.

Given the above facts, rehabilitation of the existing plant is recommended. Hence, the up-gradation of the Doddabele STP is proposed for the following design parameters.

Design flow parameters for the proposed plant:

| Sr. No. | Design Parameters | Capacity |
|---|---|---|
| 1 | Average Flow | 40.00 MLD |
| 2 | Peak Factor | 2.25 |
| 3 | Peak Flow | 90 MLD |

Design treated water parameters:

Table 2: Design effluent water quality parameters for proposed Doddabele 40 MLD STP

| Parameters | Value | Unit |
|---|---|---|
| pH | 6.5 - 8.5 | |
| BOD 5 at 20°C | <10.00 | mg/L |
| COD | <50.00 | mg/L |
| TSS | <10.00 | mg/L |
| Total Nitrogen | <5 | mg/L |

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| | | |
|---|---|---|
| Total Phosphorous | <1 | mg/L |
| Ammonical Nitrogen (NH4-N) | <5 | mg/L |
| Fecal Coliform | < 100 | MPN/100m$^3$ |

**Existing treatment Units in the 20 MLD plant:**

The technology used for secondary treatment in the plant is the Sequential Batch Reactor process followed by chlorination for disinfection.

- Sewage Pumping Station (SPS):
  - Receiving Chamber
  - Mechanical Coarse Screen
  - Raw Sewage Sump
  - Raw Sewage Transfer Pump
- Sewage Treatment Plant
    - Primary treatment: STP Inlet Chamber
    - Mechanical Fine Screens
    - Grit Basin
    - Parshall Flume
  - Secondary treatment:
    - Sequential Batch Reactor (SBR)
    - Coagulant Dosing System
  - Disinfection
    - Chlorine Contact Tank

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- Sludge Treatment
  - Gravity Thickener
  - Sludge storage tank
  - Centrifuge
  - Polyelectrolyte Dosing Tank

**Proposed modification to the existing plant:**

- Upgradation of sewer line from manhole to pumping station: Currently sewage is coming to pumping station via an 800 dia. RCC pipe which is sufficient for 20 MLD but needs to be replaced with a 1200 dia. pipeline to receive a flow of 40 MLD.
- Upgradation of coarse screen chamber: At Present, there are 2 coarse screens of size 60mm (1w + 1s mechanical) to handle 20 MLD flow. To handle an additional 20 MLD one more screen module having 2 coarse screens with necessary electro-mechanical equipment and a complete piping system needs to be constructed adjacent to the existing screen chamber.
- Upgradation of Sewage Transfer Pumps: The currently installed sewage transfer pumps can handle 20 MLD flow. The capacity needs to be upgraded to handle 40 MLD. Furthermore, an additional wet well to handle a flow of 40 MLD with a peak factor of 2.25 also needs to be constructed along with the necessary civil, electromechanical, and instrumentation equipment.
- Upgradation of Rising Main from Pumping Station to STP Inlet Chamber: Currently a 700 mm dia. rising main sufficient for 20 MLD is present and one more rising main is required for the additional 20 MLD flow.
- Upgradation of primary treatment Units:

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- Presently 3 (2 working + 1 standby) mechanical medium Screens are installed. These are sufficient to treat 40 MLD flow at a velocity of 1.2 m/s at peak flow without any further modification.
- 2 working mechanical detritus type grit chambers are installed which are not sufficient to cater to 40 MLD flow even at the maximum surface loading rate specified in the CPHEEO manual. At peak flow, it will reach around 1600 m3/m2/day which is very high. Due to this, an additional grit chamber shall be provided to cater the 40 MLD flow with all 3 grit chambers in working condition each for 1/3rd of peak flow.

- Change in aeration capacity of SBRs: Presently 4 working blowers are installed which are not sufficient for aeration of 40 MLD flow. Additional 4 air blowers of the same capacity are required along with piping network, civil, electromechanical & instrumentation equipment.
- Change in cycle timing of SBR for Nitrification and Denitrification: To increase the removal of BOD, COD, and Nitrogen in SBR, it is proposed to revise/change in the cycle time so that proper nitrification and denitrification shall be carried out in SBR.
- Upgradation of decanters of SBR Basins: Currently there are 4 decanters for 20 MLD flow. The decanting system needs to be upgraded. The new decanters shall be installed to cater to 40 MLD flow.
- Upgradation of Chlorinator: Currently there are 2 chlorinators of 15 kg capacity which are sufficient for 40 MLD flow with a dosing rate of 5 ppm. Therefore, there is no need to upgrade the chlorinator.
- Sludge Handling system: Currently there are 2 sludge thickeners of 13.9 m dia. and 2 sludge storage tanks of 400 $m^3$ capacity each, which are present at the STP. In addition to this, 1 more

sludge thickener of 400cum capacity needs to be constructed including piping, electro mechanical, and instrumentation equipment.

- Sludge Dewatering Machines: Currently there are 2 sludge dewatering machines of a capacity of 27 m3/hr are available and these can be used for 18 hours per day to handle incoming sludge.
- Additional Electrical Load: Additional power requirement may be met through the existing power infrastructure.

The above technical requirements are recommended based on the site conditions and available data. But a detailed design analysis has to be carried out by considering the complete feasibility of the up-gradation of the plant.

### *4.5: K&C Valley: 60 MLD*

#### *4.5.1: Standard Operating Procedure recommended by IISc:*

- The current operational procedures are adequate for achieving BNR removal as per NGT standards.
- The plant is operating at its capacity and cannot take any more load. Continuous monitoring should be done to assure the NGT standards are met with in the long term.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

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### *4.6: Bellandur: 90 MLD*

#### *4.6.1: Standard Operating Procedure recommended by IISc:*

- The current operational procedures are adequate for achieving BNR removal as per NGT standards.
- The plant is operating at its capacity and cannot take any more load. Continuous monitoring should be done to assure the NGT standards are met with in the long term.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

#### *4.6.2: Amendment to the standard operating procedure:*

- Sludge storage yard should be constructed since there is no provision for sludge (Centrifuge) storage at the site.
- Chlorine contact tanks should be thoroughly cleaned, tiled, and painted with algae-resistant paint or coating, preferably in blue colour.

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## 5.0 SUMMARY OF RECOMMENDATIONS FOR MODIFIED BORDERLINE STPs WHICH ARE NOW MEETING THE NGT-BNR STANDARDS:

### *5.1 Rajacanal phase 1: 40 MLD*

#### *5.1.1 Past status of the plant:*

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 35 MLD | 2004 | EAP | 2700 mg/L | 85% | 400 $m^3$/day | 1.8 2 mg/L | Yes |

1. The Dissolved oxygen level maintained in the aeration basin is at par with the claimed DO levels. The plant uses surface aerators.
2. The current MLSS in the aeration tank are most likely lower than the claimed value
3. The water quality analysis shows that the plant meets the BOD and phosphorus standards but does not meet the total Nitrogen and COD standards.
4. Unclean Chlorine contact tanks with settled sludge and algal growth are increasing the COD of effluent

#### *5.1.2 Modifications suggested to meet NGT-BNR standards*

1. Turn the aerators on and off in such a way as to split the aeration tank into three separate zones
2. Zone 1 is aerated at 3 mg/L. Zone 2 is unaerated, and zone 3 is aerated at 2 mg/L.
3. This modification will result in the removal of Nitrogen. Further increasing the MLSS in the tank will improve nitrogen removal.
4. The MLSS in the aeration tank should be increased by at least 1000 mg/L.
5. Chlorine contact tanks should be thoroughly cleaned, tiled, and painted with algae-resistant paint or coating, preferably in blue color.

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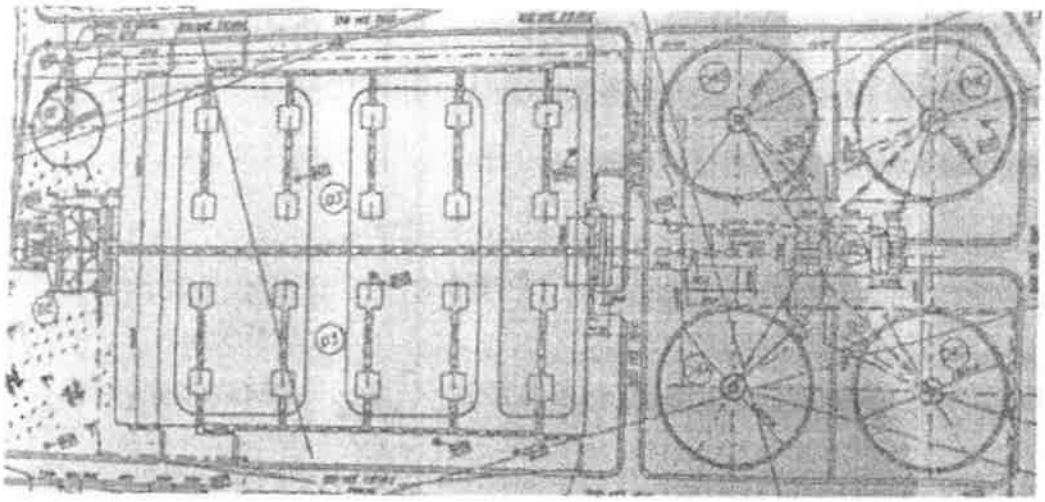

Figure 1: Layout of Rajacanal phase – I indicating which aerators to turn on and off. Blue: Aerators ON, Orange: Aerators OFF

*5.1.3 Standard Operating Procedure recommended by IISc:*

- Split the aeration basin to create three zones: aerated-unaerated-aerated.
- Turn on the first two rows (4 aerators) of surface aerators to achieve a dissolved oxygen concentration of 3 mg/L. The hydraulic retention time of the aeration zone at the inflow of 40 MLD should be 4 hrs.
- Turn off the next two rows (4 aerators) of surface aerators to create an anoxic zone with a retention time of 4 hrs at 40 MLD inflow.
- Turn on the last row of (2 aerators) of surface aerators to achieve a dissolved oxygen concentration of 2 mg/L. The hydraulic retention time of the aeration zone should be 2hrs at 40 MLD inflow.
- The MLSS in the tank should be increased to fall between 3500-4000 mg/L by controlling RAS and WAS.

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- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

***5.1.3 Results of applied modifications:***

The plant has two aeration basins. The suggested standard operating procedure was implemented in one out of the two aeration basins at the sewage treatment plant leading to overall better effluent quality. The plant effluent is now meeting the NGT-BNR standards. The graph below shows a comparison between the outlet parameters before and after the modification.

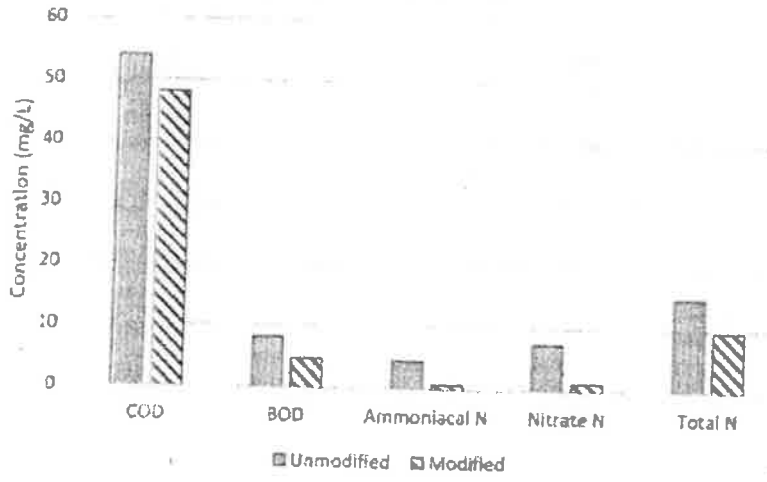


Figure 2: Comparison of outlet water quality parameters before and after implementing the modification at Rajacanal phase I

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*5.1.5 Amendment to the standard operating procedure:*

- Above recommendations should not be implemented in the event the effluent from the plant is being for irrigation purposes.
- A project report with detailed cost estimates of electromechanical replacements, civil structure strengthening, and other permanent measures required should be prepared.
- A separate grit Chamber should be provided before the screen chamber
- Mechanical Fine Screen and its allied works to be upgraded
- Mechanical raked coarse screens, belt conveyors along with all its accessories and allied civil works should be replaced.
- Deteriorated raw sewage pumps should be replaced.
- Columns and platform area of the aeration tank are severely damaged. Therefore, the aeration tank should be refurbished after strengthening the RCC structure.
- Diffused Aeration system should be provided in the Aeration tank through Blowers/Blower room.
- Anaerobic zone should be introduced after the Anoxic zone in the Aeration tank
- A SCADA system should be installed for continuous monitoring and management of all electro-mechanical equipment including all Electrical related works.
- New TSPS with necessary electro-mechanical equipment & Civil cum Electrical work should be constructed along with the construction of ISPS for the new proposed Horamavu STP, inside the Rajacanal STP premises.
- To avoid the necessity of a sludge drying bed and manual sludge loading, Sludge Thickener, Centrifuge system should be installed with all its accessories.

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- Following Electro-Mechanical Equipment appear to have reached the end of their service and should be replaced after detailed inspections.
    - Motorized Valve – 4 nos
    - Grit Chamber Detritor – 2 nos
    - Submersible Mixers – 2 nos
    - Grit Classifier – 2nos
    - Surface Aerator – 4 nos
    - Sluice Gates – 4 nos
    - 2MT EOT crane – 2nos
    - DO Analyser for the Aeration Tank – 2nos
    - Classifier Assembly with its accessories – 4 nos
    - RAS Pumps – 3 nos
    - Thickener Sludge Transfer pump – 2 nos
    - Supernatant pumps – 2 nos
    - Chlorination System to be upgraded – 1 no
    - Scrubber to be provided for neutralization system
    - Service Water Pumps – 2 nos
    - Streetlights – all to be replaced with LED along with Cables

### *5.2 Rajacanal phase -2: 40 MLD*

#### *5.2.1 Past status of the plant:*

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 45 MLD | 2018 | EAP | 3500 mg/L | 80% | ~2000 $m^3$/day | 3 mg/L | Yes |

1. The dissolved oxygen level maintained in the aeration basin is at par with the claimed DO levels. The plant uses diffuse aerators
2. The water quality analysis shows that the plant meets the BOD and phosphorus standards but does not meet the total Nitrogen and COD standards.
3. Unclean Chlorine contact tanks with settled sludge and algal growth are increasing the COD of effluent.

### *5.2.2 Modifications suggested to meet NGT-BNR standards*

1. Turn the aerators on and off in such a way as to split the aeration tank into two separate zones
2. Zone 1 is aerated at 3.5 mg/L, and Zone 2 is unaerated.
3. This modification will result in the removal of Nitrogen. Further increasing the MLSS in the tank will improve nitrogen removal.
4. Chlorine contact tanks should be thoroughly cleaned, tiled, and painted with algae-resistant paint or coating, preferably in blue color.

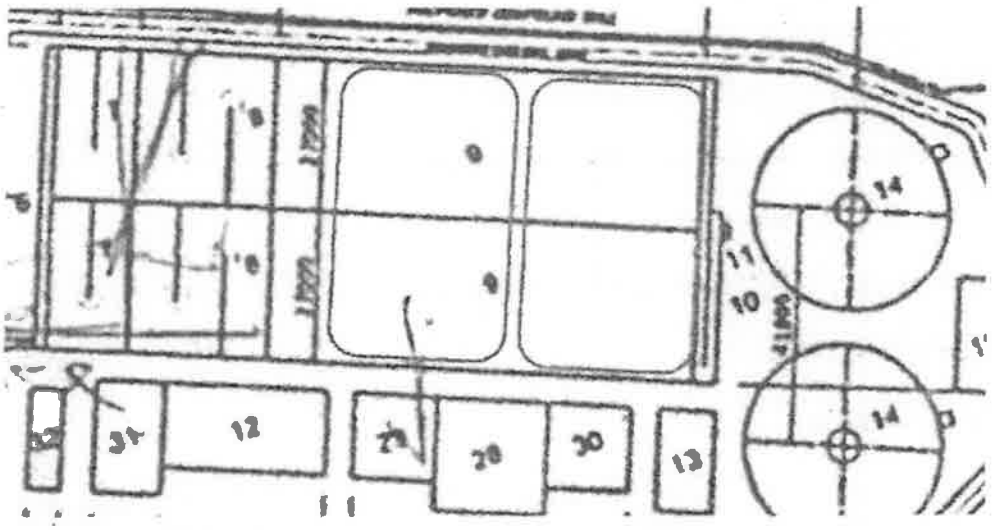


Figure 3: Layout of Rajacanal phase – 2 indicating which aerators to turn on and off. Blue: Aerators ON, Orange: Aerators OFF

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*5.2.3 Standard Operating Procedure recommended by IISc:*

- Split the aeration basin to create an aeration zone followed by an anoxic zone.
- Turn on the first 16 rows of diffusers to achieve a dissolved oxygen concentration of 3.5 mg/L. The hydraulic retention time of the aeration zone at an inflow of 45.5 MLD should be 4.1 hrs.
- Turn off the next 16 rows of diffusers to create an anoxic zone with a retention time of 3.8 hrs at 45.5 MLD inflow.
- Turn on the last row of diffusers to polish the water. The retention time would be 0.3 hrs.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

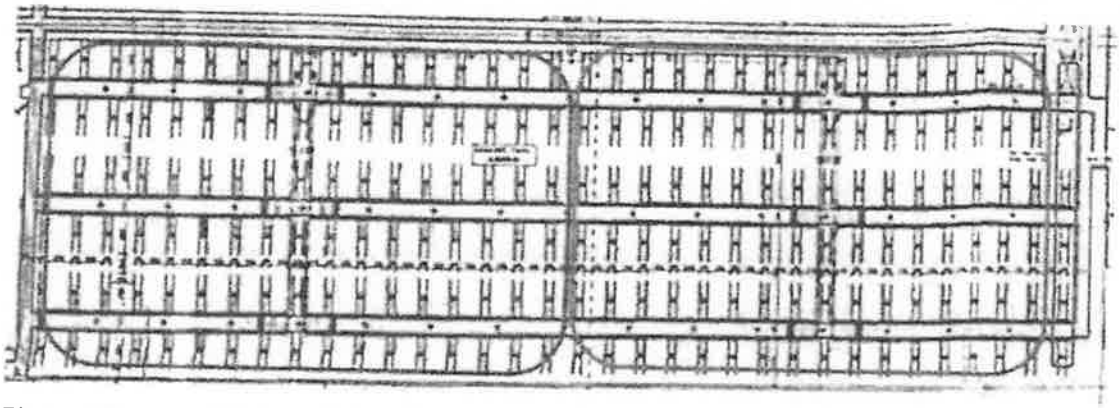

Figure 4: Layout of Rajacanal phase – 2 indicating which aerators to turn on and off. Blue: Aerators ON, Orange: Aerators OFF

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*5.2.4 Results of applied modifications:*

The plant has two aeration basins. The suggested standard operating procedure was implemented in one out of the two aeration basins at the sewage treatment plant leading to overall better effluent quality. The plant effluent is now meeting the NGT-BNR standards. The graph below shows a comparison between the outlet parameters before and after the modification.

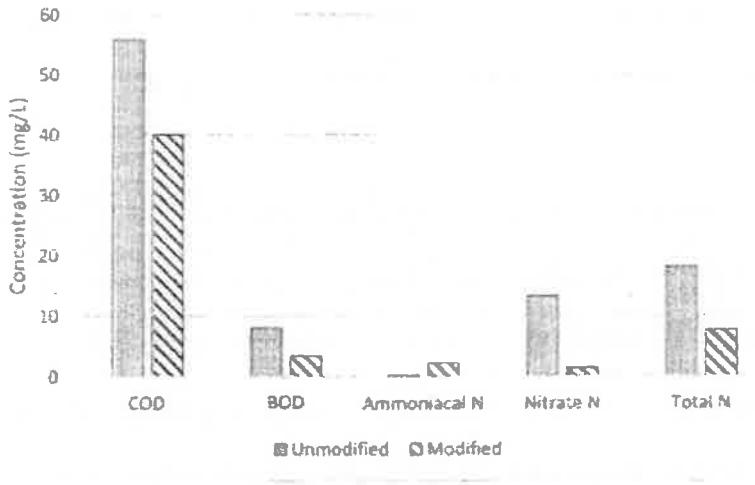


Figure 5: Comparison of outlet water quality parameters before and after implementing the modification for Rajacanal phase II

*5.2.5 Amendment to the standard operating procedure:*

- Above recommendations should not be implemented in the event the effluent from the plant is being for irrigation purposes.
- A project report with detailed cost estimates of electromechanical replacements, civil structure strengthening, and other permanent measures required should be prepared.
- Grit/Silt removing Chamber should be installed before Coarse Screen

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- Consideration of IFAS process inside the Aeration Basin to reduce Total Nitrogen and COD parameters.
- Recirculation Pump Capacity should be increased as per the requirement
- Chlorine contact tanks should be thoroughly cleaned, tiled, and painted with algae-resistant paint or coating, preferably in blue color.

## 6.0 FINAL RECOMMENDATIONS FOR BORDERLINE STPS:

### *6.1 Mailasandra phase -1: 75 MLD*

#### *6.1.1 Current status of the plant:*

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 70 MLD | 2015 | EAP | 3500 mg/L | 73% | ~550 $m^3$/day | - | Yes |

1. The Dissolved oxygen level maintained in the aeration basin is 2-3 mg/L. The plant uses surface aerators
2. The MLSS in the aeration tank is not adequate.
3. The water quality analysis shows that the plant meets the BOD and phosphorus standards but does not meet the total Nitrogen and COD standards.
4. Unclean Chlorine contact tanks with settled sludge and algal growth are increasing the COD of effluent.

#### *6.1.2 Modifications required to meet NGT-BNR standards*

1. Turn the aerators on and off in such a way as to split the aeration tank into three separate zones
2. Zone 1 is aerated at 3.5 mg/L. Zone 2 is unaerated, and zone 3 is aerated at 3.5 mg/L

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3. This modification will result in the removal of Nitrogen. Further increasing the MLSS in the tank will improve nitrogen removal. MLSS should be increased by at least 1000 mg/L.
4. Chlorine contact tanks should be thoroughly cleaned, tiled, and painted with algae-resistant paint or coating, preferably in blue color.

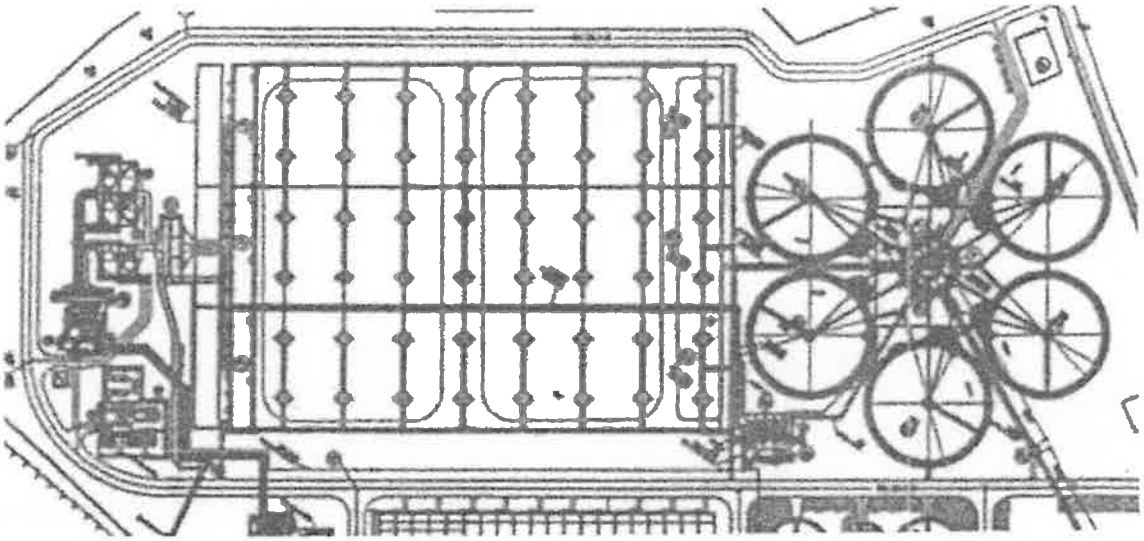

Figure 6: Layout of Mailasandra phase – I indicating which aerators to turn on and off. Blue: Aerators ON, Orange: Aerators OFF

***6.1.3 Standard Operating Procedure recommended by IISc:***

- Split the aeration basin to create three zones: aerated-unaerated-aerated.
- Turn on the first three rows of surface aerators to achieve a dissolved oxygen concentration of 3 mg/L. The hydraulic retention time of the aeration zone at an inflow of 75 MLD should be 5.4 hours.
- Turn off the next four rows of surface aerators to create an anoxic zone with a retention time of 5.4 hours at 75 LD inflow.

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- Turn on the last row of surface aerators to achieve a dissolved oxygen concentration of 2 mg/L. The retention time of the aeration zone should be 1.5 hrs.
- The MLSS in the aeration basin is claimed to be 3500 mg/L but is most likely less than 2000 mg/L. Therefore increase the MLSS level in the aeration basin to a concentration between 3500-4000 mg/L by altering RAS and WAS.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

***6.1.4: Amendment to the standard operating procedure:***

- Upgrade the current STP to meet NGT standards. In addition, increase the capacity of the existing treatment plant from 75 MLD to 100 MLD.

***6.1.5: Feasibility report for up-gradation of the plant capacity from 75 to 100 MLD:***

**Introduction:**

BWSSB has installed a 75MLD STP at Mailasandra village adjacent to Mysore road, near Kengeri, Bengaluru-560059 in the year 2002 – 2005. This plant is treating the sewage generated from Kanakapura road, ISRO layout, Kethamaranahalli, and Arkavathi valley areas. It is located on 32 Acres and 36 guntas lands and has a built-up area of about 23 acres.

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The plant is operating at a full designed capacity of 75MLD. The Treatment process adopted in this plant is an Extended Aeration system with an anoxic zone. The treatment process includes coarse bar screen, inlet wet well chamber, fine bar screen, grit chamber, anoxic zone, aeration basin, secondary clarifier, treated water storage tank, sludge thickener, sludge feed pumping station, centrifuge units, chlorination unit, and sludge drying beds.

The plant was designed for the following influent quality parameters:

Table 3: Design influent water quality parameters for Mailasandra 75 MLD STP

| Sr.no | Parameters | Unit | Limit |
|---|---|---|---|
| 1 | pH | - | 6.8 – 8.1 |
| 2 | Total Solids | mg/l | 636 – 1356 |
| 3 | Total Suspended solids | mg/l | 300 - 600 mg/l |
| 4 | BOD5, | mg/l | 259 - 343 mg/l |
| 5 | COD | mg/l | 505 – 770 |
| 6 | Chlorides (as Cl) | mg/l | 82 – 140 |
| 7 | Sulphates (as SO4) | mg/l | 21 – 42 |

The plant was designed for the following effluent quality parameters:

Table 4: Design effluent water quality parameters for Mailasandra 75 MLD STP

| Sr.no | Parameters | Unit | Limit |
|---|---|---|---|
| 1 | pH | - | 5.5 - 9 |
| 2 | Total Solids | mg/l | ≤ 10 |
| 3 | Total Suspended solids | mg/l | ≤ 30 |
| 4 | BOD5, | mg/l | ≤ 20 |
| 5 | COD | mg/l | ≤ 250 |
| 6 | Chlorides (as Cl) | mg/l | Not more than 1000 |
| 7 | Sulphates (as SO4) | mg/l | Not more than 1000 |
| 8 | Colour & Odour | | Not objectionable |
| 9 | Total residual chlorine | mg/l | Not more than 1 |
| 10 | Ammonical Nitrogen | mg/l | Not more than 50 |

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| | | | |
|---|---|---|---|
| 11 | Total Kjeldahal Nitrogen | mg/l | Not more than 100 |
| 12 | Free ammonia | mg/l | Not more than 5 |
| 13 | Total Phosphate | mg/l | Not more than 5 |
| 14 | Dissolved Oxygen | mg/l | Not less than 2 |
| 15 | Bio-Assy test | | 90% of fishes should |

**Treatment scheme at existing 75MLD STP at Mailsandra:**

This plant is designed for the following flow rates:

| | |
|---|---|
| Constant flow | 75 MLD |
| Peak flow | 155 MLD |
| Minimum flow | 45 MLD |

The overall treatment process is divided into Pre-treatment, Biological Treatment, Disinfection, and Sludge Treatment systems.

- **Pre-treatment system which includes the following:**
  - De-gritting Unit
- **Biological treatment system which includes the following:**
  - Anoxic Tanks
  - Aeration Tank
  - Secondary Clarifier
- **Disinfection system which includes the following**
  - Mixing Tank
  - Chlorine Contact Tank
  - Chlorination Building
  - Treated Sewage Discharge Channel

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- **Sludge treatment system which includes the following**
    - Gravity Thickeners
    - Dewatering of Sludge - Sludge Drying Beds

**Need for enhancement of Mailsandra STP capacity from 75MLD to 100MLD:**

The quantity of sewage generated in the V.Valley's catchment area is about 574 MLD. The present capacity of existing and under construction STP's coming under the V.Valley division are as follows:

**The capacity of existing STP's:**

- 180 MLD STP: V.Valley Nayandanahalli
- 75 MLD STP: Mailasandra Kengeri.
- 1 MLD STP: Kemambudhi
- 60 MLD STP: Kengeri
- 20 & 40 MLD STP: Doddabele

The total capacity of the existing STP at present is **376 MLD.**

**The capacity of STPs under construction:**

| Sr. no. | Location and Capacity | Status |
|---|---|---|
| 1 | 150 MLD STP at V.Valley, Nayandanahalli | Commissioning under progress |

The total capacity of existing and under construction STP's coming under the VValley division is 526 MLD. Therefore, the available treatment capacity will be 45 MLD less than the total sewage generated sewage in the Vrishbhavathi valley catchment. To be able to treat all of the sewage generated in the Vrishbhavathi Valley catchment zone, the capacity of Mailsandra STP needs to be increased from 75MLD to 100MLD.

**Need for up-gradation of Mailsandra STP:**

The existing Mailsandra STP is constructed based on an extended aeration process and is meeting design parameters given in the contract condition. However, these parameters are not designed to meet the new NGT standards Though KSPCB has issued consent for operation (CFO) for the STP which is valid up to 30-06-2025, they are insisting that BWSSB treat the sewage to meet all parameters as per NGT standards.

To meet new effluent discharge standards given by Hon. National Green Tribunal (NGT), BWSSB had entrusted the IISc team to inspect and recommend suitable modifications to the current treatment process at Mailsandra STP. The IISc team gave SOP in the final report for operating the STP to meet NGT standards. Further, the IISc team directed BWSSB to give their opinion regarding individual plants in terms of up-gradation / enhancement capacity considering NGT requirements.

The plant is currently running at full design capacity and to treat the sewage generated in Vrishbhavathi valley in the future (as per data provided by WWM Division), the plant capacity needs to be increased from the existing 75 MLD to 100MLD.

The details for up-gradation and increasing capacity from 75MLD to 100 MLD STP are as follows:

- Civil work:

Table 5: Description of civil work for up-gradation of Mailsandra STP

| Sr. No | Description of works |
|---|---|
| 1 | TSPS: Minor repair works at Inlet & Screen chamber, arresting leakages, and flooring repair works |
| 2 | Construction of new Screen & Degritting Chamber with pretreated effluent channel including demolishing the existing system |
| 3 | Construction of new Primary clarifier with primary treated effluent channel up to Distribution chamber of Aeration Tank |
| 4 | Construction of new primary sludge sump & pump house |
| 5 | The modification works at Aeration Tank to enhance capacity & Biological nutrients removal (A2O Process) |

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| Sr. No | Description of works |
|---|---|
| 6 | Construction of New Process Air Blower Building with Panel Room |
| 7 | Construction of New Chemical Building |
| 8 | Secondary Clarifiers Distribution Chamber – Civil Repair works |
| 9 | Secondary Clarifiers 6 nos – Civil Repair works |
| 10 | Return Activated Sludge Sump & Pump House – Civil repair works |
| 11 | Chlorine Building – Civil repair works |
| 12 | Chlorine Contact Tank – Civil repair works |
| 13 | Demolishing existing Sludge Drying beds |
| 14 | Construction of new Thickener Feed sump & Pump |
| 15 | Gravity Sludge Thickeners – Civil Repair works and construction of one number GST |
| 16 | Thickened Sludge Sump & Pump House – Civil Repair works |
| 17 | The modification works at Centrifuge Building to enhance the capacity |
| 18 | Construction of Plant Drain Sump & Pump |
| 19 | Construction of SCADA Room at existing Administration Building and repair work if any |
| 20 | Civil repair works for remaining structures (Except stated above) |
| 21 | Road works (Which will damage due to Construction) |
| 22 | Drainworks (Which will damage due to Construction) |
| 23 | Landscaping works (which will Damage due to Construction) |
| 24 | Painting |
| 25 | RCC retaining wall / Boundary wall |

- Mechanical work:

Table 6: Description of mechanical work for up-gradation of Mailsandra STP

| Sr. No | Description of works |
|---|---|
| 1 | TSPS:<br>4 numbers brand new Raw sewage Pumps (Centrifugal Type), brand new Belt Conveyor Drive system of capacity and Replacement of existing piping system, Existing valves (KGV/NRV) with brand new, existing gates with brand new, dewatering pumps with brand new and Host |
| 2 | New Screen & Degritting Unit:<br>(a) Removing & re-fixing 2 numbers mechanical Fine screens, (b) Replaced with a brand new mechanical fine screen with 6mm opening size – 2 numbers, (c) brand new Belt Conveyor Drive system, (d) Providing, supplying, and installing brand new |

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| Sl. No | Description of works |
|---|---|
| 8 | Safety procedures |
| 9 | Flow measuring systems |
| 10 | Level measuring system |
| 11 | Pressure indicating transmitters |
| 12 | Pressure gauges |
| 13 | Temperature measuring system |
| 14 | Junction box, Earthing, Panel mounted digit indicator, Temperature scanner indicator, Surge protection devices, Alarm annunciators, Weight indicator transmitter |
| 15 | Analyzers – DO, ORP, Residual Chlorine, pH, MLSS, Hardness, etc. |
| 16 | Instrumentation cables / Cable trays |
| 17 | Automation system (PLC based SCADA System) |
| 18 | UPS system |
| 19 | CCTV for complete STP area with centralized monitoring at the admin building |

The above requirements are recommended based on the site conditions and available data. But the detailed design analysis has to be carried out by considering the complete feasibility of new STP construction.

### *6.2 Kempabudhi: 1 MLD*

#### *6.2.1 Current status of the plant:*

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 1 MLD | 2002 | EAP | 3500-3600 mg/L | 21 $m^3$/hr for 22 hrs | 21 $m^3$/hr for 2 hrs | 2-2.4 mg/L | No |

1. The grit chamber is clogged.
2. The Dissolved oxygen level maintained in the aeration basin is most likely < 1 mg/L. The plant uses surface aerators.
3. The MLSS in the aeration tank is most likely less than the claimed value. The sludge in the aeration tank is lean and filamentous. The RAS ratio is low.

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4. The water quality analysis shows that the plant meets the COD and phosphorus standards however do not meet the total Nitrogen and BOD standards.

### *6.2.2 Modifications required to meet NGT-BNR standards*

1. Turn the aerators on and off in such a way as to split the aeration tank into two separate zones
2. Zone 1 is aerated at 1.75 mg/L. Zone 2 is unaerated.
3. This modification will result in the removal of Nitrogen.
4. Increase the RAS ratio to increase the MLSS in the tank; this will improve the nitrogen removal as well as BOD and COD removal and increase the settling quality of the sludge. The MLSS should be increased by at least 1000 mg/L.
5. The grit and screen chamber should be cleaned properly to increase the efficiency of its use
6. It is recommended that the plant be operated at a lower inflow rate and the rest of the sewage be diverted to other STPs.

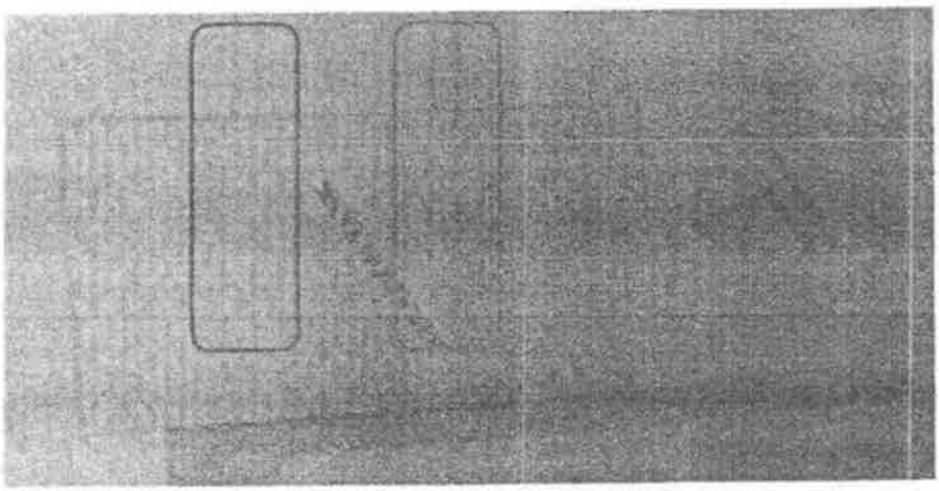

Figure 7: Layout of Kempabudhi indicating which aerators to turn on and off. Blue: Aerators ON, Orange: Aerators OFF

*6.2.3 Standard Operating Procedure recommended by IISc:*

- Split the aeration basin into two zones: aerated followed by unaerated.
- Turn on the first row of surface aerators to achieve a dissolved oxygen level of 2 mg/L. The hydraulic retention time in the aeration zone should be 9.72 hrs at an inflow of 1 MLD.
- Turn off the second row of surface aerators to create an anoxic zone with a retention time of 9.72 hrs.
- The MLSS in the aeration tank, though claimed to be between 3500-3600 mg/L, is most likely less than 2000 mg/L. The MLSS in the aeration basin should be brought up to the claimed concentration.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

*6.2.4: Amendment to the standard operating procedure:*

- Increase the capacity of the existing treatment plant from 1 MLD to 5 MLD.

*6.2.5: Feasibility report for up-gradation of the plant capacity from 1 to 5 MLD:*

**Introduction:**

In the year 2002 BWSSB installed 1 MLD Sewage Treatment Plant at Kempambudhi to treat incoming sewage. The treated sewage is being pumped to Kempambudhi Lake for rejuvenating the lake. The plant

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is located on 1.50 Acres of land. The treatment process adopted is an extended aeration system without nutrient removal facilities. The plant is operating at full designed capacity. The units of the plant are the inlet chamber, bar and grit chamber, aeration basin, secondary clarifier, and treated water storage tank. It was designed for the following design parameters:

Table 8:Design effluent water quality parameters for Kempambudhi 1 MLD plant

| Sr.no | Parameters | Unit | Tolerance limit |
|---|---|---|---|
| 1 | pH | - | 5.50 – 9.0 |
| 2 | BOD | mg/l | Not more than 20 |
| 3 | COD | mg/l | Not more than 250 |
| 4 | TSS | mg/l | Not more than 30 |
| 5 | Oil & Grease | mg/l | Not more than 10 |

Presently the plant is not designed to treat the effluent as per NGT standards. KSPCB has issued consent for operation (CFO) which is valid up to 30-06-2022 and they are insisting that BWSSB should treat the sewage to meet all the parameters as per NGT standard.

**Purpose of increasing the plant capacity:**

To meet new effluent discharge standards given by Hon. National Green Tribunal (NGT), BWSSB had entrusted the IISc team to inspect and recommend suitable modifications to the current treatment process at Kempambudhi STP. During detailed discussion issues regarding 1 MLD STP Kempambudhi, the IISc team has suggested reducing the treatment capacity in the STP to less than 1 MLD to meet NGT standards. Further, they directed plant engineers to give their opinion regarding individual plants in terms of up-gradation / enhancement capacity considering NGT requirements.

The inlet pipeline to the Kempambudhi STP is 450mm in dia and is currently carrying a load of about 4 - 5 MLD. Hence it is proposed a new 5 MLD STP based on SBR technology be constructed instead of upgrading the existing 1 MLD capacity STP. Presently the plant has an LT power supply operating 35

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KW sanctioned load to operate the 1 MLD STP. HT power supply can be obtained in place of the existing LT power supply after a detailed inspection.

The above requirements are recommended based on the site conditions and available data. But the detailed design analysis has to be carried out by considering the complete feasibility of new STP construction.

### *6.3: Kadugodi: 6 MLD*

#### *6.3.1 Current status of the plant:*

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 4.6 MLD | 2018 | SBR | 3000-3500 mg/L | 30 $m^3$/hr for 1.5 hr/cycle | ~ 207 $m^3$/day | 1-4 mg/L | Yes |

1. There are three SBR units, out of which one unit is on standby. Diffuse aerators are used during the aeration cycle.
2. Adequate aeration is maintained during the aeration phase.
3. Surfactants are present in the influent but are removed during the treatment process.
4. The effluent did not meet COD, BOD, and total nitrogen standards.
5. The Chlorine contact tank had algal growth, insect larva growth, and mould growth, leading to higher COB and BOD in the effluent water.

#### *6.3.2 Modifications required to meet all NGT-BNR standards*

1. The current cycle includes an unaerated filling stage. The aeration should begin with filling so that the total aeration time is 1.5 hrs. (keep the filling stage unaerated only if nitrates in the influent are high and are not removed during the primary process). Dissolved oxygen during aeration time should be maintained at 3.5 mg/l

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2. The current cycle includes a settling time of 45 mins which should be increased to 102 mins.
3. In the case of diluted sewage, additional carbon may have to be added to the sewage to assure proper nutrient removal.

*6.3.3 Standard Operating Procedure recommended by IISc:*

- The current cycle includes 45 mins filling, 45 mins aeration, 45 mins settling, and 45 mins decanting.
- This operational cycle should be altered to include 1.5 hrs of filling and aeration, 40 mins of unaerated mixing, 60 mins of settling, and 45 mins of decanting. The dissolved oxygen concentration during the aeration stage should be maintained at 3.5 mg/L.
- In case carbon limiting conditions occur, extra carbon should be added before the unaerated mixing stage.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

*6.3.4: Amendment to the standard operating procedure:*

- A project report with detailed cost estimates of electromechanical replacements, civil structure strengthening, and other permanent measures required should be prepared.

- Chlorine contact tanks should be thoroughly cleaned, tiled, and painted with algae-resistant paint or coating, preferably in blue colour.
- Bypass channel with gate valve provision should be made for periodical cleaning of the Chlorine contact tanks.
- Diesel Generator capacity should be raised to full electricity requirement capacity of the plant to run the plant during times of power failure without any interruption.

### *6.4: Halasuru: 2 MLD*

#### *6.4.1 Current status of the plant:*

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 2 MLD | 2018 | SBR | 3500 mg/L | 30 $m^3$/hr for 2 hr/cycle | As needed | 2.5-3 mg/L | Yes |

1. There are two SBR units; both are operational. Diffuse aerators are used during the aeration cycle.
2. The influent included a high quantity of oil and grease, which was observed in the SBR chambers in the form of frothing.
3. The effluent did not meet COD, BOD, and total nitrogen standards.
4. The sludge settling was poor, which led to high BOD and COD values in the effluent.

#### *6.4.2 Modifications required to meet NGT-BNR standards:*

1. The MLSS in the SBR tank should be increased by at least 1000 mg/L by controlling the RAS ratio. Currently, the RAS is at 33-36% and should be increased. Dissolved oxygen during aeration time should be maintained at 3.5 mg/l
2. The current cycle includes a settling time of 1 hr, which should be increased to 2 hrs.

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3. Oil and grease traps should be installed in the primary treatment to remove excess oil and grease in the influent.
4. In the case of diluted sewage, additional carbon may have to be added to the sewage to assure proper nutrient removal.
5. A lot of oil and grease were observed in the incoming sewage and SBR basins. It is recommended that the nearby restaurants be given a warning about not letting water with a high concentration of oil and grease get into the mainline. They should be given a directive to install oil and grease traps. Furthermore, an oil and grease trap should be installed at the STP as part of primary treatment.

***6.4.3 Standard Operating Procedure recommended by IISc:***

- The current cycle includes 2hrs of filling and aeration, 1 hr of settling, and 1 hr of decanting.
- This operational cycle should be altered to include 2 hrs of filling and aeration, 1 hr of unaerated mixing, 1 hr of settling, and 1 hr of decanting. The dissolved oxygen concentration during the aeration stage should be maintained at 3.5 mg/L.
- In case carbon limiting conditions occur, extra carbon should be added before the unaerated mixing stage.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

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*6.4.4: Amendment to the standard operating procedure:*

- A project report with detailed cost estimates of electromechanical replacements, civil structure strengthening, and other permanent measures required should be prepared.
- Grit Chamber with grit trap unit should be provided to remove grit waste seamlessly.
- Oil and grease trap unit should be provided in primary treatment.
- Recirculation Pump Capacity should be increased as per the requirement.
- For better disinfection of the treated effluent Chlorine contact tank capacity should be increased to have proper retention time for Chlorination.
- Chlorine contact tanks should be thoroughly cleaned, tiled, and painted with algae-resistant paint or coating, preferably in blue colour.
- Bypass channel with gate valve provision should be made for periodical cleaning of the Chlorine contact tanks.
- Diesel Generator for full electricity requirement capacity of the plant to run the plant during a power failure without any interruption.

## *6.5: Yellamallappa Chettikere:*

### *6.5.1 Current status of the plant:*

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 14.6 MLD | 2018 | SBR | - | - | 310 $m^3$/day | - | Yes |

1. There are four SBR units. Diffuse aerators are used during the aeration cycle.
2. The effluent did not meet the BOD and total nitrogen standards.

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*6.5.2 Modifications required to meet NGT-BNR standards*

1. The MLSS in the SBR tank should be increased by controlling WAS. Dissolved oxygen during aeration time should be maintained at 3.5 mg/l
2. The current cycle includes a settling time of 1.5 hr, which should be increased to 3 hrs.
3. In the case of diluted sewage, additional carbon may have to be added to the sewage to assure proper nutrient removal.

***6.5.2 Standard Operating Procedure recommended by IISc:***

- The current cycle includes 1.5 hrs of filling, 1.5 hrs of aeration, 1.5 hrs settling, and 1.5 hrs decanting.
- This operational cycle should be altered to include 1.5 hrs of filling, 1.5 hrs aeration, 1.5 hrs of unaerated mixing, 1.5 hrs of settling, and 1.5 hrs of decanting. The dissolved oxygen concentration during the aeration stage should be maintained at 3.5 mg/L.
- In case carbon limiting conditions occur, extra carbon should be added before the unaerated mixing stage.
- The MLSS in the SBR should be maintained at a concentration between 3500-4000 mg/L
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

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### *6.6: Malathahalli:*

#### *6.6.1 Current status of the plant:*

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 4.7 MLD | 2018 | SBR | 3500-3600 mg/L | - | 391 $m^3$/day | < 2 mg/L | No |

1. There are two SBR units; both are operational. Diffuse aerators are used during the aeration cycle.
2. The effluent did not meet the BOD and total nitrogen standards.
3. The effluent of SBR passes through a cloth filter and chlorine contact tank. Both tanks are unclean and lead to the addition of BOD and COD to the effluent.

#### *6.6.2 Modifications required to meet NGT-BNR standards*

1. The aeration should begin with filling so that the total aeration time becomes 2.24 hrs. (However, if the influent has a high nitrate-N concentration, which is not removed during primary treatment, the fill time should be unaerated). Dissolved oxygen during aeration time should be maintained at 3.5 mg/l
2. The current cycle includes a settling time of 69 mins which should be increased to 3.2 hrs.
3. Oil and grease traps should be installed in the primary treatment to remove excess oil and grease in the influent.
4. One Inlet screen needs repair, one blower needs to be replaced, and one centrifuge that is not working should be replaced.
5. In the case of diluted sewage, additional carbon may have to be added to the sewage to assure proper nutrient removal.

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*6.6.3 Standard Operating Procedure recommended by IISc:*

- The current cycle includes 64 mins of filling, 80 mins of aeration, 15 mins rection time, 69 mins of settling, and 60 mins of decanting.
- This operation cycle should be altered to include 144 mins of filling and aeration, 2 hrs of unaerated mixing, 1.2 hrs of settling, and 60 mins of decanting.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

*6.6.4: Amendment to the standard operating procedure:*

- A separate grit chamber should be introduced before the screen chamber.
- Oil skimmer should be replaced.
- Out of 4 air blowers, one is worn out and should be replaced. The remaining 3 air blowers have also their efficiency due to aging (more than 10 years) and repeated repairs. It is recommended that these also should be replaced.
- Guide mechanisms for sludge pumps and diffusers should be replaced for both SBR tanks.
- Cloth disc filter media is completely worn out and should be replaced.
- Chlorination system is not working. Hence chlorine dosing system should be provided.
- Chlorine contact Tank should be tiled and painted.

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- One of the centrifuges is not working and should be replaced.
- Two Ullal pumps of capacity 75 Hp each should be replaced.
- Flowmeters at inlet & outlet points (3 Nos) should be replaced.
- Existing laboratory should be assessed for the necessity of additional lab equipment.
- One additional stand-by Transformer of 630 KVA should be provided.
- All the electrical panels inside the panel room should be assessed thoroughly for refurbishment.
- Following electro-mechanical equipment appear to have reached the end of their service age and should be replaced after a detailed inspection.

    1. Transformer-1 No
    2. Air blower-4 Nos
    3. Chlorine dosing system
    4. Cloth media filter-1 No
    5. Centrifuge-2 Nos
    6. Flow meters -3 Nos
    7. Screw Conveyor-2 Nos
    8. Ullal pumping main
    9. Ullal pump 75 Hp-2 Nos
    10. Oil skimmer-1 No

- As the STP is more than 10 years old, a detailed conditional assessment of all electro-mechanical components, electrical systems, instrumentation equipment should be done. Required repairs/replacements should be done to achieve the prescribed standards of effluent.

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## 7.0 FINAL RECOMMENDATIONS FOR POORLY PERFORMING STPs:

### *7.1 Kadubeesanahalli phase - 1:*

#### *7.1.1 Current status of the plant:*

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 43 MLD | 2005 | EAP | - | 60% | 40% | - | No |

1. The IISc team suspected that the plant operation had been suspended for some time and had only resumed a few hours before the visit. The high concentration of ammoniacal Nitrogen in the effluent supported this assessment.
2. The MLSS in the aeration tank is not adequate.
3. The effluent quality was not satisfactory and included suspended matter. The water quality analysis shows that the plant met none of the Hon'ble NGT standards. However, if operated properly, the effluent quality will improve.

#### *7.1.2 Modifications required to meet NGT-BNR standards:*

1. Turn the aerators on and off in such a way as to split the aeration tank into three separate zones
2. Zone 1 is aerated at 2 mg/L. Zone 2 is unaerated, and zone 3 is aerated at 1 mg/L.
3. This modification will result in the removal of Nitrogen. However, a further increase in MLSS is required to improve nitrogen and carbon removal capacity.
4. Increase the RAS ratio to increase the MLSS in the tank; this will improve the nitrogen removal as well as BOD and COD removal and increase the settling quality of the sludge. The MLSS value should be between 2500-3500 mg/L.

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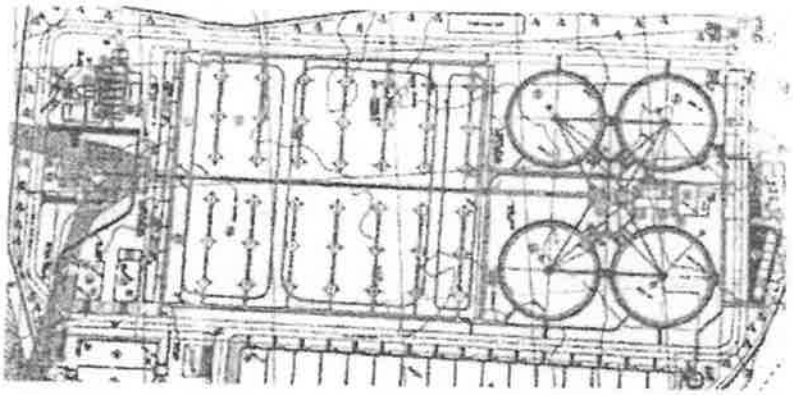

Figure 8: Layout of Kadubeesanahalli – 1 indicating which aerators to turn on and off. Blue: Aerators ON, Orange: Aerators OFF

***7.1.3 Standard Operating Procedure recommended by IISc:***

- The aeration basin should be split into three zones: aerated-unaerated-aerated
- Turn on the first two rows of aerators to achieve a dissolved oxygen concentration of 2 mg/L. The hydraulic retention time in the aeration zone should be 3.5 hrs at an inflow of 50 MLD.
- Turn off the next four rows of surface aerators to create an anoxic zone of retention time of 6.9 hrs.
- Turn on the last row of the surface aerators to achieve a dissolved oxygen concentration of 1 mg/L. The hydraulic retention time in the aeration zone should be 1.7 hrs at 50 MLD inflow.
- The MLSS in the aeration basin should be maintained between 3000-3500 mg/L.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.

- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

*7.1.4 Amendment to the standard operating procedure:*

- A project report with detailed cost estimates of electromechanical replacements, civil structure strengthening, and other permanent measured required should be prepared.
- Deteriorated raw sewage pumps should be replaced.
- A separate grit chamber should be provided before the screen chamber.
- New Manual Screens should be installed along with gate valves.
- Mechanical raked coarse screens, belt conveyor along with all its accessories and allied civil works should be replaced.
- Mechanical Fine Screen and its allied works should be upgraded.
- A primary clarifier should be introduced before the biological treatment.
- Anaerobic zone should be introduced after the anoxic zone inside the aeration tank along with MLR Pump.
- Diffused aeration system should be provided inside the aeration tank through Blowers/Blower room.
- Columns, walls, and platform area of the aeration tank are severely damaged. The aeration tank should be refurbished after strengthening the RCC structure.
- Chlorine contact tanks should be thoroughly cleaned, tiled, and painted with algae-resistant paint or coating, preferably in blue color.
- Bypass channel with gate valve provision should be made for periodical cleaning of the Chlorine contact tanks.

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- To avoid the necessity of a sludge drying bed and manual sludge loading, Sludge Thickener, Centrifuge system should be installed with all its accessories.
- Laboratory Equipment should be provided to carry out the necessary tests to ensure compliance with the latest NGT standards.
- A SCADA system should be installed for continuous monitoring and management of all electro-mechanical equipment including all Electrical related works.
- Diesel Generator capacity should be raised to full electricity requirement capacity of the plant to run the plant during times of power failure without any interruption.
- Following electro-mechanical equipment appear to have reached the end of their service life and should be replaced after a detailed inspection.
    1) Motorized Valve – 6 nos
    2) Grit Chamber Detritor – 2 nos
    3) Submersible Mixers – 4 nos
    4) Grit Classifier – 2nos
    5) Surface Aerator – 15 nos
    6) Sluice Gates – 10 nos
    7) 2MT EOT crane – 2nos
    8) DO Analyser for the Aeration Tank – 2nos
    9) Clarifier Assembly with its accessories – 4 nos
    10) RAS Pumps – 3 nos
    11) Thickener Sludge Transfer pump – 2 nos
    12) Supernatant pumps – 2 nos
    13) Chlorination System to be upgraded – 1 no

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14) Service Water Pumps – 2 nos

15) Streetlights – all to be replaced with LED along with Cables

### *7.2 Nagasandra phase - 1:*

#### *7.2.1 Current status of the plant:*

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 11 MLD | 2005 | EAP | - | - | - | - | No |

1. Oil and grease, and algae were observed in the grit chamber
2. The plant uses surface aerators. Aeration is not being done properly. Aerators are not run 24 hrs and are turned off during nighttime. The high ammoniacal nitrogen concentration in the effluent fortifies this assessment.
3. The MLSS in the aeration tank is not adequate. Sludge settling is not adequate.
4. The effluent quality was not satisfactory. The water quality analysis shows that the plant met none of the Hon'ble NGT-BNR standards.

#### *7.2.2 Modifications required to meet NGT-BNR standards*

1. Turn the aerators on and off in such a way as to split the aeration tank into two separate zones
2. Zone 1 is aerated at 2 mg/L. Zone 2 is unaerated.
3. This modification will result in the removal of Nitrogen. However, a further increase in MLSS is required to improve nitrogen and carbon removal capacity. MLSS levels should be between 3000-3500 mg/L.
4. Increase the RAS ratio to increase the MLSS in the tank; this will improve the nitrogen removal as well as BOD and COD removal and increase the settling quality of the sludge.

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5. The scraper mechanism should be inspected for rust, flow directional gates are broken, and should be replaced. Other equipment should be checked and replaced.
6. Anoxic mixers are not working and should be replaced.
7. Surface aerators are running with noise and vibrations. There is a reduction in rpm due to rewinding. Gearboxes have outlived their service life. If possible, shift to diffuse aerators.
8. The strength of material for clarifiers should be analyzed, and the system should be assessed and replaced accordingly.
9. Major flow meters are not working and should be replaced.

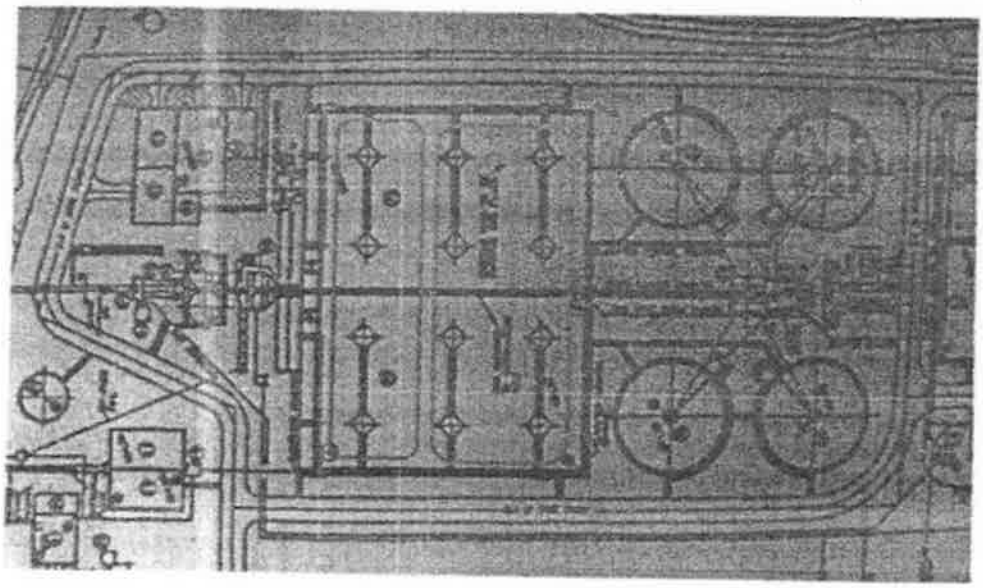

Figure 9: Layout of Nagasandra phase – 1 indicating which aerators to turn on and off. Blue: Aerators ON, Orange: Aerators OFF

### *7.2.3 Standard Operating Procedure recommended by IISc:*

- Split the aeration basin into two zones, aerated followed by unaerated

- Turn on the first row of aerators to achieve a dissolved oxygen concentration of 2 mg/L. The hydraulic retention time in the aeration zone should be 4hrs at 20 MLD inflow.
- Turn off the next two rows of aerators to create an anoxic zone of retention time 8 hrs at 20 MLD inflow.
- The MLSS in the aeration basin should be maintained at a concentration of 3500 mg/L.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.
- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

***7.2.4: Amendment to the standard operating procedure:***

- A project report with detailed cost estimates of electromechanical replacements, civil structure strengthening, and other permanent measures required should be prepared.
- A Grit Chamber should be introduced before the Screen chamber.
- Mechanical raked fine screens, manual screen, belt conveyor along with its accessories and allied civil works should be replaced.
- In the Detritor unit, scrapper mechanism, flow directional gates, organic return pump, and Grit collector drive should be replaced due to aging.
- Anoxic mixers along with the electrical system are not working and should be replaced.

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- Surface Aerators have reached the end of their service life (as per manufacturers). Gears are worn out and aerators are running with noise and vibrations and should be replaced. (Providing Diffused Aeration through blowers/blower room is recommended).
- Existing SCADA system is not working and should be replaced with a new system.
- Columns, walls, and platform area of the aeration tank are severely damaged. The aeration tank should be refurbished after strengthening the RCC structure.
- Electro-mechanical components of the secondary clarifiers need to be replaced due to aging. The civil structure also should be strengthened.
- Chlorination system is not working. A chlorine dosing system should be provided along with a scrubber unit.
- Chlorine contact Tank should be tiled and painted.
- To avoid the necessity of a sludge drying bed and manual sludge loading, Sludge Thickener, Centrifuge system should be installed with all its accessories.
- Other utilities needing attention:
  1. Bore wells should be replaced/repaired as needed.
  2. Major flowmeters such as inflow, outflow, RAS flow are not working and should be replaced. Additional flowmeters should be provided as needed.
  3. Existing laboratory should be assessed for the necessity of additional lab equipment.
  4. The electrical panels of the 500KVA diesel generator should be replaced.
  5. All the electrical panels/switch gears/breakers in MCC-I and MCC-II should be refurbished.
  6. All valves/gates inside the STP should be assessed thoroughly and non-operational valves/gates should be replaced.
  7. All STP lighting systems should be replaced.

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8. Bypass line for the NK Halli pumping main should be constructed for diverting the sewage from NK halli, by tapping the line near the drying beds of Phase I and connecting it to the inlet of Phase II (about 220 mm to 450 mm dia DI pipe).

- Following electro-mechanical equipment appear to have reached the end of their service life and should be replaced after a detailed inspection.

1) Fine bar screen- 2 Nos
2) Mechanical fine screen- 2Nos
3) Manual fine screen- 1No
4) Belt conveyor- 1 No
5) Grit classifier and Grit collector drive- 2 Nos
6) Organic return pump- 2Nos
7) Raw sewage feed pump- 2 Nos
8) Slow mixer for Anoxic Mixer- 8 Nos
9) Fixed surface Aerators- 12 Nos
10) Secondary clarifiers- 4 Nos
11) Return sludge pumps- 2 Nos
12) Sludge Thickener- 2 Nos
13) Surplus Anoxic mixer- 1 No
14) Chlorination Booster pumps- 2 Nos
15) Service water pumps- 4 Nos
16) Autosampler- 1 No
17) All Instrumentation systems inside the STP.
18) All electrical systems inside MCC I room MCC II room, and others.

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19) Diesel Generator- 1 No

20) Chlorination System and allied system

21) Pressure gauge-16 Nos of different capacity

22) SCADA and PLC System

23) Borewells – 2Nos

24) All major flowmeters

25) All STP lighting system

- To undertake the total refurbishment of all equipment and utilities detailed above, the operation of nagasandra phase I STP needs to be halted. At present both phases I and II plants are running at ~50% capacity. Currently the average flow to the phase I plant from N.K.Halli ISPS is about 9 MLD. Whereas the adjacent phase II, the plant receives an average inflow of about 12.06 MLD from Bagalagunte ISPS, Karibhuvanahalli ISPS, and Nagasandra ISPS. To halt the operation of phase I till refurbishment work is done, the sewage inflow from N.K. Halli ISPS should be diverted to Phase II by providing a diversion pipeline of ~ 215 m.
- The electro-mechanical equipment replacement needed at 3 ISPS constructed during Phase I

1. 25MLD ISPS at N.K.Halli :
    - 3 64kW capacity pumps along with respective electrical systems should be replaced.
    - One out of the two transformers is in good condition and the other should be refurbished.
    - The DI pumping main from NK Halli ISPS to 20 MLD STP phase I is worn out due to aging & should be replaced.
    - Borewells should be provided.
    - All gates/valves inside the ISPS which are beyond repair should be replaced.
    - All ISPS lighting systems to be replaced.

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- This ISPS has 3 Pumps (2W + 1S). The designed capacity of each pump is 550m3/hr. With two pumps working per hour, the total pumping capacity of the ISPS is about 1ML/hr. In the peak hours of the day, the inflow to the ISPS is more than 1ML/hr. Hence, in peak hours the design capacity is inadequate. Therefore, to pump all the sewage received through sub mains, either existing ISPS should be upgraded to have a higher capacity or one more ISPS should be constructed.

2. 30MLD ISPS at Bagalgunte:
   - Electrical system for pumps should be replaced.
   - The DI pumping main from Bagalagunte ISPS to 20 MLD STP Phase I is worn out due to aging & should be replaced.
   - Borewells should be provided
   - All gates/valves inside the ISPS which are beyond repair should be replaced.
   - All ISPS lighting systems to be replaced
   - This ISPS has 3 Pumps (2W + 1S). The designed capacity of each pump is 695 m3/hr. With two pumps working per hour, the total pumping capacity of the ISPS is about 1.3 ML/hr. In the peak hours/during monsoon, the inflow to the ISPS is more than 1.3ML/hr. Hence, in peak hours the design capacity is inadequate. Therefore, to pump all the sewage received through the sub-mains, either an existing ISPS should be upgraded to have a higher capacity or one more ISPS should be constructed.
3. 15MLD ISPS at Medarahalli:
   - 3 110 kW capacity pumps along with respective electrical systems should be replaced.

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- The DI pumping main from Medarahalli ISPS to Bagalgunte ISPS is worn out due to aging & should be replaced.
- Borewells should be provided
- All gates/valves inside the ISPS which are beyond repair should be replaced.
- All ISPS lighting systems to be replaced.
- This ISPS has 3 Pumps (2W + 1S). The designed capacity of each pump is 340m3/hr. With two pumps working per hour pumping is about 0.65ML/hr. In the peak hours of the day, the inflow to the ISPS is more than 0.65ML/hr. Hence, in peak hours the design capacity is inadequate. Further, in recent years additional sub-main are linked to the existing ISPS. Therefore, to pump all the sewage received through sub-mains, either an existing ISPS should be upgraded to have a higher capacity or one more ISPS should be constructed.

### *7.3: K R Puram:*

#### *7.3.1 Current status of the plant:*

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination methodology |
|---|---|---|---|---|---|---|---|
| 11 MLD | 2005 | UASB + EAP | 3500 mg/L | 100% | 0.8 MLD | 2 mg/L | No chlorination |

1. The UASB is blocked, and some of the sewage is bypassing the UASB and directly entering the ASP system leading to higher nitrogen levels in the effluent.
2. The DO level in the aeration tank is significantly lower than the claimed levels. The sludge collected from the aeration tank shows the same.
3. The ammoniacal nitrogen content in the effluent is very high, indicating that sufficient aeration is not taking place and raw sewage is bypassing the UASB

4. The effluent did not meet the COD and total nitrogen standards.
5. The plant is designed for effluent Nitrogen of no more than 50 mg/l

*7.3.2 Modifications required to meet NGT-BNR standards*

1. The UASB should be made operational so that no influent is bypassing it and proper nutrient removal occurs.
2. MLSS in the aeration tank should be increased to optimal levels, ensuring proper removal of nutrients.
3. The modification to the plant operation is suggested in the layout below; it includes splitting one of the UASB tanks into two and altering the flow in the extended aeration process.

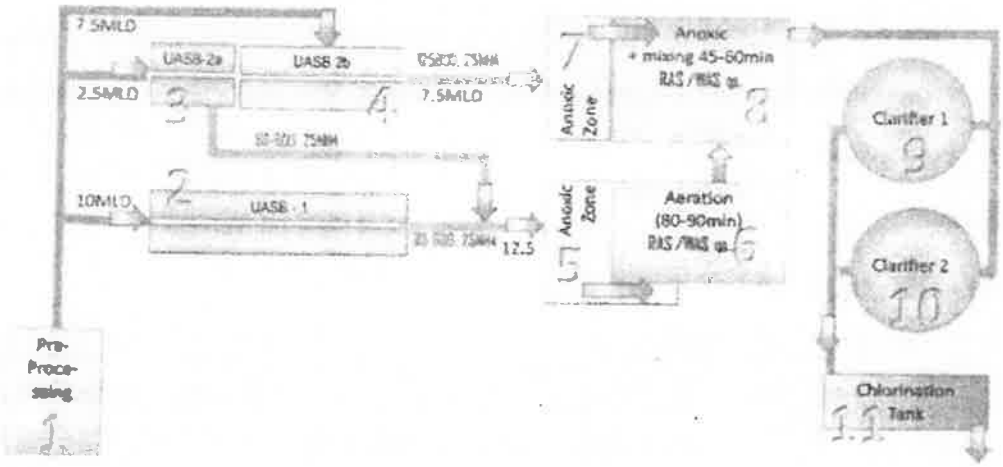


Figure 10: Modified layout for K R Puram STP

*7.3.2 Standard Operating Procedure recommended by IISc:*

- The primary treatment unit should be fixed. Any equipment broken or needing maintenance should be attended to immediately.
- The UASB downflow inlet pipes should be unclogged.

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- Inspect and fix any other blockages causing sewage to bypass the UASB.
- The feed levels to the UASB should never be less than one-third of the rated capacity of the UASB (here, it is 20 MLD). If the feed levels are low for more than a week, proper start-up procedures should be taken up. Shock loads of more than 10% to the UASB should be prevented.
- The quality of sludge in the UASB and aeration basin should be monitored continuously.
- Once the UASB tanks are made properly operational, one of the UASB tanks should be divided into two zones, as shown in the image below. The smaller zone will have 25% of the volume of the full tank, whereas the larger zone will have a volume that is 75% that of the full tank. Feed to different UASB tanks should be kept proportional to the numbers given in the diagram below.
- There are two aeration basins on the plant. One should be converted into an anoxic mixing basin, and the other should be kept as an aeration basin.
- The smaller zone and the other full UASB tank should be loaded at a normal rate to achieve an effluent BOD of about 80 mg/L. The effluent from these tanks should be directed towards the aeration basin, where a retention time of 80-90 mins should be ensured.
- The larger zone of the UASB should be loaded at a higher rate to achieve effluent BOD of about 125 mg/L.
- The effluent from the larger UASB zone and effluent of the aeration basin should be mixed in the anoxic mixing basin, allowing for a retention time of 45-60 mins.
- The effluent from the anoxic mixing tank should be taken to the clarifiers. Necessarily activated sludge should be returned from the clarifiers to the aeration basin.
- The chlorine contact tank should be cleaned properly. It should be repainted with anti-algae paint, preferably blue.

- Toxicity Characteristic Leaching Procedure (TCLP) test should be done for the sludge before disposal. A year's worth of TCLP test reports should be kept in the records for the plant.
- A detailed inventory of the recycled and wasted sludge should be kept on the record.
- All equipment should be inspected to check whether they are functioning properly and efficiently. Any equipment needing maintenance or replacement should be tended to as soon as possible.

*7.3.4: Amendment to the standard operating procedure:*

- TSPS motors should be replaced along with electromechanical equipment and screens.
- New wet well should be constructed with a depth of 6 to 8 meters.
- A separate grit Chamber should be provided before the screen chamber.
- Primary unit should be upgraded to include vertex technology and oil and grease traps.
- Mechanical Raked Coarse Screens, Belt Conveyor along with its accessories and allied civil works should be replaced
- UASB feeder channel level must be increased, and the complete Gas Flare system should be replaced completely.
- Anoxic zone should be upgraded to have a higher number of mixers with higher capacity.
- Diffused Aeration/Aspiration aeration system should be provided inside the aeration tank through new blower equipment with all allied accessories and civil structures.
- SCADA system should be installed for continuous monitoring and one-point access for all electro-mechanical equipment including all Electrical allied works
- Sensors should be installed throughout the plant.
- Chlorination system should be upgraded completely to include a de-chlorination system as well

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- To avoid sludge drying bed and manual sludge loading, a new sludge thickener, centrifuge/belt filter press system should be included with all its accessories and civil structures.
- New DG should be installed to run the plant completely without any interruption during power outages.
- Following Electro-Mechanical Equipment have reached the end of the service live (15 years) and hence should be replaced.
  a. Motorized Valve – 3
  b. Grit Chamber Detroiter – 2
  c. Submersible Mixers – 4
  d. Grit Classifier - 2
  e. Surface Aerator – 8
  f. Sluice Gates – 4
  g. 2 MT EOT crane – 2
  h. DO Analyzer for the Aeration Tank – 2
  i. Classifier Assembly with its accessories – 4
  j. RAS Pumps – 4
  k. Thickener Sludge Transfer pump – 2
  l. Supernatant pumps – 2
  m. Chlorination System to be upgraded – 1
  n. Service Water Pumps – 2
  o. Street Lights – all to be replaced with LED along with Cables

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## 8.0 FINAL RECOMMENDATIONS FOR OTHER STPs:

### *8.1: V Valley STP: 180 MLD*

#### *8.1.1: Recommendation:*

- The entire biological treatment units (bio-filters) are below the highest flood level (HFL). As such, even after minor rainfall events, all treatment units get flooded from backwater from the drain. This completely disturbs the treatment process and kills the microbial population in the biological treatment units. Regeneration of microbial population takes weeks, during which time the quality of effluent is affected.
- Hence the construction of a new 150 MLD treatment plant is recommended instead of rehabilitation of the old plant.

#### *8.1.2: Feasibility report for the construction of new 150 MLD plant at V Valley location:*

**Introduction:**

The existing 180 MLD sewage treatment plant is located adjacent to Vrishabhavathi Valley, Nayandanahalli. Construction activity for the above plant began in 1971 and the STP was completed and commissioned in the year 1974. During Stage -1, only preliminary, primary, and sludge treatment units consisting of screening, grit removal, primary settling, sludge digestion, and sludge drying beds were constructed. The design capacity of the Stage -1 plant was 123 MLD. In the year 1986, the plant was upgraded to secondary standards under CWSS Stage – II and the treatment capacity of the existing plant was also increased to 180 MLD by providing additional units. The work was taken up under the stage - 2 scheme included the installation of additional screen, grit chamber, primary settling tanks, digester, and sludge drying beds, and construction of new secondary trickling filters and secondary settling tanks. The plant was designed for an influent $BOD_5$ concentration of 300 mg/l and a TSS concentration of 460 mg/l.

The design parameters for the plant effluent are as follows:

Table 9: Design effluent parameters for 180 MLD V Valley STP

| Sr.no | Designed parameters | Unit | Limit's |
|---|---|---|---|
| 1 | pH | - | 5.5 - 9 |
| 3 | Total Suspended solids (TSS) | mg/l | ≤ 30 |
| 4 | BOD5, | mg/l | ≤ 20 |
| 5 | COD | mg/l | ≤ 250 |

Details of existing Treatment units at 180 MLD V- Valley STP:

Table 10: Existing treatment units at 180 MLD V Valley STP

| Sr. No. | Unit Description | Size of Unit | No. of Units |
|---|---|---|---|
| 1 | Primary settling tanks | 47.26 m dia., 3.80 m SWD<br>58.00 m dia, 3.99 m SWD | 2<br>3 |
| 2 | Primary biofilters (trickling filters) | 61.80 m dia, 1.67 m depth | 4 |
| 3 | Secondary biofilters (trickling filters) | 61.80 m dia, 1.17 m depth | 4 |
| 4 | Secondary settling tanks | 59.00 m dia, 2.08 m SWD | 4 |

In addition to the above units, the existing plant has inlet chambers, distribution chambers, sludge outlet chambers, re-circulation pumping station, primary sludge pumping station, and secondary pumping station.

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**Performance of the existing 180 MLD STP:**

Presently the existing 180 MLD STP is receiving a total of about 120-130 MLD of sewage is from the newly constructed TSPS. But the Plant is not designed for the required parameters prescribed by the NGT.

**Flooding of Existing STP:**

The invert level at the outlet of 180 MLD STP is the same as the level of flow in the valley during the dry season. HFL near V.Valley STP is 803.30 m. It is observed that many of the structures in the existing STP are below HFL. Structures below HFL are 4 Secondary Clarifier and Bio-filter, 4 Primary Bio-filter, Re-circulation pump house, Secondary Sludge pump house, and Inlet pump house for TTP. Further with the increase of sewage in the valley, flows from the valley enter the existing STP, directly affecting the treatment process.

Due to the lower level of the units, huge quantities of plastic waste, silt, and floating materials directly enter the secondary clarifier launders and in turn into secondary clarifiers. Recirculation pump house tanks for primary and secondary recirculation pipe lines get choked up due to the incoming solid waste and secondary sludge pump house gets submerged. Furthermore, the approach roads for the above-mentioned units also get submerged during flooding. Dewatering of all secondary clarifiers and removal of silt and floating materials which has been accumulated at the bottom of clarifiers and clearing of the sludge withdrawal line requires weeks of work. Dewatering and removal of plastic and floating material that has entered the primary and secondary tanks of the recirculation pump house and recirculation pipeline are required to avoid damage to recirculation pumps.

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**Rehabilitation of existing 180 MLD plant and new under construction 150 MLD plant at V Valley:**

The gauged sewage inflow into V Valley near Rajarajeshwarinagar Bridge is about 300 MLD and there are design inadequacies in the existing STP, BWSSB contemplated constructing a 300 MLD STP by demolishing the existing 180 MLD STP. In this regard, BWSSB had awarded consultancy services to TATA Consulting Engineers Limited (TCE) for preparation of Detailed Project Report and Tender Document for the construction of new 300 MLD Sewage Treatment Plant with Biological Nutrient Removal (BNR) and Power Generation facility.

Further, during inspection of V.Valley plant by the competent authority in the year 2014, it was instructed to initially only construct a new 150 MLD (phase – 1) capacity STP at V-Valley with TSPS & sludge handling system and also carry out the rehabilitation work of existing old 180 MLD Nayandanahalli STP. The space provision was made for the construction of the additional 150 MLD STP (phase-2) in the future to provide an overall treatment facility of up to 300 MLD capacity.

At present, the work of Design and Construction of 150 MLD Sewage Treatment Plant (STP) (phase – 1) based on Activated Sludge Process with Biological Nutrient removal system (ASP with BNR) and Power Generation at V Valley, Bangalore including Operation & Maintenance of Constructed Facilities for Ten (10) Years (Trunkey Basis) has been awarded to M/s Suez India PVT. ltd. vide ref No. BWSSB/CE (WWM)/ACE (WWM)-1/TA-2/810/2017-18, dated:31.07.2017 with project duration of 36 months. This work includes 150 MLD capacity STP at V-Valley with TSPS & sludge handling system of 300 MLD capacity along with rehabilitation of existing 180 MLD STP.

**Availability of secondary treated water for Minor Irrigation Department:**

During the meeting held with the competent authority of BWSSB along with the minor irrigation department on 10.01.2020, it has been confirmed that 243 (135 +108) MLD can be supplied after up-

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gradation of STP to minor irrigation department in 2023 from 180 MLD STP @ V.Valley and the same has been informed vide ref No.BWSSB /CH/CE(WWM) /ACE(WWM)-1&2/3097/2019-20, dt: 22.01.2020.

**Proposal of additional 150 MLD (Phase –II) STP at V.valley:**

To meet new effluent discharge standards given by National Green Tribunal (NGT), the competent authority has entrusted the work to the IISc team to inspect and recommended suitable modifications to the current treatment process to meet the required standards by NGT.

In this regard, the IISc team has visited the site and submitted the report and recommendations as listed below;

The entire biological treatment units (Biofilters) are below the HFL. As such, even after minor rainfall events, all treatment units get flooded from backwater from the drain (Nala). This completely disturbs the treatment process and kills the microbial population in the biological treatment units. Regeneration of microbial population takes weeks, during which time the quality of effluent is affected.

**Hence the construction of a new 150 MLD (phase-2) STP is recommended instead of up-gradation / rehabilitation of the old plant.**

Further, an interaction meeting was conducted with the IISc team in CE(WWM) chamber on 26th Nov 2021. As per the final recommendation of the existing 180 MLD STP at V.Valley, a proposal for construction of new 150 MLD STP (Phase II) is here with prepared as below;

Presently the existing 180 MLD STP is being operated & treated the sewage about 110 – 120 MLD of sewage. However, the parameters are not meeting the standards prescribed by the NGT.

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Now as per the recommendation of IISc, it is proposed to construct new 150 MLD STP (Phase II) in place of the existing 180 MLD STP. The existing 180 MLD STP is located on 40 Acres of land. Out of that, about 10 acres of land will be used to set up new 150 MLD STP (Phase II). This will enable the running of the existing 180 MLD STP (partially) during and after the construction of the proposed new 150 MLD STP (phase-2).

The newly constructed (ongoing) 150 MLD STP (phase-1) has a common TSPS, Headworks, sludge handling system & power generation for 300 MLD capacity. Only water line-related structures and associated/allied works need to be taken up in proposed (piping, electromechanical equipment, Instrumentations, etc.,) additional 150 MLD STP (Phase II).

The newly constructed 150 MLD STP (phase-1) is constructed with ASP and BNR process, the same technology can be adopted for additional 150 MLD STP (Phase II).

However, a detailed project report (DPR) shall be prepared by calling a tender for arriving cost for design and construction of the new 150 MLD STP (Phase II).

The details for the new 150 MLD STP (Phase II) construction are as follows:

Table 11: Details for new 150 MLD plant at V Valley location

| Item | Description |
|---|---|
| **Civil and Building Works** | |
| 1 | **Primary Clarifiers** |
| 2 | Primary Sludge Sump & Pumping Station |
| 3 | **Aeration Basin** |
| 4 | Process Air Blower Building |
| 5 | Electrical Panel Room |
| 6 | Transformer yard |

| | |
|---|---|
| 7 | Chemical building/Alum Building (Ground Floor) |
| 8 | Chemical building/Alum Building (First Floor) |
| 9 | **Secondary Clarifiers** |
| 10 | Return Activated Sludge Sump & Pumping Station |
| 11 | **Chlorine Contact Tank** |
| 12 | Chlorine Building |
| 13 | Chlorine Scrubber Area/ Foundation |
| 14 | **Substation for STP** |
| 15 | Switchgear room |
| 16 | Transformer yard |
| 17 | **Miscellaneous** |
| 18 | Roads |
| 19 | Drains |
| 20 | Landscaping with Sprinkler System |
| 21 | Shifting of existing utilities of 180 MLD STP (pipes, electromechanical equipment) |
| 21 | Site Clearing, Excavation, Leveling, Grading, and Backfilling Activities |
| | **Process, Mechanical, Electrical Works and Instrumentation & Control Works** |
| 1 | Alum Preparation and Dosing system for proposed STP |
| 2 | Detroiter with complete scraping mechanism, Rake Classifier, Organic return pump, and accessories for proposed STP |
| 3 | Primary Clarifier and Distribution Structure |
| 4 | Inlet & Outlet sluice gates and hardware |
| 5 | Central Drive, Bridge, Scrappers, and ancillaries |
| 6 | Tube settler mechanism |

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| | |
|---|---|
| 7 | Treated Sewage outlet hardware |
| 8 | Desludging valves and pipework |
| 9 | Primary sludge sump and Pumps, valves and Piping, and accessories |
| 10 | Hoists & Jib Cranes |
| 11 | Anaerobic Zone |
| 12 | Submersible Mixer and complete accessories |
| 13 | Anoxic and Aeration Zone |
| 14 | Inlet & Outlet sluice gates and hardware |
| 15 | Submersible Mixer for Anoxic Zone and complete accessories |
| 16 | Retrievable Fine Bubble Diffuser Aeration system complete with Pipe Gird and accessories |
| 17 | Process Air Blowers with suction & Discharge Silencers, Acoustic Hood, Piping with Valves and accessories |
| 18 | Mixed Liquor Internal Recycle Pumps, Valves, and Piping complete |
| 19 | EOT Cranes and Hoists, Jib Cranes |
| 20 | Ventilation system for Blower House & Mixed Liquor Internal Recycle Pumping Station |
| 21 | Aeration Basins Effluent Channel and Secondary Clarifiers |
| 22 | Inlet & Outlet sluice gates and hardware |
| 23 | Central Drive, Bridge, Scrappers, Scum Remover and ancillaries |
| 24 | Secondary Treated Water outlet hardware |
| 25 | Desludging valves and pipework |
| 26 | Return sludge sump Sluice Gate and Hardware |
| 27 | Return sludge Pumps, Valves, Piping, and accessories |
| 28 | Crane & Hoists, Jib Cranes |
| 29 | Ventilation system for Return sludge Pump House |

| | |
|---|---|
| 30 | Chlorination System |
| 31 | Chlorine storage equipment |
| 32 | Chlorinators, chlorine pipework, dosing system, leak detection, diffusers, ventilation, and accessories |
| 33 | Safety Equipment |
| 34 | EOT Cranes, Lifting Beam, and Accessories |
| 35 | Motive water Pumps and Piping |
| 36 | Service Water System |
| | **Electrical Systems** |
| 1 | Installation, testing, and commissioning of 11kV underground Cables, termination Kits, and straight joints at the following locations as per scope, specification, and drawings. |
| 2 | Installation, testing, and commissioning of electrical equipment at STP Substation building & Process Air Blower Building at Sewage treatment plant with following major equipment as per scope, specification, and drawings. |
| 3 | Installation, testing, and commissioning of Motor Control Centres, Distribution boards, etc at various locations in the Sewage Treatment Plant and Terminal Sewage Pumping station with the following major equipment, items as per scope, specification, and drawings. |
| 4 | Installation, testing, and Commissioning of LED Lighting System at Sewage Treatment plant and Terminal pumping station with the following major equipment, items as per scope, specification, and drawings. |
| 5 | Installation, testing, and Commissioning of L.T Cabling System, HT/LT Cable Carrier System at Sewage Treatment Plant, and Terminal Sewage Pumping Station with following major components as per scope, specification, and drawings. |
| 6 | Installation, testing, and Commissioning of Earthing & Lightning Protection System at the Sewage Treatment Plant and Terminal Sewage Pumping Station with the following major components as per scope, specification, and drawings. |
| 7 | Installation, testing, and Commissioning of safety procedures for Electrical Equipments at Sewage Treatment Plant and Terminal Sewage Pumping station as per scope, specification, and drawings. |

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| | |
|---|---|
| 8 | Installation, testing, and Commissioning of safety procedures for Electrical Equipments at Sewage Treatment Plant and Terminal Sewage Pumping station as per scope, specification, and drawings. |

The above technical requirements are recommended based on the site conditions and available data. But the detailed design analysis has to be carried out by considering the complete feasibility of the project.

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## 9.0 GENERAL RECOMMENDATIONS FOR ALL PLANTS:

1. Chlorine dose should be given to the effluent at all locations to reduce the concentration of pathogenic micro-organisms.
2. Unclean Chlorine contact tanks with settled sludge and algal growth are increasing the COD of effluent.
3. Chlorine contact tanks should be thoroughly cleaned, tiled, and painted with algae-resistant paint or coating, preferably in blue color.
4. Residual chlorine is measured at various stages of chlorination, however, it is recommended that appropriate residual chlorine content is measured after adequate chlorine addition, retention time and needs to be measured before discharge point. Unclean Chlorine contact tanks with settled sludge and algal growth are increasing the COD of effluent.
5. All plant equipment such as screens, grit scrappers, flow meters, and aerators should be inspected thoroughly and broken/non-operational equipment should be replaced.

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## 10.0 CONCLUSIONS:

- All STPs on the list were visited and inspected
- Water quality analysis was done for samples collected from STPs
- Process modifications were suggested for STPs not meeting NGT standard
- Out of 17, STPs studied, 6 STPs are meeting NGT-BNR standards. Out of these 6 STPs, 4 are working at maximum capacity and cannot be expected to take on more load. 2 STPs, namely Chikkabanavara and Nagasandra phase 2 can take on more load. Chikkabanavara is currently only using two of the three SBR basins available on site; with the used use of the third basin, it can take up more load. Nagasandra phase 2 is currently operating at half its capacity and therefore can take up an additional load till it meets its design capacity. Details for these six plants are given in Appendix - 1 And Appendix - 3.
- Two STPs namely Rajacanal Phase I and Rajacanal Phase II implemented some of the process modifications suggested by IISc and post these modifications, the effluent from these two STPs are meeting the BNR standards.
- Out of the 17, STPs studied, 6 were marginally underperforming in terms of nutrient removal. Out of these 6. 2 were Extended aeration plants, and 4 were SBRs. Simultaneous nitrification and denitrification by creating aerated and unaerated zones in the aeration basin were suggested as modifications for the Extended aeration plants. The addition of an unaerated mixing stage after the aeration stage was suggested as a modification for the SBR plant. Details of modifications for individual plants are given in Appendix - 4. The standard operating procedure based on the modifications is given in Appendix - 1.

- Out of the 17 STPs studied, 3 were performing very poorly. 2 of these plants were Extended aeration plants, and the remaining one was a UASB plant. The main issue with Extended aeration plants were intermittent operations and insufficient aeration. Inspection and repair of all required equipment were recommended for these plants. Additionally, simultaneous nitrification-denitrification by creating aerated and unaerated zones in the aeration basin were suggested as modifications for proper nutrient removal when the plants are operating continuously. The UASB plant maintenance modifications were suggested for the proper functioning of the technology. Further system modification was given to ensure proper nutrient removal. The details of the modifications suggested for individual plants are given in Appendix - 4. The standard operating procedure based on the modification suggested for individual plants is given in Appendix – 1.
- Maintenance of chlorine contact tanks is an issue across all STPs, and it is decreasing the quality of effluent. Hence it is recommended that periodic maintenance of chlorine contact tanks be done to keep them clean. It is also recommended that they be repainted, preferably blue and with anti-algae paint.
- Continuous monitoring for 6 STPs meeting the NGT standards is necessary to ensure long-term compliance with NGT standards. Similarly, continuous monitoring will be required for all other plants after given modifications are applied to ensure long-term compliance.

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## Appendix-1

*Table: Values used for simulation purposes*

| STP | Inlet Parameters | | | | | | Outlet Parameters | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pH | COD (mg/L) | BOD (mg/L) | TKN (mg/L) | Nitrate Nitrogen (mg/L) | Total Phosphorus (mg/L) | pH | TSS (mg/L) | COD (mg/L) | BOD (mg/L) | Total Nitrogen (mg/L) | Total Phosphorus (mg/L) |
| Nagasandra phase 2 | 7.3 | 725 | 310 | 55 | 8 | 6.2 | 7.3 | 9 | 49.9 | 4.7 | 5.1 | 0.65 |
| Chikkabanavara | 6.9 | 623 | 307 | 40 | 8.2 | 4 | 7.5 | 5 | 49.9 | 7.5 | 9.7 | 0.12 |
| Horamavu | 6.7 | 570 | 350 | 45 | 7.5 | 8.5 | 7.4 | 8 | 48.8 | 4.4 | 9.8 | 0.49 |
| Doddabele | 7 | 413 | 203 | 50 | 7 | 4.5 | 7.6 | 7 | 54.4 | 3.2 | 9.4 | 0.78 |
| K&C Valley | 8.5 | 448 | 193 | 40 | 6 | 15.3 | 7 | 9 | 27 | 3.4 | 5 | 0.7 |
| Belandur | 8 | 460 | 200 | 45 | 7 | 13 | 7.6 | 13 | 47 | 7 | 6.7 | 0.8 |
| Rajacanal phase 2 | 7.5 | 743 | 310 | 50 | 3.2 | 5.4 | 7.8 | 6 | 56 | 8.1 | 17.7 | 0.5 |
| Rajacanal phase 1 | 7.2 | 660 | 280 | 40 | 8.6 | 3 | 7.3 | 6 | 54 | 8.2 | 15 | 0.09 |
| Mallasandra | 7.5 | 552 | 224 | 37 | 8.1 | 4.5 | 7.7 | 11 | 64 | 8.3 | 13.8 | 0.8 |
| Kempambudhi | 7 | 450 | 230 | 35 | 5.8 | 3 | 7.5 | 7 | 48.8 | 10.56 | 15.8 | 0.2 |
| Kadugodi | 7.4 | 375 | 190 | 50 | 6.9 | 6.9 | 7.5 | 9 | 72.7 | 25.33 | 17.2 | 0.3 |
| Halasuru | 7 | 331 | 125 | 35 | 6 | 2.3 | 7.4 | 8 | 56 | 14.4 | 14.7 | 0.4 |
| Yelhemellappa chettikere | 7.4 | 365 | 125 | 35 | 6 | 3.3 | 7.5 | 8 | 48.4 | 14.6 | 17.8 | 0.3 |
| Malathahalli | 7.2 | 511 | 220 | 48 | 10.6 | 4.5 | 7.5 | 11 | 48.8 | 16.2 | 17.3 | 0.2 |
| Kadubeesanhalli | 7.2 | 650 | 139 | 71 | 3.3 | 13.5 | 7.6 | 100 | 92 | 18 | 35 | 10.3 |
| Nagasandra phase 1 | 7.4 | 580 | 261 | 73 | 6.6 | 5.6 | 7.2 | 16 | 58 | 28.25 | 47.7 | 0.5 |
| KR Puram | 7.4 | 437 | 306 | 55 | 3 | 7 | 7.4 | 183 | 56 | 8.2 | 50.9 | 0.7 |

Please note: These values are based on average data and single grab samples; some violations are expected.

Please note that the outlet parameters included in this appendix for Rajacanal phases 1 and 2 are before the modifications were applied.

Table Comparison of outlet data before and after implementing suggestions given by IISc team in one of the two aeration basins at the plant

| STP | Outlet parameters before implementation | | | | | | Outlet parameters after implementation | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pH | TSS mg/L | COD mg/L | BOD mg/L | TN mg/L | TP mg/L | pH mg/L | TSS mg/L | COD mg/L | BOD mg/L | TN mg/L | TP mg/L |
| Rajacanal PI | 7.8 | 6 | 56 | 8.1 | 17.7 | 0.5 | 7.5 | 8 | 48 | 4.8 | 9.8 | 0.26 |
| Rajacanal PII | 7.3 | 6 | 54 | 8.2 | 15 | 0.09 | 7.2 | 7 | 40 | 3.3 | 7.6 | 0.36 |

Comparison of outlet parameters for Rajacanal phase I and II, before and after implementation of modifications suggested by IISc. The results are for the final effluent when modifications were applied to one of the two aeration basins at the plants.

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Appendix-2

# BWSSB

## STP COMPLIANCE WITH NGT-BNR STANDARDS

DR. L N RAO, PROF. MOHAN KUMAR AND PROF. H N CHANAKYA

## SCOPE OF WORK:

The scope of work included:

1. On site inspection of all 20 STPs included in the list
2. Collection and analysis of water samples
3. Recommendations for modifying the operation of STPs to meet the new BNR standards

NGT Standards:

| Parameter | Unit | Standard |
|---|---|---|
| pH | - | 5.5-9 |
| Biological Oxygen Demand | mg/L | 10 |
| Chemical Oxygen Demand | mg/L | 50 |
| Total Suspended Solids | mg/L | 20 |
| Total Nitrogen | mg/L | 10 |
| Total Phosphorus | mg/L | 1 |
| Total Coliforms | MPN/100 ml | <100 desirable, <230 OK |

# Details of the STPs studied:

The list included 20 STPs. Out of the 20 STPs, **V Valley** STP is under upgradation and hence not completely operational, similarly **Madiwala** STP is also under construction and hence non-operational. Further the team was informed that **Kengeri** STP was put on the list unintentionally. Therefore, these were not visited.

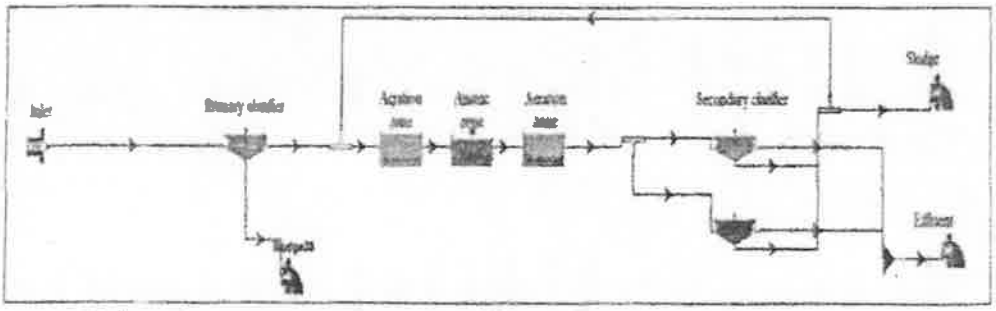
**List of STPs Studied:**

| | | |
|---|---|---|
| [illegible] | 9. Mallasandra phase 1 (75 MLD) | [illegible] |
| [illegible] | 10. Kempambudhi (1 MLD) | [illegible] |
| [illegible] | 11. Kadagodi (6 MLD) | |
| [illegible] | 12. Hulimavu (2 MLD) | |
| [illegible] | 13. Yelemallappa Chetukere (15 MLD) | |
| [illegible] | 14. Mallathahalli (5 MLD) | |
| 7. Rajakaluve phase-2 (40 MLD)** | | |
| 8. Rajakaluve phase-2 (60 MLD)** | | |

** Suggested modification were applied at these plants. As a result, these now meet the required NGT-BNR standards.

# Methodology used :

1. An 'As-Is BioWin' Simulation model for each of the STPs was created




2. The created model was validated for the water samples collected and analyzed
3. Using the validated model at full flow conditions, the model was run for different scenarios and the optimum values for each STPs have been determined.

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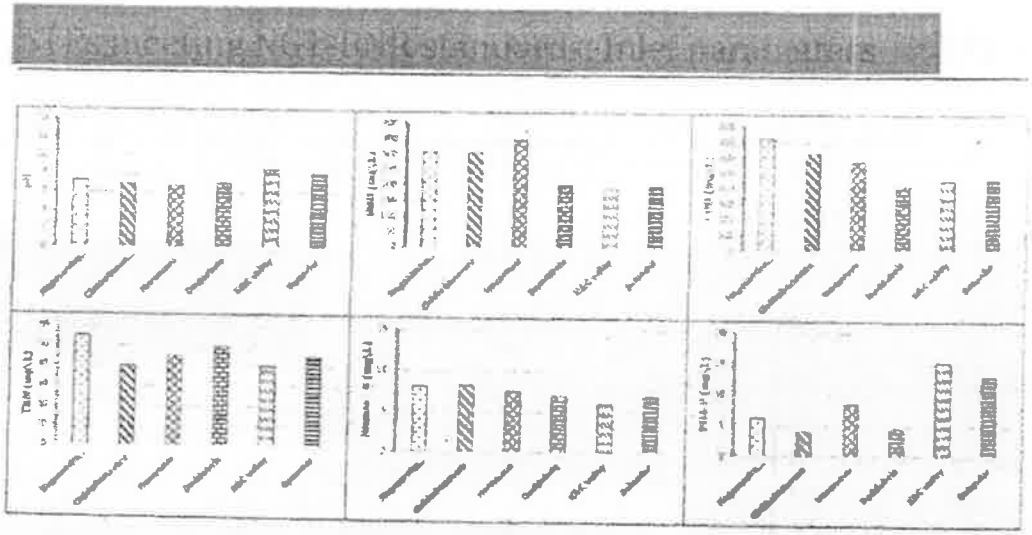

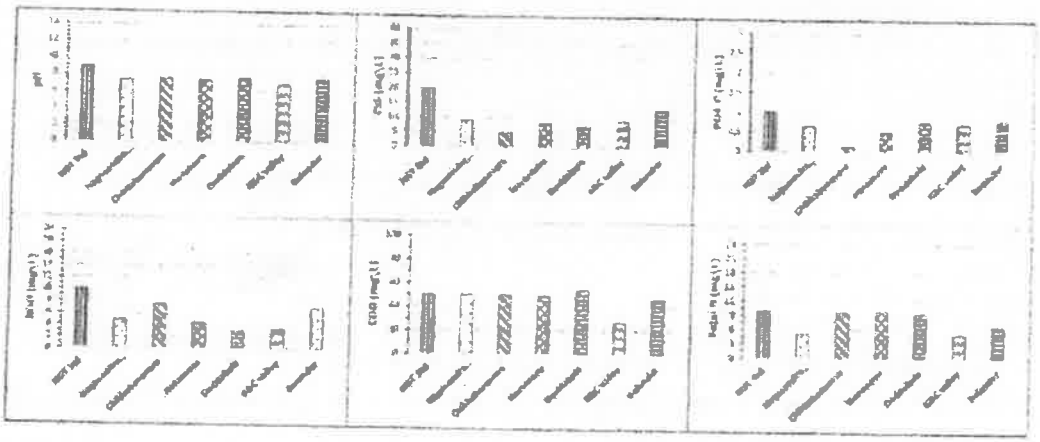

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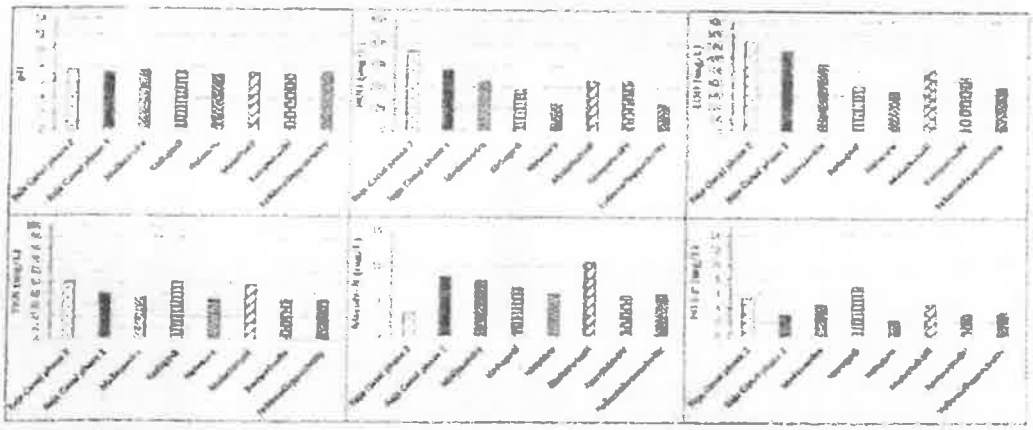
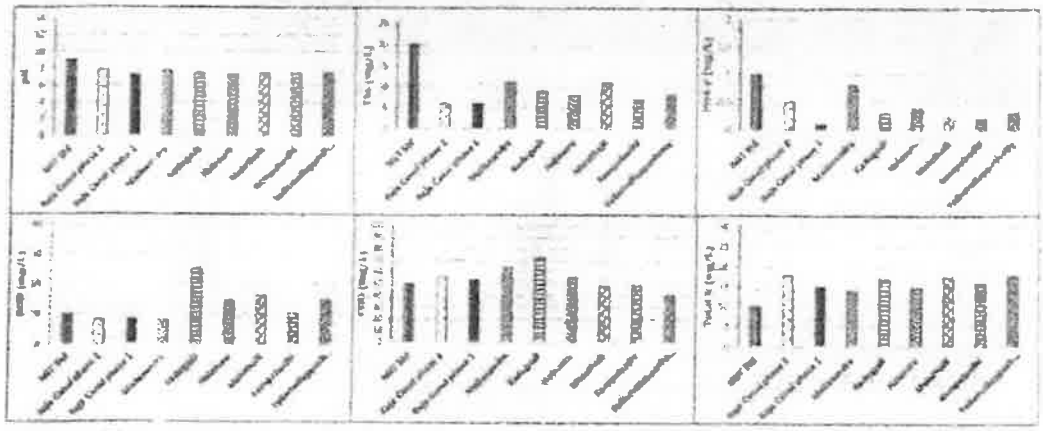
## Marginally underperforming STPs: Inlet parameters



Suggested modification were applied at Ranjacanal phase 1 & 2. As a result, these now meet the required NGT-BNR standards.

## Marginally underperforming STPs: Outlet parameters



Suggested modification were applied at Ranjacanal phase 1 & 2. As a result, these now meet the required NGT-BNR standards.

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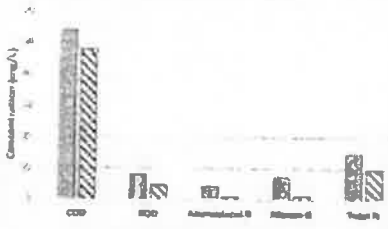
## Rajacanal phase -1: 40 MLD

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 35 MLD | 2004 | EAP | 2700 mg/L | 85% | 400 m³/day | 1.8-2.0 mg/L | Yes |

**SUGGESTED MODIFICATIONS:**

1. Turn the aerators on and off in such a way as to split the aeration tank into three separate zones
2. Zone 1 is aerated at 3 mg/L. Zone 2 is left unaerated, and zone 3 is aerated at 2 mg/L.
3. The MLSS in the aeration tank should be increased to 3500 mg/L.
4. Surface aerators and other equipment should be inspected and replaced where necessary.



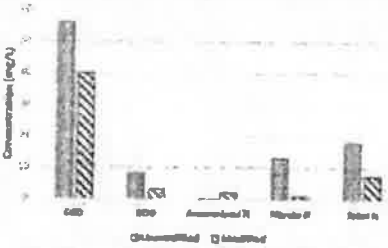
Comparison of outlet water quality parameters before and after implementing the modifications at Rajacanal phase I

## Rajacanal phase - 2: 40 MLD

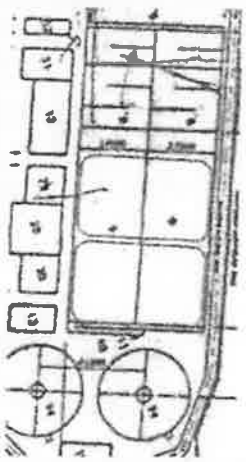
| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 45 MLD | 2018 | EAP | 3500 mg/L | 80% | ~2000 m³/day | 3 mg/L | Yes |

**SUGGESTED MODIFICATIONS:**

1. Turn the aerators on and off in such a way as to split the aeration tank into two separate zones
2. Zone 1 is aerated at 3.5 mg/L, and Zone 2 is unaerated. Turn on the last set of aerators.
3. The MLSS in the aeration tank should be increased to 4000 for further improvements
4. Consider sending excess 5 MLD to phase 1



Comparison of outlet water quality parameters before and after implementing the modifications at Rajacanal phase II



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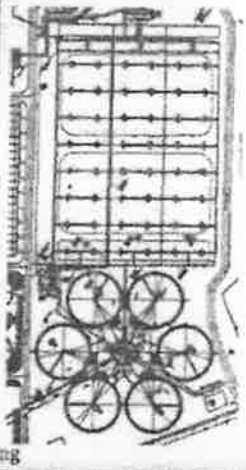
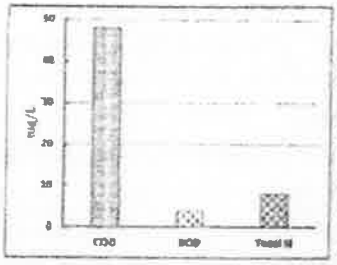
# Mailasandra phase -1: 75 MLD

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 70 MLD | 2015 | EAP | 3500 mg/L | 73% | ~550 m³/day | - | Yes |



SUGGESTED MODIFICATIONS:

1. Turn the aerators on and off in such a way as to split the aeration tank into three separate zones
2. Zone 1 is aerated at 3 mg/L. Zone 2 is left unaerated, and zone 3 is aerated at 2 mg/L.
3. The MLSS in the aeration tank should be increased to 4000 mg/L



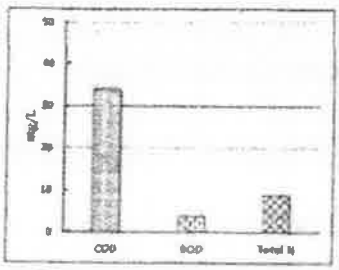

Expected Output Parameters from Modelling

# Kempambudhi: 1 MLD

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 1 MLD | 2002 | EAP | 3500-3600 mg/L | 21 m³/hr for 22 hrs | 21 m³/hr for 2 hrs | 2-2.4 mg/L | No |

SUGGESTED MODIFICATIONS:

1. Turn the aerators on and off in such a way as to split the aeration tank into two separate zones
2. Zone 1 is aerated at 2 mg/L. Zone 2 is left unaerated.
3. The MLSS should be increased to 4000 mg/L
4. It is recommended that the plant is operated at a lower inflow rate (0.6 MLD) and the rest of the sewage be diverted to downstream STPs




Expected Output Parameters from Modelling

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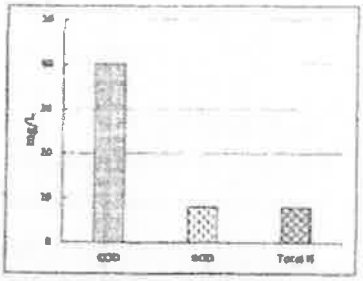
## Kadugodi: 6 MLD

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 4.6 MLD | 2018 | SBR | 3000-3500 mg/L | 30 $m^3$/hr for 1.5 hr/cycle | ~ 207 $m^3$/day | 1-4 mg/L | Yes |

**SUGGESTED MODIFICATIONS:**

1. The current cycle includes an unaerated filling stage. The aeration should begin with filling so that the total aeration time is 1.5 hrs. Dissolved oxygen during aeration time should be maintained at 3.5 mg/l
2. The current cycle includes settling time of 45 mins which should be increased to 100 mins.
3. In the case of diluted sewage, additional carbon may have to be added to the sewage to assure proper nutrient removal.



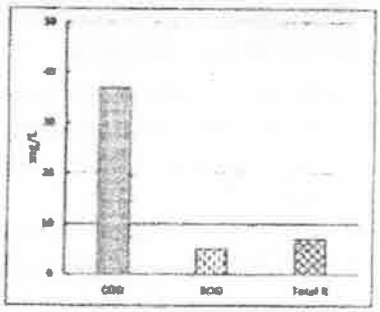

Expected Output Parameters from Modelling

## Halasuru: 2 MLD

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 2 MLD | 2018 | SBR | 3500 mg/L | 30 $m^3$/hr for 2 hr/cycle | As needed | 2.5-3 mg/L | Yes |

**SUGGESTED MODIFICATIONS:**

1. The MLSS in the SBR tank should be increased to 4000 mg/L by controlling the RAS ratio. Dissolved oxygen during aeration time should be maintained at 3.5 mg/l
2. The current cycle includes settling time of 1 hr., which should be increased to 2 hrs. till proper settling quality of sludge is recorded.
3. Oil and grease traps should be installed in the primary treatment to remove excess oil and grease in the influent.




Expected Output Parameters from Modelling

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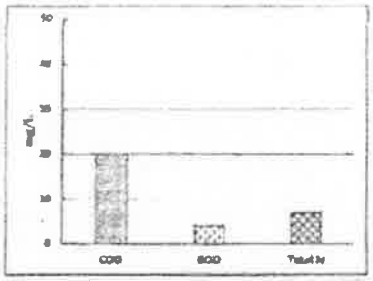
## Yellamallappa chettikere: 15 MLD

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 13.6 MLD | 2018 | SBR | - | - | 810 $m^3$/day | - | Yes |

**SUGGESTED MODIFICATIONS:**

1. The MLSS in the SBR tank should be increased by controlling WAS. Dissolved oxygen during aeration time should be maintained at 3.5 mg/l
2. The current cycle includes settling time of 1.5 hr, which should be increased to 3 hrs.
3. In the case of dilute sewage being received, additional carbon may have to be added to the sewage to assure proper nutrient removal.
4. Make provisions for diverting rainwater and increase BOD levels



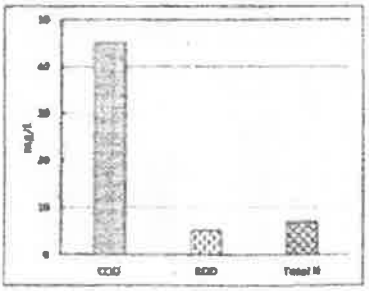

Expected Output Parameters from Modelling

## Malathahalli: 5 MLD

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 4.7 MLD | 2015 | SBR | 3500-3600 mg/L | - | 391 $m^3$/day | < 2 mg/L | No |

**SUGGESTED MODIFICATIONS:**

1. The aeration should begin with filling so that the total aeration time becomes 2.24 hrs. (However, if the influent has a high nitrate-N concentration, which is not removed during primary treatment, the fill time should be unaerated). Dissolved oxygen during aeration time should be maintained at 3.5 mg/l
2. The current cycle includes settling time of 69 mins which should be increased to 3.2 hrs. till proper sludge quality is achieved.




Expected Output Parameters from Modelling

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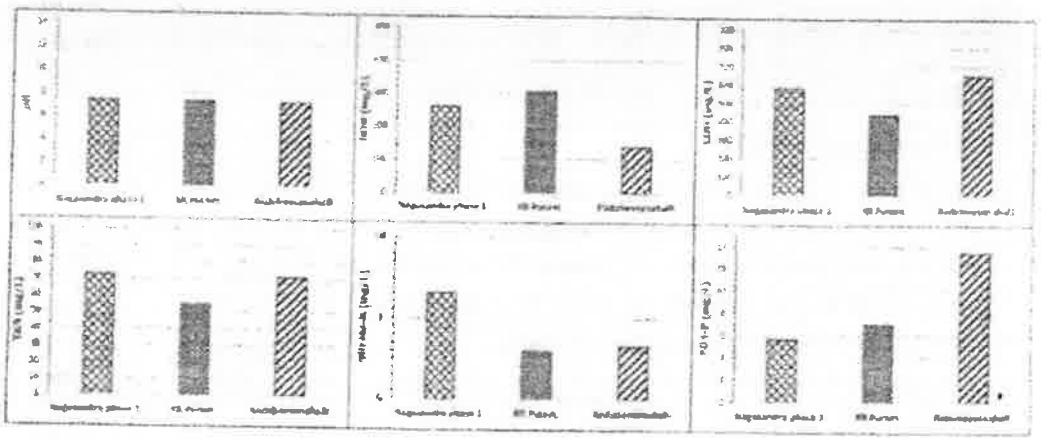
## Malathahalli: 5 MLD

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed BD levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 4.7 MLD | 2018 | SBR | 3500-3600 mg/L | | 391 m³/day | < 2 mg/L | No |

**FURTHER MODIFICATIONS REQUIRED:**

1. Oil and grease traps should be installed in the primary treatment to remove excess oil and grease in the influent.
2. One inlet screen needs repair, one blower needs to be replaced, and one centrifuge that is not working should be replaced.
3. In the case of diluted sewage, additional carbon may have to be added to the sewage to assure proper nutrient removal.

## Poorly performing STPs: Inlet parameters



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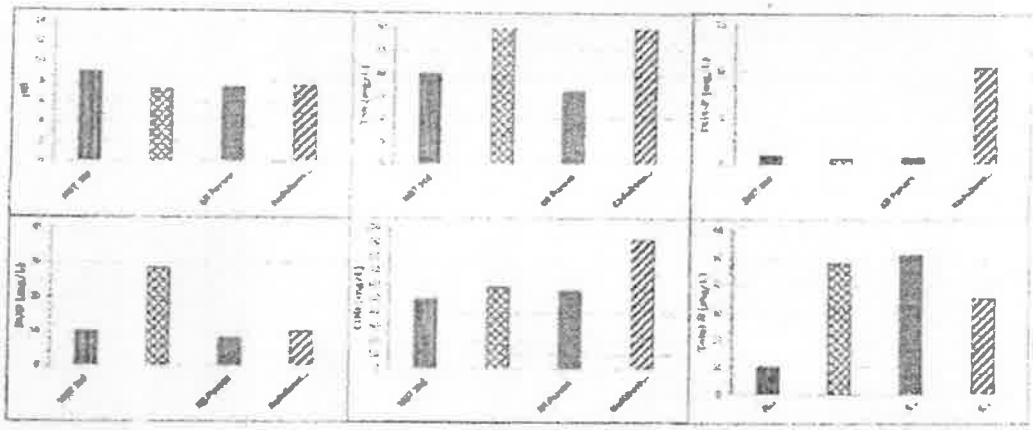
# Poorly performing STPs: Outlet parameters

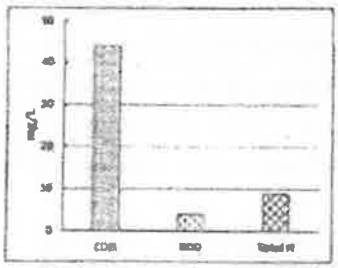


## Adutheesavalai: 50 MLD

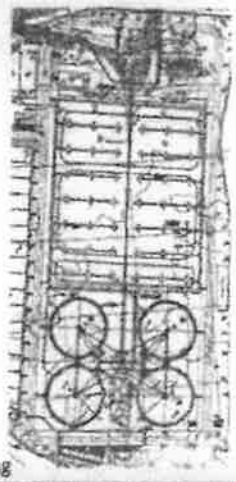
| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 42 MLD | 2005 | EAP | - | 60% | 40% | - | No |

**SUGGESTED MODIFICATIONS:**

1. Turn the aerators on and off in such a way as to split the aeration tank into three separate zones
2. Zone 1 is aerated at 2 mg/L. Zone 2 is unaerated, and zone 3 is aerated at 1 mg/L.
3. The MLSS value should be between 2500-3500 mg/L



Expected Output Parameters from Modelling



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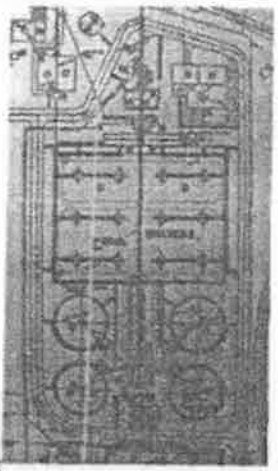
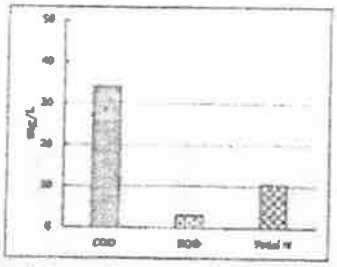
## Nagasandra phase -1: 20 MLD

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 11 MLD | 2005 | EAP | - | - | - | - | No |



**SUGGESTED MODIFICATIONS:**

1. Turn the aerators on and off in such a way as to split the aeration tank into two separate zones
2. Zone 1 is aerated at 2 mg/L. Zone 2 is unaerated.
3. MLSS levels should be between 3000-3500 mg/L.




Expected Output Parameters from Modelling

## Nagasandra phase -1:

| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination |
|---|---|---|---|---|---|---|---|
| 11 MLD | 2005 | EAP | - | - | - | - | No |

**FURTHER MODIFICATIONS:**

1. The scraper mechanism should be inspected for rust, flow directional gates are broken and should be replaced. Other equipment should be checked and replaced.
2. Anoxic mixers are not working and should be replaced.
3. Surface aerators are running with noise and vibrations. There is a reduction in rpm due to multiple rewindings. Gearboxes have outlived their service life. If possible, shift to diffuse aerators.
4. The strength of material for clarifiers should be analyzed, and the system should be assessed and replaced accordingly.
5. Major flow meters are not working and should be replaced.

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## K R Puram: 20 MLD

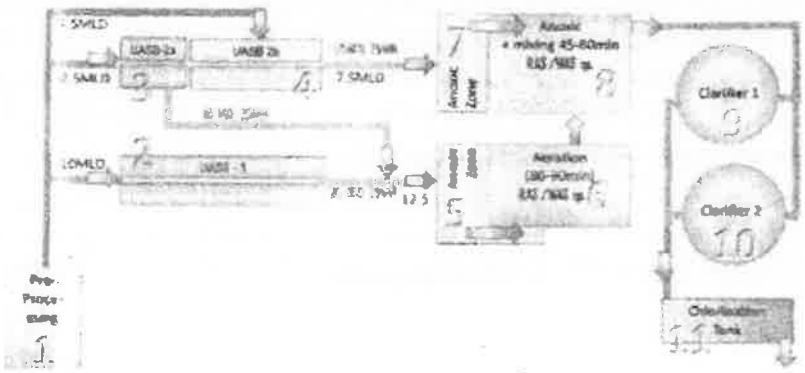
| Current flow | Year | Operation technology | Claimed MLSS | RAS | WAS | Claimed DO levels | Chlorination methodology |
|---|---|---|---|---|---|---|---|
| 12 MLD | 2005 | UASB + EAP | 3500 mg/L | 100% | 0.8 MLD | 2 mg/L | No chlorination |

**INITIAL SUGGESTED MODIFICATIONS:**

- Primary treatment needs to be fixed. Any units/equipment that are not working should be inspected and repaired
- UASB downflow inlet pipes are blocked/clogged. These should be unclogged and made sure that they are working properly
- The UASB should be made operational so that no influent is bypassing it and proper nutrient removal occurs. The sludge quality and performance need to be monitored from time to time.
- The surface aerators should be inspected and fixed to make sure they are aerating properly
- MLSS in the aeration tank should be increased to optimal levels, ensuring proper removal of nutrients.

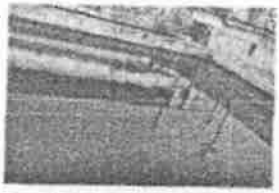
## K R Puram: 20 MLD

**FURTHER MODIFICATION:**



# General Recommendations:

1. Unclean Chlorine contact tanks with settled sludge and algal growth are increasing the COD of effluent.
2. Chlorine contact tanks should be thoroughly cleaned, tiled and painted with algae-resistant paint or coating, preferably in blue color.



# General Recommendations:

3. All plant equipment such as screens, grit scrappers, flow meters, and aerators should be inspected and replaced wherever necessary.
4. The extent of non-settled portion of sludge should be monitored and reported daily as part of routine SVI and SSI test. This will allow timely tweaking of the process through SCADA.
5. Chlorine dose should be given to the effluent at all locations to reduce the concentration of pathogenic micro-organisms.
6. Chlorine demand should be monitored and reported routinely to ensure satisfactory disinfection is being done.
7. It is recommended that appropriate residual chlorine content is measured after at least 30 mins after chlorine addition and needs to be measured before the discharge point.

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## Acknowledgement :

BWSSB TEAM:
Sri Suresh S T
Sri Pavan N
Sri Miraganje M
Sri Raghu R
Sri Dharanish J
Srimati Vidya K
Sri Prakash S
Sri Gurivasa M N

IISc TEAM:
Aniruddha T P
Santrupt R M
Srimati Kavita Verma
Sohan Yadav
Shivani Kulkarni

# THANK YOU!

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**Additional information pertaining to National Green Tribunal Original Application No:111/2020 (SZ)**

On the Original Application filed the Hon'ble National Tribunal has directed the Board to take up the rehabilitation / upgradation of existing old wastewater treatment plants to treat the wastewater to the following revised effluent treatment standards as prescribed by KSPCB:

| Parameter | Measured unit | Standards prescribed by KSPCB | Revised standards prescribed by Hon'ble NGT in its original Application No.1069/2019 Dated 30.04.2019. |
|---|---|---|---|
| pH | pH Units | 6.5 – 9.0 | 6.5 – 9.0 |
| BOD-5 | MG/L | 20 | 10 |
| TSS | MG/L | 30 | 10 |
| COD | MG/L | 250 | 50 |
| Total Nitrogen | MG/L | 10 | 10 |
| Total Phosphorus | MG/L | 5 | 1 |
| Total Coliform | MPN / 100 ML | 100 | Prescribed < 230 required < 100 |

Further as per the orders of the Hon'ble National Green Tribunal in O.A. No.1069/2018, it is required for the Board to take up similar upgradation works of existing 33 wastewater treatment plants of the City. The work of preparation of the feasibility report has been entrusted to M/s. Indian Institute of Science (M/s. IISc). After conducting site visits, detailed investigation, M/s. IISc have submitted the final feasibility report to the Board with recommendation to upgrade 20 nos STPs out of 33 existing STPs.

Further, based on the recommendations of M/s. IISc the 12 STP's upgradation works have been taken up under Dakshina Pinakini River basin and status of which are as follows:

| Sl no | Name of STP | IISc recommendation | BWSSB Action Taken Status | Remarks |
|---|---|---|---|---|
| 1 | 40 MLD STP at Rajacanal (Phase II) | BNR Removal, and CCT Tile laying and painting | The upgradation work awarded to the firm for installation of disc filter in order to achieve prescribed NGT parameters and CCT rehabilitation works | The work is under progress and shall be completed by end of 2025 |
| 2 | 20 MLD STP at Horamavu and construction of new 60MLD STP | BNR Removal, and CCT Tile laying and painting | The upgradation work awarded to the firm for installation of disc filter in order to achieve prescribed NGT parameters | The work is under progress and shall be completed by end of 2026 |

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| | | | | |
|---|---|---|---|---|
| | | | and CCT rehabilitation works and Construction of new 60 MLD capacity STP. | |
| 3 | 60 MLD STP at Hebbal | Construction of new 60 MLD capacity STP in lieu of existing 60 MLD STP | Construction of new 60 MLD capacity STP. | The work is under progress and shall be completed by end of 2026 |
| 4 | 40 MLD STP at Rajacanal (Phase I) | Electro-Mechanical equipments replacements, civil structures strengthening and other permanent measures | The upgradation work awarded to the firm for replacement of Electro-Mechanical equipments in order to achieve prescribed NGT parameters | The work is under progress and shall be completed by end of 2026 |
| 5 | 10 MLD STP at Yelahanka | Electro-Mechanical equipments replacements, civil structures strengthening and other permanent measures | The upgradation work awarded to the firm for replacement of Electro-Mechanical equipments in order to achieve prescribed NGT parameters | The work is under progress and shall be completed by end of 2026 |
| 6 | 50 MLD STP at Kadubeesinahalli | Electro-Mechanical equipments replacements, civil structures strengthening and other permanent measures | The upgradation work awarded to the firm for replacement of Electro-Mechanical equipments in order to achieve prescribed NGT parameters | The work is under progress and shall be completed by end of 2026 |
| 7 | 20 MLD STP at K R PURAM | Electro-Mechanical equipments replacements, civil structures strengthening and other permanent measures | The upgradation work awarded to the firm for replacement of Electro-Mechanical equipments in order to achieve prescribed NGT parameters | The work is under progress and shall be completed by end of 2026 |
| 8 | 90 MLD STP at Bellandur & Amanikere | BNR Removal, and CCT Tile laying and painting | The upgradation work awarded to the firm for installation of disc filter in order to achieve prescribed NGT parameters and CCT rehabilitation works | The work is under progress and shall be completed by end of 2025 |
| 9 | 60 MLD STP at K and C Valley | BNR Removal, and CCT Tile laying and painting | The upgradation work awarded to the firm for installation | The work is under progress and shall be completed by end of |

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| | | | | |
|---|---|---|---|---|
| | | | of disc filter in order to achieve prescribed NGT parameters and CCT rehabilitation works | 2025 |
| 10 | 15 MLD STP at Yellammallpachetty | BNR Removal, and CCT Tile laying and painting | The upgradation work awarded to the firm for installation of disc filter in order to achieve prescribed NGT parameters and CCT rehabilitation works | The work is under progress and shall be completed by end of 2025 |
| 11 | 2 MLD STP at Ulsoor | BNR Removal, and CCT Tile laying and painting | The upgradation work awarded to the firm for installation of disc filter in order to achieve prescribed NGT parameters and CCT rehabilitation works | The work is under progress and shall be completed by end of 2025 |
| 12 | 6 MLD STP at Kadugodi | BNR Removal, and CCT Tile laying and painting | The upgradation work awarded to the firm for installation of disc filter in order to achieve prescribed NGT parameters and CCT rehabilitation works | The work is under progress and shall be completed by end of 2025 |

During 2020 BWSSB was treating 450 MLD of sewage only and after completion of 5 nos of STPs under Amrut and 2nos of STPs under Megacity Revolving Funds project, presently around 776.89 MLD is being treated under Dakshina Pinakin catchment.

After 2020 BWSSB has laid the Laterals, Submains and Trunk Sewers under 110 villages/CMC area which comes under Dakshina Pinakin catchment around 850KMs.

CE(WWM-E)
BWSSB

CE(WWM-W)
BWSSB

CE(P)
BWSSB .

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Annexure-IV

| List of Under Construction STPs (BWSSB) | | | | | | |
|---|---|---|---|---|---|---|
| Sl. No. | STP location | Proposed capacity (MLD) | Amount in crore | Technology used | Proposed date of completion of work | Status of the project |
| 1 | Kaggadasapura | 5 | 26.38 | SBR | 31.12.2025 | Under construction |
| 2 | Varthur | 25 | 95.25 | EA | - | After clearance of court case pending in Hon'ble Supreme Court and High Court, the construction work will be taken up |
| 3 | Bilishivale | 17 | 61.61 | SBR | 31.12.2025 | Under construction |
| 4 | Doddabetta hally | 7 | 36.30 | SBR | 31.12.2025 | Under construction |
| 5 | Jakkur | 7 | 31.27 | SBR | 30.08.2025 | Under construction |
| 6 | Yelahanka | 6 | 38.29 | SBR | 31.12.2025 | Under construction |
| 7 | Jakkur-down stream | 10 | 29.33 | SBR | 23.9.2025 | Under construction |
| 8 | Byrahikanne | 13 | 49.68 | SBR | 26.9.2025 | Under construction |
| 9 | Anjanapura | 5 | 28.20 | SBR | 23.9.2025 | Under construction |
| 10 | Rachenahalli | 10 | 32.85 | SBR | 31.12.2025 | Under construction |
| 11 | Horamavu | 60 | 149.55 | IFAS | 23.9.2025 | Under construction |
| 12 | Hebbal | 60 | 139.40 | IFAS | 23.9.2025 | Under construction |
| **Total** | | **225.00** | **718.11** | | | |

CE(WWM-East)
BWSSB

CE(WWM-West)
BWSSB

CE(P)
BWSSB

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Annexure-V

List of proposed STPs (BWSSB)

| Sl. No. | STP location | Proposed capacity (MLD) | Amount in crore | Technology used | Proposed date of completion of work | Status of the project |
|---|---|---|---|---|---|---|
| 1 | Madiwala | 75 | 306.48 | Sequential Batch Reactor (SBR) | After award of 36 months | DPR submitted to GoK for administrative approval and seeking for financial assistance |
| 2 | Kadabeesanahalli | 50 | 234.46 | Sequential Batch Reactor (SBR) | After award of 36 months | |
| 3 | Kadugodi | 20 | 134.51 | Integrated fixed –Film Activated sludge(IFAS) | After award of 24 months | |
| 4 | Koramangala | 20 | 123.32 | Integrated fixed –Film Activated sludge(IFAS) | After award of 24 months | |
| 5 | Basavanapura | 10 | 75.64 | Sequential Batch Reactor (SBR) | After award of 24 months | |
| 6 | Bellandur | 60 | 324.75 | Conventional ASP | After award of 36 months | |
| 7 | Kogilu | 15 | 39.97 | - | After award of 24 months | PMC appointed and Tender will be invited shortly |
| 8 | Channasandra | 20 | 48.18 | - | After award of 24 months | |
| 9 | Sowlkere | 28 | 59.02 | - | After award of 24 months | |
| 10 | Chikkabegur | 15 | 39.97 | - | After award of 24 months | |
| Total | | | | | | |

CE(P)
BWSSB

CE(WWM-East)
BWSSB

**Annexure-VI**

**Analysis Report of Dakshina Pinakini River at Mugaluru Bridge from April - 2024 to February - 2025**

| Parameters | Units | Apr-24 | May-24 | Jun-24 | Jul-24 | Aug-24 | Sep-24 | Oct-24 | Nov-24 | Dec-24 | Jan-25 | Feb-25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature | °C | 22 | 28 | 22 | 22 | 22 | 22 | 25 | 28 | 23 | 21 | 24 |
| pH@25°C | | 7.2 | 6.9 | 6.9 | 6.8 | 7 | 7.3 | 6.5 | 7.6 | 7.2 | 7.2 | 7.5 |
| Conductivity @25°C | us/cm | 974 | 1439 | 1406 | 1235 | 968 | 1345 | 1224 | 1324 | 1458 | 1291 | 1234 |
| Dissolved Oxygen | mg/L | BDL | BDL | BDL | BDL | 2.2 | BDL | BDL | 1.4 | 1.2 | BDL | BDL |
| BOD | mg/L | 71 | 58 | 25 | 21 | 42 | 44 | 71 | 17 | 36 | 75 | 36 |
| COD | mg/L | 232 | 280 | 200 | 152 | 236 | 220 | 360 | 137 | 200 | 265 | 344 |
| Nitrates as N | mg/L | 5.6 | 5.01 | BDL | 4.98 | 3.4 | 5 | 4.7 | 1.4 | 6.8 | 5 | 4.74 |
| Ammonical Nitrogen NH4-N | mg/L | --- | --- | --- | --- | | | | | | | |
| Ammonia as N | mg/L | 30 | 24 | 20.4 | --- | 20 | 18 | 22.1 | 42 | 7.6 | 45 | 43 |
| Total Kjeldahl Nitrogen | mg/L | 40 | 32 | 26.5 | 36.4 | 28 | 24 | 25.8 | 54 | 8.4 | 58.5 | 60.2 |
| Turbidity | mg/L | 30 | 15.2 | 80.7 | 32.8 | 144 | 81 | 31.8 | 28 | 29 | 17.8 | 90 |
| Total Hardness as CaCO3 | mg/L | 276 | 292 | 380 | 300 | 212 | 460 | 332 | 296 | 400 | 316 | 340 |
| Calcium as CaCO3 | mg/L | 144 | 152 | 196 | 156 | 112 | 232 | 172 | 168 | 204 | 156 | 176 |
| Calcium as Ca | mg/L | 58 | 61 | 78 | 63 | 45 | 93 | 69 | 67 | 82 | 62 | 70 |
| Magnesium as CaCO3 | mg/L | 132 | 140 | 184 | 144 | 100 | 228 | 160 | 128 | 196 | 160 | 164 |
| Magnesium as Mg | mg/L | 32 | 34 | 45 | 35 | 24 | 55 | 39 | 31 | 48 | 39 | 40 |
| Chloride as Cl | mg/L | 196 | 160 | 220 | 172 | 120 | 244 | 204 | 120 | 244 | 196 | 192 |
| Sodium as Na | mg/L | 164 | 140 | 136 | 84 | 94 | 148 | 116 | 132 | 117 | 137 | 104 |
| potassium as K | mg/L | 32 | 29 | 18 | 7 | 31 | 23 | 24 | 32 | 29 | 26 | 32 |
| Percent Sodium | mg/L | 53 | 48 | 47 | 37 | 45 | 40 | 41 | 46 | 36 | 46 | 37 |
| Sulphate as SO4 | mg/L | 23 | 22 | | 21 | 32 | 33 | 50 | 34 | 59 | 24 | 21 |
| P-Alkalinty as CaCO3 | mg/L | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL |
| T-Alkalinty as CaCO3 | mg/L | 428 | 340 | 396 | 392 | 220 | 436 | 284 | 248 | 340 | 464 | 112 |
| Sodium Absorption Ratio (SAR) | mg/L | 5.9 | 4 | 3 | 3 | 3 | 3 | 2.77 | 3.3 | 2.54 | 3.3 | 2.5 |
| Free Ammonia | mg/L | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL |
| TDS | mg/L | 666 | 948 | 952 | 826 | 648 | 922 | 826 | 900 | 984 | 900 | 840 |
| Total Suspended Solids | mg/L | 40 | 22 | 106 | 42 | 14 | 110 | 36 | 36 | 34 | 26 | 118 |
| Total Phoshate as P | mg/L | 4.6 | 0.6 | 2.7 | 2.11 | 1.4 | 0.3 | 1.44 | 0.24 | 0.62 | 0.53 | 0.67 |
| Ortho Phosphate | mg/L | 1.4 | 1.6 | 7.4 | 5.57 | 3.6 | 0.9 | 4.24 | 0.65 | 1.64 | 8 | 1.6 |
| Fluoride as F | mg/L | 0.2 | 0.23 | 0.48 | 0.38 | 0.26 | 0.28 | 0.26 | 0.14 | 0.18 | 0.17 | 0.29 |
| Boron as B | mg/L | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL |
| Bicarbonate(HCO3) | mg/L | BDL | 340 | 396 | 392 | 220 | 436 | 284 | 248 | 340 | 464 | 112 |
| Carbonate(CO3) | mg/L | | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL |
| Total Coliform | MPN/100ml | 790 | 230000 | 7900 | 330000 | 3500 | 630000 | 4600000 | 14000 | 2800 | 110 | 4800 |
| Fecal Coliform | MPN/100ml | 140 | 45000 | 780 | 68000 | 260 | 170000 | 920000 | 2700 | 170 | 14 | 2100 |
| Cadmium | mg/L | BDL | --- | --- | --- | --- | --- | BDL | --- | --- | --- | --- |
| Copper | mg/L | BDL | --- | --- | --- | --- | --- | BDL | --- | --- | --- | --- |
| Lead | mg/L | BDL | --- | --- | --- | --- | --- | BDL | --- | --- | --- | --- |
| Total Chromium | mg/L | BDL | --- | --- | --- | --- | --- | BDL | --- | --- | --- | --- |
| Nickel | mg/L | BDL | --- | --- | --- | --- | --- | BDL | --- | --- | --- | --- |
| Zinc | mg/L | BDL | --- | --- | --- | --- | --- | 0.138 | --- | --- | --- | --- |
| Iron | mg/L | 6.744 | --- | --- | --- | --- | --- | 2.295 | --- | --- | --- | --- |
| Manganese | mg/L | 0.144 | --- | --- | --- | --- | --- | 0.18 | --- | --- | --- | --- |
| Fecal Streptococi | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Aluminum | mg/L | --- | --- | --- | 4.975 | 126 | --- | 5.959 | 1354 | 2.986 | 1.35 | --- |
| Nitrite as N | mg/L | --- | --- | --- | --- | 0.72 | BDL | 0.3 | --- | --- | --- | --- |
| Total Dissolved Phosphate | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Oil & Grease | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| INFERENCE | | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" |

**Class "B" - Out door bathing (organized).**

**Class "C" - Drinking water souce with conventional treatment followed by disinfection**

**Class "D" - Propogartion of wild life. Fisheries.**

**Class "E" - Irrigation, Industrial cooling, controlled Waste disposal.**

**Class "Below E" - Not meeting A,B,C,D & E Criteria.**

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English True Translation of Annexure 7.

**BANGALORE DEVELOPMENT AUTHORITY**

No.BDA/EE(E)/1142/2024-25 Dated: 26.03.2025

**To**:

The Member Secretary,
Karnataka State Pollution Control Board,
Parisara Bhavan, Church Street,
Bengaluru.

Sir,

**Sub**: Submission of report to the Petition No.125/2017 filed before the Hon'ble National Green Tribunal – reg.

******

With reference to the subject above, the latest progress report of the works undertaken in Bellandur Lake and Varthur Lake of Varthur Hobli, Bengaluru East Taluk as per the directions of the Hon'ble National Green Tribunal in Petition No.: 125/2017 is enclosed with this letter as per Annexures - 1 and 2 and forwarded for further action.

Thanking you,

Yours faithfully,

Sd/-
Executive Engineer,
East Division,
BDA, Bengaluru.

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## ANNEXURE – A

## REJUVENATION WORK OF BELLANDUR LAKE

- As per the order of Hon'ble National Green Tribunal, rejuvenation work of Bellandur lake is being undertaken by the Bangalore Development Authority.

- The area of Bellandur lake is 916 acres and 17 guntas and it has a capacity of 0.42 TMC.

- After the completion of the comprehensive rejuvenation work, the capacity can be expanded from the existing 0.42 to 0.54 TMC and with an additional capacity of 0.12 TMC, the flooding that was happening in the catchment areas of the lake during monsoons can be prevented.

- A contract for Rs.100.30 Crores has been entered into with the contractor, M/s. RMN Infrastructures Ltd. on 23.11.2020, to carry out revival and development work of Bellandur lake and the work is scheduled to be completed within 18 months.

- During the removal of silt accumulated in the lake, due to high humidity and during the rainy season, obstruction of vehicular traffic in the yard of the lake, due to untimely rains, there is a delay in the work due to the protest of the local people at the specified places for removing the water stored in the lake and disposal of the silt, and due to non-cooperation of the traffic police to transport the silt in the morning (Day Time).

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- At present, 70 percent physical progress and 88 percent economic progress has been achieved in the work.
- A permanent solution is being devised for the problems caused to the surrounding public due to foul smell and foam problem from the lake water.
- A diverted canal has been constructed to separate the polluted water coming from different sources into the lake.
- Sluice gates have been installed in the Kodi (Sluice) area of the lake to avoid the problems which were being caused by the flood situation due to the intensity of water during the rainy season.
- Disasters that may be caused by rain water in the surrounding area can be reduced by maintaining the Sluice Gates in a planned manner during floods.
- Chain link fencing has already been installed by the authority along the length of 11.26 km out of a total of 12.26 km. As there is a case in the court, excluding 1.00 km in Ambedkar Nagar limits on the northern direction of the lake yard, barbed wire fence has been installed in the remaining parts.
- Residents of Ambedkar Nagar have been rehabilitated by the Revenue Department and the Slum Clearance and during the clearance of the unauthorized buildings the slum dwellers have approached the court and brought an order of injunction. After the Court Case W.P.No.50953/2019 is

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vacated and the unauthorized buildings are vacated, steps shall be taken to install chain link fencing.

- About 22.5 lakh cubic meters of silt accumulated in the lake has been removed. 70% of the work is complete. 30% physical progress has been achieved in wetland the works.

- At present rain water has been accumulated in 200 acres of the lake yard and as there is lack of grant, a proposal has been submitted to the Government for the grant and after the approval is obtained, it has been planned to take up and complete the work.

- Water coming from Koramangala - Agara Valleys is planned to be filled into the lake after treatment by Bengaluru Water Board.

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## ANNEXURE – B

## REJUVENATION WORK OF VARTHUR LAKE

- As per the order of Hon'ble National Green Tribunal, rejuvenation work of Varthur lake is being undertaken by the Bangalore Development Authority.

- The area of Bellandur lake is 439 acres and 34 guntas and it has a capacity of 0.14 TMC.

- A contract for Rs.53.81 Crores has been entered into with the contractor, M/s. Star Infratech on 23.11.2020, to carry out revival and development work of Varthur lake and the work is scheduled to be completed within 18 months.

- During the removal of silt accumulated in the lake, due to high humidity and during the rainy season, obstruction of vehicular traffic in the yard of the lake, due to untimely rains, there is a delay in the work due to the protest of the local people at the specified places for removing the water stored in the lake and disposal of the silt, and due to non-cooperation of the traffic police to transport the silt in the morning (Day Time).

- A permanent solution is being devised for the problems caused to the surrounding public due to foul smell and foam problem from the lake water.

- A diverted canal has been constructed to separate the polluted water coming from different sources into the lake.

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- At present, 97 percent physical progress and 94.46 percent economic progress has been achieved in the work.

- Sluice gates have been installed in the Kodi (Sluice) area of the lake to avoid the problems which were being caused by the flood situation due to the intensity of water during the rainy season.

- Disasters that may be caused by rain water in the surrounding area can be reduced by maintaining the Sluice Gates in a planned manner during floods.

- 8.06 km Chain link fencing has been installed around the perimeter of the lake to prevent encroachment of land area of the lake. About 17.22 lakh cubic meters of silt accumulated in the lake has been removed and the slit removal work has been completed and 98% physical progress has been achieved in the construction of wetland, remaining work is in progress and it has been planned to complete the same by 30.03.2025.

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# Annexure R-4

**IN THE NATIONAL GREEN TRIBUNAL**

**SOUTHERN ZONE, CHENNAI**

**ORIGINAL APPLICATION NO. 111/2020**

**IN THE MATTER OF:**

Tribunal on its own motion Suo Motu based on the news item in Tamil Newspaper Dinamalar Chennai Edition dt. 13.07.2020, **"Frothing of Chemical Foam in the River Thenpennai"**

Versus

Principal Secretary to the Government
Public Works Department, Chennai & Ors. ...Respondents

**AFFIDAVIT**

I, Dr. Shalini Rajneesh, wife of Dr. Rajneesh Geol, aged about 57 years, working as Chief Secretary to the Government of Karnataka, having office at Vidhana Soudha, Bengaluru,56000, Karnataka, do hereby affirm and state on oath as under:

1. That I am working as Chief Secretary to the Government of Karnataka and in my official capacity and as verifiable from the official records maintained with the Government of Karnataka, as also the information provided by various Departments of the Government of Karnataka. I am familiar with the facts of the case and hence I am swearing to this affidavit.

2. That I have gone through the accompanying Report, drafted on my instructions. I say that the contents thereof are true and correct to the best of my knowledge and belief. Annexures are true copies of their respective originals.

Shalini

**DEPONENT**
(Dr. SHALINI RAJNEESH)
Chief Secretary

**VERIFICATION:**

I, the above named deponent, do hereby verify that the contents of my affidavit are true and correct to the best of my knowledge and belief, no part of which is false and nothing material has been concealed therefrom.

Verified at Bengaluru on this 20th day of August, 2025.

Shalini

**DEPONENT**
(Dr. SHALINI RAJNEESH)
Chief Secretary

SWORN BEFORE ME
CHANDRAH. S
Advocate & Notary
No. 917, Kamadhenuvanda Milaya
3rd Cross, Muthuraysaamy Extension
Sunkadakatte, Bangalore-560091
Reg. No. 17-8-2016

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**IN THE NATIONAL GREEN TRIBUNAL**
**SOUTHERN ZONE, CHENNAI**
**ORIGINAL APPLICATION NO. 111/2020**

**IN THE MATTER OF:**

Tribunal on its own motion Suo Motu based on the news item in Tamil Newspaper Dinamalar Chennai Edition dt. 13.07.2020, **"Frothing of Chemical Foam in the River Thenpennai"**

Versus

Principal Secretary to Government
Public Works Department, Chennai & Ors. ...Respondents

**FURTHER ACTION TAKEN REPORT ON BEHALF OF THE CHIEF SECRETARY TO THE STATE OF KARNATAKA**

**MOST RESPECTFULLY SHOWETH:**

1. That the instant Original Application pertains to pollution of Dakshina Pinaki/Thennepannai River. In this regard, the action taken on behalf of the State of Karnataka is as follows:

2. The instant report is being filed in continuation of the earlier Action Taken Report dated 01.04.2025 filed by the answering Respondent in the instant matter.

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**Action taken by the KSPCB**

3. **Re: High Rise Buildings in the Catchment Area of the River** – It is submitted that at present, all the residential apartments and commercial complexes located in the catchment area of the river have provided STPs for treating domestic sewage and treated water is being utilised for toilet flushing and gardening in premises. The latest report of analysis of treated domestic sewage shows that pH, Biochemical Oxygen Demand, Chemical Oxygen Demand, Total Suspended Solids, Amonical Nitrogen as N, Total Nitrogen and Fecal Coliform are within the permissible limit prescribed by KSPCB.

4. However, for the past violations by the residential apartments and commercial complexes, where they have not provided STPs, KSPCB has lodged Criminal cases after following procedure as per law. A copy of the list 16 units is produced herewith as **Annexure-R1 indicating the status of the trial at different stages.**

5. **Re: Action by the KSPCB against Polluting Industries** – It is submitted that out of 11 non complied industries, notices were issued to 10 industries with respect to non-compliance of the consent condition (i.e., samples do not conform to the Board standards) as reported by the Regional Officers. In response, the

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units have submitted their replies and have agreed to rectify the WPC measures, which are being verified by the respective Regional Offices of the Board. These industries are not discharging any effluents into the water bodies as per the details provided by the Regional Officers. A copy of the list of 11 industries provided by the Regional officers is produced herewith as **Annexure-R2.**

Regarding the 11th unit, the Board issued the closure order on 28-01-2022 to M/s Karnataka Meat and Poultry (Slaughter house) since it was discharging effluent to the stormwater drain. A criminal complaint has also been registered against the defaulter (Slaughter house) vide CC No. 1065/2013 and the premises have been sealed. Hence, there is no discharge of effluents into the river or into the lakes which feed the river.

6. **Re: Real Time Monitoring System** – It is submitted that as per the direction of the NGT O.A No. 111/2020 the Board has installed a Real Time Water Quality Monitoring System (RTWQMS) at the interstate boundary in Karnataka at Muglur Bridge to ensure continuous monitoring of water quality. Photographs with geo-tags are annexed herewith as **Annexure- R3.**

7. **Re: Results of the Real Time Monitoring** – It is submitted that prior to Real Time Water Quality Monitoring, Board has been

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monitoring the water quality of inter-state river Dakshina Pinakini (Thenpennai) at Muglur Bridge on a monthly basis and the sample has been analysed at Board Central Laboratory.

8. The water quality of the river is meeting to the Class "E" standard as per the designated best use water quality criteria stipulated by CPCB (*i.e.* fit for irrigation, industrial cooling, controlled waste disposal).

9. True copy of report furnished by Karnataka State Pollution Control Board dated 29.07.2025 is annexed herewith as **Annexure R-4**.

**Action taken by Bangalore Water Supply and Sewerage Board ('*BWSSB*')**

10. **Re: Sewage Generated in the River Catchment Area** – Earlier in 2020, the existing 16 STPs of total installed capacity was 621.5 MLD and treating capacity was 550 MLD. Presently, BWSSB is having 26 STPs with installed capacity is 958.5 MLD and is treating 830 MLD.

Total Quantity of Sewage generated in Thenepennai River catchment is 1329 MLD. The balance amount of sewage 499 MLD is proposed to be treated in 12 STPs as planned.

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11. 4 STPs at Hebbala valley are under construction. At present BWSSB is constructing 12 STPs of 225 MLD capacity in both Hebbala and K & C valley. Out of 12 STPs, the BWSSB has planned to complete construction as below:

- 4 STPs by end of December 2025,
- 6 STPs by end of December 2026,
- 1 STP by end of 2027 and
- 01 STP of 25 MLD capacity completion period at Varthur cannot be ascertained, as the land dispute is before the Hon'ble Supreme Court of India, vide SLP (C) No.16055 of 2021. (Writ Appeal No. 3897/2019 (W.P: 23812/2016) dtd. 23.04.2021 judgement of Hon'ble High Court, Karnataka is being questioned by petitioner before Hon'ble Supreme Court of India)).

12. Further, in order to ensure complete utilization of existing STPs and under construction STPs the works are proposed under Environmental Compensation Fund (being monitored by this Hon'ble Tribunal under OA No. 606/2018) and these works are under progress. The details are as follows:

13. **Interim Measures taken by the BWSSB**

Work of Providing Underground Drainage Facilities (Laterals) to Byatarayanapura Bommanahalli & Mahadevapura Zones coming under 110 Villages of BBMP. The total length taken under this



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catchment was about 800 Kms, further the balance is proposed to be taken up under KWSR&P through World Bank Loan. The work of laying laterals is completed and at present the linking of laterals to sub-mains/trunk sewers of CP-25, 26 is under progress and is planned to be completed by end of 2025.

14. **Works under *JICA Assisted Bengaluru Water Supply & Sewerage Project III*:**

a) Engineering Construction Commissioning of Sewage Treatment Plants and Intermediate Sewage Pumping Stations with Operation & Maintenance and thereof or Seven Years is in progress, about 80% of the work is completed and the work will be completed by end of 2026;

b) Procurement and Construction of Main Sewers including Manholes in & Byatarayanapura, Bommanahalli Mahadevapura Zone is in progress and the work will be completed by March 2026.

c) Work of providing and laying of 1600mm dia RCC sewer pipeline from Outer Ring Road near Hennur Police Station to Rajacanal STP taken up under Environment compensation fund (under OA No. 606/2018) is in progress and the work will be completed by March 2026.

d) Work of Providing and laying of 900/1200/1400 mm dia RCC NP-3 class sewer pipeline including trenchless method from MV Garden to Amarjyothi layout ISPS, Domluru taken up under Environment compensation fund (under OA No. 606/2018) is in progress and the work will be completed by March 2026.

e) Work of Providing and Constructing ISPS at KGA Road, Amarjyothi Layout and Laying 1100mm dia DI rising Main from ISPS Domluru to 218 MLD STP,Challaghatta Turnkey taken up under Environment compensation fund (under OA No.

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606/2018) is in progress and the work will be completed by December2026.

f) As per the Hon'ble NGT directions and IISc recommendation, BWSSB has taken up upgradation (20) STPs, and the work will be completed by December 2026.

g) As per the Hon'ble NGT directions, BWSSB have taken up upgradation of 248 MLD STP at K&C valley B Nagasandra and the work will be completed by December 2025.

15. **Long Term Measures being taken by the BWSSB:**

a) Work of Providing and Laying of 1000/1200/1800/2000mm dia RCC NP-3 class sewer pipe line from 7th main road. Garvebhavipalya along HSR layout up to Agaram STP and Construction of ISPS at HSR layout under AEE (WWM-N)K&T-2 Sub Division at Various locations under Environmental Compensation Fund(OA 606) is in progress, and the work will be completed by March 2027.

b) Under Phase II- KWSR&P Project funded by World Bank (Balance packets) it is proposed to cover balance UGD network of various dia of about 300 Km with construction WWTP/TSPS/ISPS tendering under process and works planned to completed by 36 months from date of the award of work.

16. The Bangalore Water supply & Sewerage Board covering an area 800 Sq.km covers the core area of 215 sq.km, 8 urban local bodies of 330 sq.km and 110 villages of 225 sq.km.

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The core area CMC/TMC is having a UGD network in a complete manner, therefore the sewage from these areas are conveyed out through a piped network and treated in the existing STPs.

As reported in the Action Taken report to treat the sewage of newly added 110 villages to the BBMP jurisdiction, BWSSB has taken up the work of laying lateral network and the work is almost completed covering 570km. To convey and treat the sewage from these lateral networkscoming under the catchment of Dakshina Pinaki/Thennepennai River the trunk sewer/sub-mains of around 105km is completed and the STPs are under progress.

Total expected household connections in Mahadevapura & Bytarayanapura zone is around 1,50,000 out of which Mahadevapura 1,00,000 connections and Byatarayanapura zone 50,000 connections.

Around 20% of sewage from Mahadevapura zone is discharged and treated in the existing 90 MLD Bellandur Amanikane STP.

To treat the balance quantity of sewage, a 25 MLD STP at Varthur under JICA Phase III was taken up and proposed to be completed by December 2025. However, the work is not yet started, due to land dispute before Hon'ble High Court of Karnataka. Until & unless Varthur STP does not commission the sewage generated in

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Mahadevapura zone cannot be treated in a complete manner, which is a major catchment of Dakshinapinaki.

Similarly, 60% of sewage from Bytarayanapura zone is being treated in the existing Rajacanal, Jakkur & Puttenehalli STP's

To cover the newly added areas & missing bit areas of Mahadevapura, Bytarayanapura & Bommanahalli zone of 110 villages, the work of laying around 200km of UGD pipeline with construction of 20MLD, 15MLD capacity STP's at Channasandra & Kogilu lake are proposed under World Bank supported Karnataka Water Security & Disaster Resilience Programme. Presently, this project is just awarded and the works are expected to be completed by 2028.

Around, 50,000 household connections under Dakshinapinaki catchment of 110 villages jurisdiction are being provided where the sewerage system is completed with conveyance to the STPs for treatment as per NGT norms. After completion of ongoing STP's by 2025 another 30,000 household connections comes under sewerage network for treatment.

For those balance 70,000 household connections depends upon the completion and commissioning of Varthur STP is very much crucial for sewerage treatment along with works proposed under Karnataka Water Security & Disaster Resilience Programme. Till then, the



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residents are using their existing own soak pits being maintained by them, which are not disturbed by BWSSB.

True Copy of the report furnished by BWSSB dated 21.07.2025 is annexed herewith as **Annexure R-5**.

17. The above information is hence placed on record for the consideration of this Hon'ble Tribunal.

Shalu

**CHIEF SECRETARY**
**GOVERNMENT OF KARNATAKA**

**FILED BY DARPAN KM**
**STANDING COUNSEL**
**STATE OF KARNATAKA**

**Date:**

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Annexure - R1

## Regional Office Bommanahalli : Status of Court Cases

| Sl. No. | Name of the industry | Name of the Act | CC/C. Misc No. | Next date of Hearing | CNR NO | Complianant Name | Advocate Name | Under Section | Court Name | Status |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | Tropical Paradise, Silver County Road, Near Shobha Cinema, Kudlu Village, Bangalore-68 | The Water (Prevention and Control of pollution Act,1974) | CC No 11740/2021 | 23.09.2025 | KABC03-032564-2021 | 1) SUNIL 2) BABURAJ 3) THE PRESIDENT | Sri Sonnappa Reddy Desai | 41,42(1)(b),43,44 | 41st ACMM, Bengaluru | Summons |
| 2 | Credez flora, Credence Developers No. 100, 16th Cross, New Mico Layout, Hongasandra, Bangalore-68 | Do | CC No. 34137/2021 | 14.07.2025 | KABC03-089465-2021 | 1) CREDENCE DEVELOPERS 2) THE PRESIDENT | Do | U/S 200 of CrPC 200 | 41st ACMM, Bengaluru | Summons |
| 3 | M/s Varun Lotus Apartment, No. 14 Near Singasandra Bus Stop, Hosur Road, Bangalore-68 | Do | CC No. 11742/2021 | 08.10.2025 | KABC03-032568-2021 | 1) TULASIPATHI M 2) THE PRESIDENT | Do | 41, 42(1)(d),43,44 | 41st ACMM, Bengaluru | Summons |
| 4 | SLV Kristal Apartment, Sy No 36/9, Begur Koppa Road, Ellenhalli, Bangalore-68 | Do | CC No 23408/2021 | 03.09.2025 | KABC03-064806-2021 | 1) BABU REDDY 2) THE PRESIDENT | Do | 20,24,25,26,44,43 | 41st ACMM, Bengaluru | Summons |
| 5 | Parijatha Apartment, Adjacent to Shobha Marbel, Bellandur, Greenlen Layout, Bangalore | Do | CC No. 11066/2022 | 22.09.2025 | KABC03-028036-2022 | 1) SATHYA GROUPS 2) THE PRESIDENT | Do | U/S 200 of CrPC 200 | 41st ACMM, Bengaluru | Summons |
| 6 | Tirumala Lotus Apartment, Gottigere Village, Bannerghatta Road, Kambattalli Road, Near Water tank, Bangalore-83 | Do | *CC NO.20755/2021* | 13.10.2025 | *KABC03-056820-2021* | *1) G K RAVI 2) D V RAGHU 3) PRESIDENT* | *Do* | U/S 200 of CrPC 200 | 41st ACMM, Bengaluru | Summons |
| 7 | AMG Conclaied Apartment, Yellenalli Village, Akshyanagar, BTM 6th Stage, Begur Hobli, Bengaluru-68 | Do | CC No. 23412/2021 | 11.09.2025 | KABC03-064807-2021 | 1) BABU NAIDU 2) THE PRESIDENT | Do | 20,24,25,26,43,44 | 41st ACMM, Bengaluru | Summons |
| 8 | Prakasa Pride, No 37/1, Kaubisanahalli, Reddy Layout, Varthur Bangalore | Do | CC No. 58000/2021 | 14.07.2023 | KABC0C-025533-2021 | 1) C Jagadeesh 2) The president | Do | U/S 200 of CrPC 200 | 41st ACMM, Bengaluru | Case Disposed on 14.07.2023 |
| 9 | Anand Enclave Apartment, Sy No. 373, Royal County Layout, J.P. Nagara 8th Phase, Gottigere-Vil, Bannerghatta Road, Bangalore-83 | Do | *CC No. 20715/2021* | 14.10.2025 | KABC03-056705-2021 | *1) MEDDAPPA 2) P G THYAGARAJ 3) THE PRESIDENT* | *Do* | *24,2526,33(A)41, 43,44,42(1)(d)* | 41st ACMM, Bengaluru | Summons |
| 10 | Prithvi Residency, No 414, MLA Layout, BG Main Road, Kalena Agrahara Village, Near Sapthagiri Castul, Bengaluru-70 | Do | CC No 36591/2021 | 14.10.2025 | KABC03-094510-2021 | 1) P SHANKAR 2) P ABDUL QUDUSE 3) PRESIDENT | Do | 47,49 | 41st ACMM, Bengaluru | Summons |
| 11 | Meenakshi Lake View, Near Doddamane Temple, 1st Cross, Sarjapur Junction, Ibblur Village, HSR Layout, Bangalore-560102 | Do | CC No 23413/2021 | 08.07.2025 | KABC03-064810-2021 | 1) REP BY ITS BUILDER RANGANATH 2) THE PRESIDENT | Do | 20,24,25,26,43,44 | 41st ACMM, Bengaluru | Summons |
| 12 | Thirumala Blossoms Apartment, B1 Layout, Gottigere-Vil, Uttarahalli-hobli, Bannerghatta Road, Bangalore-83 | Do | CC No. 8455/2021 | 24.09.2025 | KABC03-023324-2021 | 1) THIRUMALA BLOSSOMS APARTMENTS REP BY ITS BUILDER 2) THE PRESIDENT | Do | 24,25,26,33(a),41 ,43,44 | 41st ACMM, Bengaluru | NBW |
| 13 | SLV Builders, by name SLV Spandana, Sy No 25/4, Begur Village & Hobli, Bengaluru-68 | Do | CC No. 23415/2021 | 22.09.2025 | KABC03-064812-2021 | 1) HARI BABU 2) SLV BUILDERS 3) THE PRESIDENT | Do | 20,24,25,26,43,44 | 41st ACMM, Bengaluru | Summons |
| 14 | Dharani Nakshatra No. 11/10, Madhava Nagara, Yellenahelli Mn Road, Bangalore-68 | *Do* | *CC No. 4795/2022* | 09.07.2025 | *KABC03-015277-2022* | *1) SATISH 2) THE PRESIDENT* | *Do* | 47,49 | 41st ACMM, Bengaluru | Summons |
| 15 | Vardhini and Madku Apartment, Begur Koppa Road, Yelenahalli, Bangalore-68 | *Do* | *CC No. 4804/2022* | 16.07.2025 | *KABC03-015292-2022* | *1) SATISH 2) SANTOSH 3) THE PRESIDENT* | *Do* | 47,49 | 41st ACMM, Bengaluru | Summons |
| 16 | DS Max Serene, Near Hulimavu Bus Stop, Bangalore-76 | Do | PCR NO.14797/19 | 22.07.2025 | KABC03-087370-2019 | MANAGING DIRECTOR-DS MAX | Do | U/S 200 of CrPC 200 | 41st ACMM, Bengaluru | Summons |

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## (RO - Bommanahalli & City East) Details of industries in the catchment area of River Dakshina Pinakini as declared in the year 2020 (w.r.t. O. A. No. 111 of 2020)

| Sl. No. | Name and Address of the industry | Size (L/M/S) | Category (R/O/G) | Operating status | Compliance Complied/ Not Complied | Provided ETP/STP/C ETP | Latest Inspection carried out | If not complied, action taken w.r.t non-complying industries | Reason for non-compliance (such as discharge of effluents outside etc.) | Latest Status as on June'2025 ( to be given by the concerned RO) | EC levied on | EC amount | EC amount Paid | Court Cases, if any |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Bosch Automotive Electronics India Pvt Ltd,Sy No.51 & 61, Hangar No 703, PB No 10029, Main Campus, Nagasandra, Electronic City, Bangalore | Large | Green | Operating | Not Complied | STP | 03 05 2024 | Show cause notice issued | Non conforming to the standards ( There is no discharge of sewage into outside) | SCN and Reply submitted by the IA is attached for your kind reference & they have agreed to rectify the defects of STP | NO | NA | NA | Nil |
| 2 | Tenkan Engineering And Research India Pvt Ltd(NO 39(P), 41(P), 42(P), Doddathagur Village, Phase 2, Electronic City, Phase I, Bangalore | Large | Orange | Operating | Not Complied | STP | 06.06.2024 | Show cause notice issued | Non conforming to the standards ( There is no discharge of sewage into outside) | SCN and Reply submitted by the IA is attached for your kind reference & they have agreed to rectify the defects of STP | NO | NA | NA | Nil |
| 3 | Bosch LTD, (Formerly Mico Ltd),P B 6887, Nagasthapura Plant, Singasandra, Electronic City Post, Hosur Road, Bangalore | Large | Red | Operating | Not Complied | ETP/STP | 06 11 2024 | Show cause notice issued | Non conforming to the standards ( There is no discharge of effluent into outside) | SCN and Reply submitted by the IA is attached for your kind reference & they have agreed to rectify the defects of STP | NO | NA | NA | Nil |
| 4 | Shahi Exports Private Limited Unit-075, No 13,14,15,17/2,17/3 & 18/2 of Ambalipura Village, Bellandur Gate, Sarjapura Main Road, Bengaluru | Large | Orange | Operating | Not Complied | ETP/STP & CETP | 10 12 2024 | Show cause notice issued | Non conforming to the standards ( There is no discharge of effluent into outside) | SCN and Reply submitted by the IA is attached for your kind reference & they have agreed to rectify the defects of STP. | NO | NA | NA | Nil |
| 5 | Shahi Exports Pvt Ltd. Unit-23,Sy No 9 & 10, Bertana Agrahara, Hosur Main Road, Bangalore | Large | Orange | Operating | Not Complied | ETP/STP | 15 04 2024 | Show cause notice issued | Non conforming to the standards ( There is no discharge of effluent into outside) | SCN and Reply submitted by the IA is attached for your kind reference & they have agreed to rectify the defects of STP | NO | NA | NA | Nil |
| 6 | Trelleborg Industrial Products India Pvt.Ltd(No 22/9, Bertana Agrahara, Begur Hobli, Hosur Mainroad, Bangalore | Large | Orange | Operating | Not Complied | ETP/STP | 14 03 2024 | Show cause notice issued | Non conforming to the standards ( There is no discharge of effluent into outside) | SCN and Reply submitted by the IA is attached for your kind reference & they have agreed to rectify the defects of STP | NO | NA | NA | Nil |
| 7 | Shasha Distilleries, No.501/A/4, 9th Mile Stone, Bannerghatta Road, Bangalore | Large | Orange | Operating | Not Complied | Combined STP | 02 12 2024 | Show cause notice issued | Non conforming to the standards ( There is no discharge of effluent into outside) | SCN and Reply submitted by the IA is attached for your kind reference & they have agreed to rectify the defects of STP | NO | NA | NA | Nil |
| 8 | Tata Power Solar India Ltd, Unit-II, Plot No 43p & 44p Electronic City Phase II, Bangalore | Large | Red | Operating | Not Complied | ETP/STP & CETP | 29 04 2024 | Show cause notice issued | Non conforming to the standards ( There is no discharge of effluent into outside) | SCN and Reply submitted by the IA is attached for your kind reference & they have agreed to rectify the defects of STP | NO | NA | NA | Nil |
| 9 | Aurigene Discovery Technologies LimitedPlot No-39, Electronic City Phase ii, Bangalore | Large | Red | Operating | Not Complied | Combined STP | 16.03.2025 | Show cause notice issued | Non conforming to the standards ( There is no discharge of sewage into outside) | SCN and Reply submitted by the IA is attached for your kind reference & they have agreed to rectify the defects of STP | NO | NA | NA | Nil |
| 10 | 3M India Limited(No.48-51, Electronic City, Hosur Road, Bangalore | Large | Red | Operating | Not Complied | STP | 06 06 2024 | Show cause notice issued | Non conforming to the standards ( There is no discharge of sewage into outside) | SCN and Reply submitted by the IA is attached for your kind reference & they have agreed to rectify the defects of STP | NO | NA | NA | Nil |
| 11 | Karnataka Meat & Poultry(BBMP Slaughter House) Tannery Road, K.G.Halli Bangalore-45 | Medium | Red | Operating | Non complied | Yes | 20 12 2024 | Closure order was issued on 28 01 2022 | Yes | M/s BBMP Cow Slaughter House inspected on 20 12 2024 and inspection report forwarded to Board Office SEO, WMC-1 with recommend to issue 1). Issue DO letter to Commissioner BBMP to stop the operation of Slaughter House,2) Issue DO letter to Managing Director BESCOM to disconnect the Power Supply, 3) Issue directions to Deputy Commissioner Bengaluru Urban to seize the BBMP Slaughter House. As the Slaughter House is operating inspite of issuing closure order | - | - | - | Criminal Case is filed vide No.CC 21/2024(10635/2013) |

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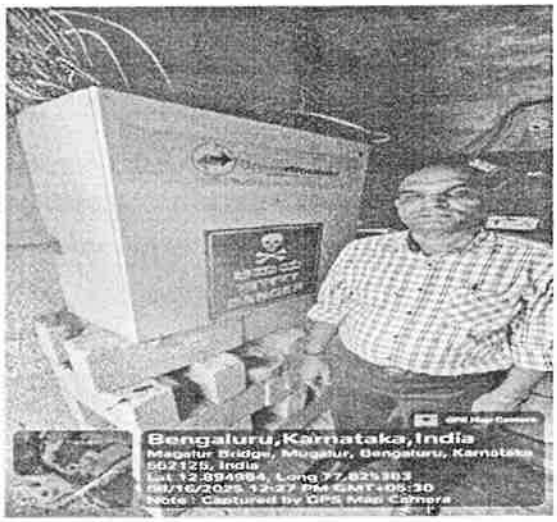
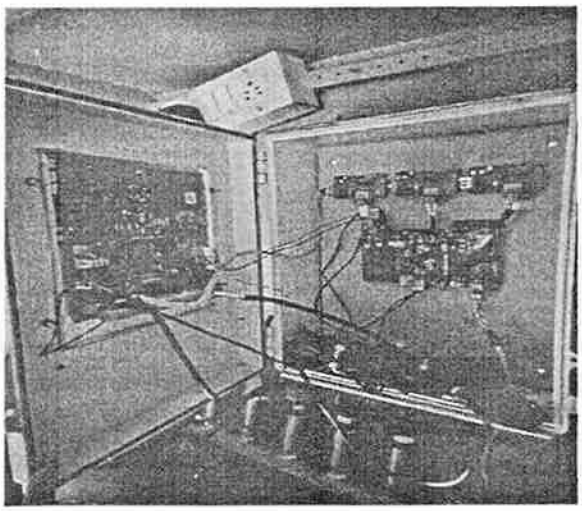
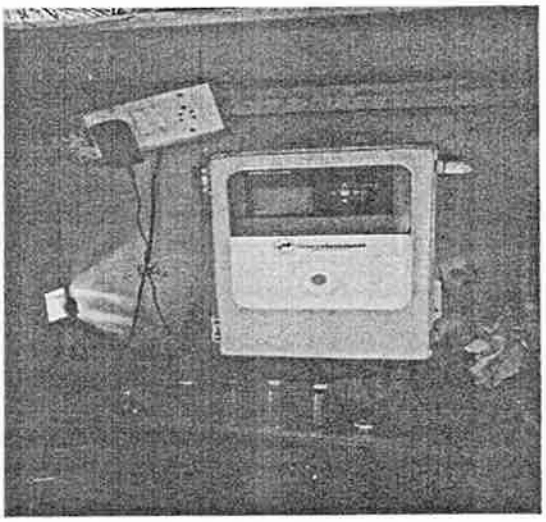
Annexure - R3

## Photographs of Real Time Water Quality Monitoring System at Muglur Bridge









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Annexure - R4

Dakshina Pinakini River Mugalur Bridge

| Parameters | Units | 05.04.2024 | 22.05.2024 | 28.05.2024 | 12-06-2024 | 10-07-2024 | 12-08-2024 | 21-08-2024 | 05-09-2024 | 04-10-2024 | 28-10-2024 | 29-10-2024 | 30-10-2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tempeature | C | 22 | 28 | | 22 | 22 | 22 | | 22 | 25 | | | |
| pH@25C | | 7.2 | 6.9 | 6.9 | 6.9 | 6.8 | 7 | 6.8 | 7.3 | 6.5 | 6.5 | 7 | 6.7 |
| Conductivity @25°C | us/cm | 974 | 1439 | 1584 | 1406 | 1235 | 968 | 1221 | 1345 | 1224 | 992 | 1104 | 1159 |
| Dissolved Oxygen | mg/L | BDL | BDL | BDL | BDL | BDL | 2.2 | 1.2 | BDL | BDL | BDL | BDL | BDL |
| BOD | mg/L | 71 | 58 | 26 | 25 | 21 | 42 | 60 | 44 | 71 | 72 | 69 | 90 |
| COD | mg/L | 232 | 280 | 170 | 200 | 152 | 236 | — | 220 | 360 | 328 | 336 | 392 |
| Nitrates as N | mg/L | 5.6 | 5.01 | — | BDL | 4.96 | 3.4 | — | 5 | 4.7 | 3.67 | 3.8 | 4 |
| Ammonical Nitrogen NH4-N | mg/L | — | — | — | — | — | — | — | | — | — | — | — |
| Ammonia as N | | 30 | 24 | — | 20.4 | — | 20 | — | 18 | 22.1 | — | — | — |
| Total Kjeldahl Nitrogen | mg/L | 40 | 32 | — | 26.5 | 36.4 | 28 | — | 24 | 25.8 | 21.38 | 30.1 | 32.4 |
| Turbidity | mg/L | 30 | 15.2 | — | 80.7 | 32.8 | 144 | — | 81 | 31.8 | | — | — |
| Total Hardnees as CaCO3 | mg/L | 276 | 292 | — | 380 | 300 | 212 | — | 460 | 332 | 228 | 244 | 240 |
| Calcium as CaCO3 | mg/L | 144 | 152 | — | 196 | 156 | 112 | — | 232 | 172 | — | — | — |
| Calcium as Ca | mg/L | 58 | 61 | — | 78 | 63 | 45 | — | 93 | 69 | — | — | — |
| Magnesium as CaCO3 | mg/L | 132 | 140 | — | 184 | 144 | 100 | — | 228 | 160 | — | — | — |
| Magnesium as Mg | mg/L | 32 | 34 | — | 45 | 35 | 24 | — | 55 | 39 | — | — | — |
| Chloride as Cl | mg/L | 196 | 160 | — | 220 | 172 | 120 | — | 244 | 204 | — | — | — |
| Sodium as Na | mg/L | 164 | 140 | — | 136 | 84 | 94 | — | 148 | 116 | — | — | — |
| potassium as K | mg/L | 32 | 29 | — | 18 | 7 | 31 | — | 23 | 24 | — | — | — |
| Percent Sodium | mg/L | 53 | 48 | — | 47 | 37 | 45 | — | 40 | 41 | — | — | — |
| Sulphate as SO4 | mg/L | 23 | 22 | — | | 21 | 32 | — | 33 | 50 | — | — | — |
| P-Alkalinty as CaCO3 | mg/L | BDL | BDL | — | BDL | BDL | BDL | — | BDL | BDL | — | — | — |
| T-Alkalinty as CaCO3 | mg/L | 428 | 340 | — | 396 | 392 | 220 | — | 436 | 284 | — | — | — |
| Sodium Absorption Ratio (SAR) | mg/L | 5.9 | 4 | 3.9 | 3 | 3 | 3 | 3 | 3 | 2.77 | 2 | 3 | 3 |
| Free Ammonia | mg/L | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL |
| TDS | mg/L | 666 | 948 | — | 952 | 826 | 648 | — | 922 | 826 | | — | |
| Total Suspended Solids | mg/L | 40 | 22 | — | 106 | 42 | 14 | — | 110 | 36 | | — | |
| Total Phoshate as P | mg/L | 4.6 | 0.6 | — | 2.7 | 2.11 | 1.4 | — | 0.3 | 1.44 | 2.46 | 2 | 2.5 |
| Ortho Phosphate | mg/L | 1.4 | 1.6 | — | 7.4 | 5.57 | 3.6 | — | 0.9 | 4.24 | | — | |
| Fluoride as F | mg/L | 0.2 | 0.23 | — | 0.48 | 0.38 | 0.26 | — | 0.28 | 0.26 | | — | |
| Boron as B | mg/L | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL |
| Bicarbonate(HCO3) | mg/L | BDL | 340 | — | 396 | 392 | 220 | — | 436 | 284 | | — | |
| Carbonate(CO3) | mg/L | | BDL | — | BDL | BDL | BDL | — | BDL | BDL | | — | |
| Total Colliform | MPN/100ml | 790 | 230000 | 2400000 | 7900 | 330000 | 3500 | 920000 | 630000 | 4600000 | 5400000 | 92000 | 16000000 |
| Fecal Colliform | MPN/100ml | 140 | 45000 | — | 780 | 68000 | 260 | 39000 | 170000 | 920000 | 1100000 | 33000 | 220000 |
| Cadmium | mg/L | BDL | — | BDL | — | — | — | BDL | — | BDL | BDL | BDL | BDL |
| Copper | mg/L | BDL | — | 0.019 | — | — | — | 0.025 | — | BDL | 0.005 | BDL | 0.006 |

T.N.P.C.B.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead | mg/L | UUL | — | BDL | — | — | — | BDL | — | BDL | BDL | BDL |
| Total Chromium | mg/L | BDL | — | 0.007 | — | — | — | BDL | — | BDL | BDL | BDL |
| Nickel | mg/L | BDL | — | 0.007 | — | — | — | BDL | — | BDL | BDL | BDL |
| Zinc | mg/L | 6.744 | — | 0.021 | — | — | — | 0.028 | — | 0.138 | 0.022 | 0.018 |
| Iron | mg/L | 0.144 | — | 10.617 | — | — | — | 3.123 | — | 2.295 | 0.749 | 0.654 |
| Manganese | mg/L | — | — | 0.404 | — | — | — | 0.17 | — | 0.18 | 0.312 | 0.303 |
| Fecal Streptococci | mg/L | — | — | — | — | — | — | — | — | — | — | — |
| Aluminum | mg/L | — | — | — | — | 4.975 | 126 | — | — | 5.959 | — | — |
| Nitrite as N | mg/L | — | — | — | — | — | 0.72 | — | BDL | 0.3 | — | 0.11 |
| Total Dissolved Phosphate | mg/L | — | — | — | — | — | — | — | — | — | 6.66 | 5.6 |
| Oil & Grease | mg/L | — | — | — | — | — | — | — | — | — | BDL | BDL |
| INFERENCE | | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" |

M.S. K.S.P.C.B

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## Dakshina Pinakini River Muglur Bridge

| Parameters | Units | 31-10-2024 | 14-11-2024 | 19-12-2024 | 17-01-2025 | 14-02-2025 | 07-03-2025 | 19-03-2025 | 17-04-2025 | 16-05-2025 |
|---|---|---|---|---|---|---|---|---|---|---|
| Tempeature | C | | 28 | 23 | 21 | 21 | 24 | | | 20 |
| pH@25C | | 6.7 | 7.6 | 7.2 | 7.2 | 7.5 | 7.6 | 7.4 | 6.9 | 7.1 |
| Conductivity @25°C | us/cm | 1074 | 1324 | 1458 | 1291 | 1234 | 1216 | 1244 | 1048 | 1171 |
| Dissolved oxygen | mg/L | 0.6 | 1.4 | 1.2 | BDL | BDL | 1.3 | BDL | BDL | BDL |
| BOD | mg/L | 75 | 17 | 36 | 75 | 36 | 54 | 65 | 50 | 28 |
| COD | mg/L | 356 | 137 | 200 | 265 | 344 | 284 | --- | 272 | 212 |
| Nitrates as N | mg/L | 3.7 | 1.4 | 6.8 | 5 | 4.74 | 0.7 | --- | --- | 4.3 |
| Ammonical Nitrogen NH4-N | mg/L | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ammonia as N | | BDL | 42 | 7.6 | 45 | 43 | 34 | --- | 15 | 14 |
| Total Kjeldahl Nitrogen | mg/L | 35.6 | 54 | 8.4 | 58.5 | 60.2 | 43 | --- | 18 | 18 |
| Turbidity | mg/L | --- | 28 | 29 | 17.8 | 90 | 113 | --- | 12.6 | 32.3 |
| Total Hardnees as CaCO3 | mg/L | 224 | 296 | 400 | 316 | 340 | 236 | --- | 220 | 260 |
| Calcium as CaCO3 | mg/L | --- | 168 | 204 | 156 | 176 | 124 | --- | 116 | 68 |
| Calcium as Ca | mg/L | --- | 67 | 82 | 62 | 70 | 50 | --- | 46 | 27 |
| Magnesium as CaCO3 | mg/L | --- | 128 | 196 | 160 | 164 | 112 | --- | 104 | 192 |
| Magnesium as Mg | mg/L | --- | 31 | 48 | 39 | 40 | 27 | --- | 25 | 47 |
| Chloride as Cl | mg/L | --- | 120 | 244 | 196 | 192 | 184 | --- | 148 | 160 |
| Sodium as Na | mg/L | --- | 132 | 117 | 137 | 104 | 113 | --- | 85 | 96 |
| potassium as K | mg/L | --- | 32 | 29 | 26 | 32 | 14 | --- | 6 | 8 |
| Percent Sodium | mg/L | --- | 46 | 36 | 46 | 37 | 48 | --- | 45 | 43 |
| Sulphate as SO4 | mg/L | --- | 34 | 59 | 24 | 21 | 19 | --- | 28 | 26 |
| P-Alkalinty as CaCO3 | mg/L | --- | BDL | BDL | BDL | BDL | BDL | --- | BDL | BDL |
| T-Alkalinty as CaCO3 | mg/L | --- | 248 | 340 | 464 | 112 | 452 | --- | 364 | 360 |
| Sodium Absorption Ratio (SAR) | mg/L | 3 | 3.3 | 2.54 | 3.3 | 2.5 | 3 | 3 | 2.49 | 2.59 |
| Free Ammonia | mg/L | | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL |
| TDS | mg/L | --- | 900 | 984 | 900 | 840 | 814 | --- | 714 | 794 |
| Total Suspended Solids | mg/L | --- | 36 | 34 | 26 | 118 | 142 | --- | 16 | 42 |
| Total Phoshate as P | mg/L | 2.6 | 0.24 | 0.62 | 0.53 | 0.67 | 0.48 | --- | 0.57 | 0.64 |
| Ortho Phosphate | mg/L | --- | 0.65 | 1.64 | 8 | 1.6 | 1.4 | --- | 1.64 | 1.86 |
| Fluoride as F | mg/L | --- | 0.14 | 0.18 | 0.17 | 0.29 | 0.39 | --- | 0.22 | 0.36 |
| Boron as B | mg/L | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL | BDL |
| Bicarbonate(HCO3) | mg/L | --- | 248 | 340 | 464 | 112 | 452 | --- | 364 | 360 |
| Carbonate(CO3) | mg/L | --- | BDL | BDL | BDL | BDL | BDL | --- | BDL | BDL |
| Total Coliform | MPN/100ml | 1400000 | 14000 | 2800 | 110 | 4800 | 170000 | 170 | 35000 | 7900000 |
| Fecal Coliform | MPN/100ml | 45000 | 2700 | 170 | 14 | 2100 | 17000 | --- | 6300 | 1200000 |
| Cadmium | mg/L | BDL | --- | --- | --- | --- | BDL | BDL | BDL | --- |
| Copper | mg/L | BDL | --- | --- | --- | --- | BDL | 0.007 | 0.005 | --- |
| Lead | mg/L | BDL | --- | --- | --- | --- | 0.008 | BDL | 0.007 | --- |
| Total Chromium | mg/L | BDL | --- | --- | --- | --- | 4.041 | BDL | 0.007 | --- |
| Nickel | mg/L | BDL | --- | --- | --- | --- | 0.068 | BDL | 0.005 | --- |
| Zinc | mg/L | BDL | --- | --- | --- | --- | 0.021 | 0.014 | 0.027 | --- |
| Iron | mg/L | 0.642 | --- | --- | --- | --- | 0.281 | 0.355 | 3.405 | --- |
| Manganese | mg/L | 0.2 | --- | --- | --- | --- | 0.008 | 0.235 | 0.162 | --- |
| Fecal Streptococi | mg/L | --- | --- | --- | --- | --- | | --- | | --- |
| Aluminum | mg/L | --- | 1354 | 2.986 | 1.35 | 1.35 | 2.48 | --- | 1.639 | BDL |
| Nitrite as N | mg/L | BDL | --- | --- | --- | --- | --- | --- | 0.31 | 0.44 |
| Total Dissolved Phosphate | mg/L | 7.4 | --- | --- | --- | --- | --- | --- | --- | --- |
| Oil & Grease | mg/L | BDL | --- | --- | --- | --- | --- | --- | --- | --- |
| INFERENCE | | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" | Class"E" |

M.S. K.S.P.C.B.

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Annexure - R5

# Report- of Action taken by BWSSB for preventing the pollution of Thenpennai River

## OA No. 111/2020, Re: Frothing and foaming in Thenpennai River

| Sl. No | Particulars | Compliance |
|---|---|---|
| 1 | Since the upcoming STPs and the UGD network are said to be complete by December 2025, what interim measures are being taken by the State to ensure that sewage does not enter the river water? | Total Quantity of Sewage generated in Thenepennai River catchment is 1329 MLD, the BWSSB is having 26 nos of STPs with installed capacity is 958.5 MLD and by treating is 830 MLD.<br><br>At present BWSSB is constructing 12 STPs of 225 capacity out of 12 STPs , the BWSSB has planned to complete constructions 4 STPs by end of December 2025, 5 STPs by end of December 2026 and 2 STPs by end of 2027.<br><br>Further, in order to ensure complete utilization of existing STPs and under construction STPs the works are proposed under Environmental Compensation Fund (OA 606) and these works are under progress. The details are as follows.<br><br>**Interim Measures are being taken by the BWSSB**<br><br>**Works taken up under BWSSB:**<br>1. Work of Providing Underground Drainage Facilities (Laterals) to Byatarayanapura ,Bommanahalli & Mahadevapura Zones coming under 110 Villages of BBMP. The total length taken under this catchment was about 800 Kms, further the balance is proposed to be taken up under KWSR&P through World Bank Loan. The work of laying laterals is completed and at present the linking of laterals to sub-mains /trunk sewers of CP-25, 26 is under progress and planned to be completed by end of 2025.<br>2. The work of JICA Assisted Bengaluru Water Supply & Sewerage Project III: (CWSS Stage-V: Contract Package CP-25, & part of CP-26 i.e., Engineering Construction and Commissioning of Sewage Treatment Plants and Intermediate Sewage Pumping Stations with Operation & Maintenance thereof for Seven Years |

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(Works- A) and Procurement and Construction of Main Sewers including Manholes in Byatarayanapura ,Bommanahalli & Mahadevapura Zone (Thenepennai Catchment) (Works-B).

a) Engineering Construction and Commissioning of Sewage Treatment Plants and Intermediate Sewage Pumping Stations with Operation & Maintenance thereof or Seven Years (Works- A) is in progress, **about 80% of the work is completed and the work will be completed by end of 2026**(Enclosed Annexure A).

b) Procurement and Construction of Main Sewers including Manholes in Byatarayanapura, Bommanahalli & Mahadevapura Zone (Works-B) **is in progress and the work will be completed by March 2026.**

c) Work of providing and laying of 1600mm dia RCC sewer pipeline from Outer Ring Road near Hennur Police Station to Rajacanal STP taken up under Environment compensation fund (OA 606) **is in progress and the work will be completed by March 2026.**

d) Work of Providing and laying of 900/1200/1400 mm dia RCC NP-3 class sewer pipeline including trenchless method from MV Garden to Amarjyothi layout ISPS, Domluru taken up under Environment compensation fund (OA 606) **is in progress and the work will be completed by March 2026.**

e) Work of Providing and Constructing ISPS at KGA Road, Amarjyothi Layout and Laying 1100mm dia DI rising Main from ISPS Domluru to 218 MLD STP, Challaghatta Turnkey taken up under Environment compensation fund (OA 606) **is in progress and the work will be**

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**completed by December2026.**

f) As per the Hon'ble NGT directions and IISc recommendation, BWSSB have taken up Upgradation (20) STPs **is in progress, and the work will be completed by December 2026.(Annexure B)**

g) As per the Hon'ble NGT directions, BWSSB have taken up upgradation of 248 MLD STP at K&C valley B Nagasandra **is in progress, and the work will be completed by December 2025.(Annexure B )**

After the commissioning of the above projects and controlling discharge of raw sewage in to lake will also depends on BBMP ensuring Buffer space all along the river stream/drain and land made available at lakes and surrounding area by revenue department for providing infrastructure & Maintenace, also treating of sewage generated from adjoining Panchayat/ area beyond BBMP limits.

From the past one decade there is a huge development in the growth of the catchment of Thenpennai River of Bangalore BBMP area both horizontally and vertically construction of more high rise buildings due to Kempegowda International Airport, KIADB Industrial Area and Hardware park resulting in exponential growth of population and this results in the generation of more quantity of sewage than what it was projected earlier. This necessitates laying of sewer network in the newly developed area & construction of New STPs for treating additional Sewage generated from valley.

**Long Term Measures are being taken by the BWSSB**

- Work of Providing and Laying of 1000/1200/1800/2000mm dia RCC NP-3 class sewer pipe line from 7th main road, Garvebhavipalya along HSR layout up to Agaram STP and Construction of ISPS at

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| | |
|---|---|
| | HSR layout under AEE(WWM-N)K&T-2 Sub Division at Various locations under Environmental Compensation Fund(OA 606) **is in progress, and the work will be completed by March2027.**<br>• Under Phase II- KWSR&P Project funded by World Bank (Balance packets) it is proposed to cover balance UGD network of various dia of about **300 Km with construction WwTP/TSPS/ISPS is tendering under process and works planned to completed by 36 months from the award of work.(Annexure C)**<br>• The proposed WwTP works is needs to be supported with Government/External funding. (Annexure D)<br>Sewage generated from private layouts beyond 10 acres are to be treated by them by having their own STPs as per NGT guidelines these to be monitored by KSPCB. The Sewage generated from villages outside BBMP area will have to be monitored by KSPCB and village Panchayaths.<br>After the completion of the all above works discharge of raw sewage will be reduced and the water quality of Thenepennai River will improve. |

Chief Engineer (WWM-East)
BWSSB

Chief Engineer (WWM-West)
BWSSB

Chief Engineer (Project)
BWSSB

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## Gap Analysis as per flow measurement

| Description | | Capacity in MLD |
|---|---|---|
| Sewage generation as per flow measurement in Koramangala Valley | A | 175 |
| Sewage generation as per flow measurement in Tavarekere Valley | B | 313 |
| Sewage generation as per flow measurement in Challaghata Valley | C | 436 |
| Sewage generation as per flow measurement in Hebbal Valley | D | 405 |
| Total Sewage generation | E=A+B+C+D | 1329 |
| Present BWSSB Sewage Treatment Capacity in K&C Valley and Hebbal Valley (26 STP's) | F | 958.5 |
| Total existing treatment capacity | G | 958.5 |
| Present GAP in Sewage Treatment | H(E-G) | 370.5 |
| Ongoing STP Works under different projects (12 STP's) | I | 225 |
| GAP | J=(H-I) | 145.5 |
| Proposed STP's to meet the GAP, 6 No's of STP are proposed (Basavanapura, Koramangala, Kadugodi, Madiwala, Kadabeesanahalli, Bellandur) | K | 235 |
| Project Cost – 956 Crore | | |
| Proposal Pending in Finance Department | | |
| 6 STP's taken up under KWS & DR Projects in 110 villages area (rendering under process) | L | 98 |
| Project Cost – 227 Crore | | |
| Total STPs proposed | M=(K+L) | 333 |

CE(WWM-East)
BWSSB

CE(WWM-West)
BWSSB

CE(East)
BWSSB

CE(South)
BWSSB

CE(North)
BWSSB

CE(P)
BWSSB

List of STPs in BWSSB in 2025 Annexure B

| Sl.No | Name | Capacity in MLD | Location near to | Level of Treatment | Types of process for treating sewage | Capacity Utilization | Remarks |
|---|---|---|---|---|---|---|---|
| | | | Existing | | | | |
| 1 | K&C valley | 218 | Belur Nagasandra (near Challaghatta) | Secondary | Activated Sludge Process (ASP) | 124.23 | Upgradation work under progress planned to be completed by Dec-25 |
| 2 | K&C valley | 30 | Belur Nagasandra (near Challaghatta) | Secondary | Activated Sludge Process (ASP) | 31.41 | Upgradation work under progress planned to be completed by Dec-25 |
| 3 | K&C Valley | 60 | Belur Nagasandra (near Challaghatta) | Secondary | ASP with power generation | 61.20 | Upgradation work under progress planned to be completed by Dec-25 |
| 4 | K&C Valley | 150 | B.Nagasandra | Secondary | Secondary -Activated Sludge Process (ASP) | 151.51 | Its meeting Revised NGT parameters |
| 5 | Lalbagh | 1.5 | Lalbagh kere | Tertiary | Activated aeration + plate settlers + UV disinfection | 1.23 | Its meeting Revised NGT parameters |
| 6 | Cubbon Park | 4 | Cubbon Park (upgraded) | Tertiary | Membrane Bio Reactor | 3.71 | Its meeting Revised NGT parameters |
| 7 | K.R.Puram | 20 | Tambuchetti palya Road | Secondary | Sequential Batch Reactor | 20.63 | Its meeting Revised NGT parameters |
| 8 | K.R.Puram Ph-I | 20 | Tambuchetti playa Road | Secondary | UASB + Extended Aeration | 16.64 | Upgradation work under progress planned to be completed by March -26 |
| 9 | Yelemallappa Chetti kere | 15 | Yelemallappa Chetti kere | Secondary | Sequential Batch Reactor | 15.35 | Upgradation work under progress planned to be completed by Dec-25 |
| 10 | Bellandur Amani kere | 90 | Vartur kere | Secondary | Activated Sludge Process (ASP) | 92.11 | Upgradation work under progress planned to be completed by Dec-25 |
| 11 | Kadabesanahalli Ph-I | 50 | Marathalli Outer Ring Road | Secondary | Extended Aeration | 45.47 | Upgradation work under progress planned to be completed by Dec-26 |
| 12 | Kadugodi | 6 | Kadugodi | Secondary | Sequential Batch Reactor | 5.85 | Upgradation work completed & |
| 13 | Halasuru | 2 | Halasuru Lake | Secondary | Sequential Batch Reactor | 1.93 | Upgradation work completed & |
| 14 | Sarakki | 5 | Sarakki kere | Secondary | Sequential Batch Reactor | 5.15 | Its meeting Revised NGT parameters |
| 15 | Agaram | 35 | Agara Ring Road | Secondary | Sequential Batch Reactor | 35.74 | Its meeting Revised NGT parameters |
| 16 | Hulimavu | 10 | Hulimavu kere | Secondary | Sequential Batch Reactor | 10.15 | Its meeting Revised NGT parameters |
| 17 | Chikkabegur | 5 | Near Chikkabeguru kere | Secondary | Sequential Batch Reactor | 4.24 | Its meeting Revised NGT parameters |
| 18 | Madivala | 4 | Madivala lake | Secondary | Sequential Batch Reactor | 2.31 | Its meeting Revised NGT parameters |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 19 | Rajacanal - Ph-I | 40 | Geddalahalli near Hebbal | Secondary | Extended Aeration | 18.86 | Upgradation work under progress planned to be completed by Dec-26 |
| 20 | Hebbal | 100 | Nagavara kere | Secondary | Sequential Batch Reactor | 93.29 | Its meeting Revised NGT parameters |
| 21 | Jakkur | 15 | Jakkur kere | Tertiary | Upflow Aerobic Sludge Blanket (UASB) + Extended Aeration | 17.25 | Its meeting Revised NGT parameters |
| 22 | Yelahanka Ph-I | 10 | Allalasandra kere | Tertiary | Activated sludge Process (ASP) + filtration + Chlorination | 5.83 | Upgradation work under progress planned to be completed by Dec-26 |
| 23 | Hennur | 1 | Hennur lake | Tertiary | Soil Bio Technology | 1.05 | Its meeting Revised NGT parameters |
| 24 | Rajacanal | 40 | Geddalahalli near Hebbal | Secondary | Sequential Batch Reactor | 41.57 | Upgradation work under progress planned to be completed by Dec-25 |
| 25 | Horamavu Agara | 20 | In between Kalkere and Horamavu Agara kere | Secondary | Sequential Batch Reactor | 18.08 | Upgradation work under progress planned to be completed by Dec-26 |
| 26 | Puttenahalli | 7 | Puttenahalli lake | Secondary | Sequential Batch Reactor | 6.04 | Its meeting Revised NGT parameters |
| | **Total** | **958.5** | | | | **830.83** | |

CE(WWM-East)
BWSSB

CE(WWM-West)
BWSSB

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| List of Under Construction STPs (BWSSB) Annexure A | | | | | | |
|---|---|---|---|---|---|---|
| Sl. No. | STP location | Proposed capacity (MLD) | Amount in crore | Technology used | Proposed date of completion of work | Status of the project |
| 1 | Kaggadasapura | 5 | 26.38 | SBR | 31.12.2025 | Under construction |
| 2 | Varthur | 25 | 95.25 | EA | - | After clearance of court case pending in Hon'ble Supreme Court and High Court, the construction work will be taken up |
| 3 | Bilishivale | 17 | 61.61 | SBR | 30.04.2026 | Under construction |
| 4 | Doddabetta hally | 7 | 36.30 | SBR | 31.12.2025 | Under construction |
| 5 | Jakkur | 7 | 31.27 | SBR | 31.08.2025 | Under construction |
| 6 | Yelahanka | 6 | 38.29 | SBR | 31.12.2025 | Under construction |
| 7 | Jakkur-down stream | 10 | 29.33 | SBR | 31.12.2026 | Under construction |
| 8 | Byrahikanne | 13 | 49.68 | SBR | 31.12.2026 | Under construction |
| 9 | Anjanapura | 5 | 28.20 | SBR | 31.12.2026 | Under construction |
| 10 | Rachenahalli | 10 | 32.85 | SBR | 31.03.2026 | Under construction |
| 11 | Horamavu | 60 | 149.55 | IFAS | 31.12.2026 | Under construction |
| 12 | Hebbal | 60 | 139.40 | IFAS | 28.02.2027 | Under construction |
| Total | | 225.00 | 718.11 | | | |

CE(WWM-East)
BWSSB

CE(WWM-West)
BWSSB

CE(P)
BWSSB

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| List of proposed STPs (BWSSB) Annexure D | | | | | | |
|---|---|---|---|---|---|---|
| Sl. No. | STP location | Proposed capacity (MLD) | Amount in crore | Technology used | Proposed date of completion of work | Status of the project |
| 1 | Madiwala | 75 | 244.32 | Sequential Batch Reactor (SBR) | 36 months from the date of award | DPR submitted to GoK for administrative approval and seeking for financial assistance |
| 2 | Kadabeesanahalli | 50 | 191.65 | Sequential Batch Reactor (SBR) | 36 months from the date of award | |
| 3 | Kadugodi | 20 | 104.7 | Integrated fixed –Film Activated sludge(IFAS) | 36 months from the date of award | |
| 4 | Koramangala | 20 | 95.41 | Integrated fixed –Film Activated sludge(IFAS) | 36 months from the date of award | |
| 5 | Basavanapura | 10 | 59.36 | Sequential Batch Reactor (SBR) | 36 months from the date of award | |
| 6 | Bellandur | 60 | 261.23 | Conventional ASP | 36 months from the date of award | |
| Total | | 235.00 | 956.67 | | | |

CE(WWM-East)
BWSSB

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| List of proposed STPs (BWSSB) Annexure C | | | | | | |
|---|---|---|---|---|---|---|
| Sl. No. | STP location | Proposed capacity (MLD) | Amount in crore | Technology used | Proposed date of completion of work | Status of the project |
| 1 | Kogilu | 15 | 39.97 | Sequential Batch Reactor (SBR) | 36 months from the date of award | Tendering under process |
| 2 | Channasandra | 20 | 48.18 | Sequential Batch Reactor (SBR) | 36 months from the date of award | |
| 3 | Sowlkere | 28 | 59.02 | Sequential Batch Reactor (SBR) | 36 months from the date of award | |
| 4 | Chikkabegur | 15 | 39.97 | Sequential Batch Reactor (SBR) | 36 months from the date of award | |
| 5 | Hulimavu | 15 | 39.97 | Sequential Batch Reactor (SBR) | 36 months from the date of award | |
| 6 | Ibblur | 5 | 15 | Sequential Batch Reactor (SBR) | 36 months from the date of award | |
| Total | | 98.00 | 227.11 | | | |

BWSSB

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# Compliance for the Action Taken Report Pertaining to BWSSB Original Application No. 111/2020

| Sl No. as per Affidavit | Observation | Compliance |
|---|---|---|
| Sl No. as per affidavit-10 | <u>Re: Sewage Generated in the River Catchment Area</u> – Total Quantity of Sewage generated in Thenepennai River catchment is 1329 MLD. BWSSB is having 26 STPs with installed capacity is 1958.5 MLD and is treating 830 MLD. (***Previous report stated there are 16 STPs***) | Earlier in 2020, the existing 16 STPs of total installed capacity was 621.5 MLD and treating capacity was 550 MLD.<br>Presently, BWSSB is having 26 STPs with installed capacity is 958.5 MLD and is treating 830 MLD. |
| Sl No. as per affidavit-11 | At present BWSSB is constructing 12 STPs of 225 MLD capacity. Out of 12 STPs, the BWSSB has planned to complete construction 4 STPs by end of December 2025, 5 STPs by end of December 2026 and 2 STPs by end of 2027. (Previous report said 4 STPs are being upgraded.) | Previous report of 4 STPs under Hebbala valley are of under construction STPs.<br>At present BWSSB is constructing 12 STPs of 225 MLD capacity in both Hebbala and K & C valley. Out of 12 STPs, the BWSSB has planned to complete construction as below:<br>• 4 STPs by end of December 2025,<br>• 6 STPs by end of December 2026,<br>• 1 STP by end of 2027 and<br>• Completion period 25 MLD capacity STP at Varthur cannot be ascertained, as the land dispute is before Hon'ble High Court of Karnataka. |
| Sl No. as per affidavit-16 | Measures stated to be 'Interim Measures' by BWSSB are actually 'Short Term Measures'. What the Tribunal has instead asked is that since the proposed STPs and UGD networks will come up by December 2025 as per the previous report, it means that at present the sewage is not going into the UGD network/STPs but is being discharged elsewhere. The Tribunal has hence sought the information on how the sewage is being dealt with until the UGD system and the proposed STPs come up. BWSSB to clarify the same. | The Bangalore Water supply & Sewerage Board covering an area 800 Sq.km covers the core area of 245 sq.km, 8 urban local bodies of 330 sq.km and 110 villages of 225 sq.km.<br>The core area CMC/TMC is having a UGD network in a complete manner, therefore the sewage from these areas are conveyed out through a piped network and treated in the existing STPs.<br>As reported in the Action Taken report to treat the sewage of newly |

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| Sl No. as per Affidavit | Observation | Compliance |
|---|---|---|
| | | added 110 villages to the BBMP jurisdiction, BWSSB has taken up the work of laying lateral network and the work is almost completed covering 570km. To convey and treat the sewage from these lateral networkscoming under the catchment of Dakshina Pinaki/Thennepennai River the trunk sewer/sub-mains of around 105km is completed and the STPs are under progress.<br>Total expected household connections in Mahadevapura & Bytarayanapura zone is around 1,50,000 out of which Mahadevapura 1,00,000 connections and Byatarayanapura zone 50,000 connections.<br>Around 20% of sewage from Mahadevapura zone is discharged and treated in the existing 90 MLD Bellandur Amanikane STP.<br>To treat the balance quantity of sewage, a 25 MLD STP at Varthur under JICA Phase III was taken up and proposed to be completed by December 2025. However, the work is not yet started, due to land dispute before Hon'ble High Court of Karnataka. Until & unless Varthur STP does not commission the sewage generated in Mahadevapura zone cannot be treated in a complete manner, which is a major catchment of Dakshinapinaki.<br>Similarly, 60% of sewage from Bytarayanapura zone is being treated in the existing Rajacanal, Jakkur & Puttenehalli STP's<br>To cover the newly added areas & missing bit areas of Mahadevapura, Bytarayanapura & Bommanahalli zone of 110 villages, the work of laying around 200km of UGD pipeline with construction of |

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| Sl No. as per Affidavit | Observation | Compliance |
|---|---|---|
| | | 20MLD, 15MLD capacity STP's at Channasandra & Kogilu lake are proposed under World Bank supported Karnataka Water Security & Disaster Resilience Programme. Presently, this project is just awarded and the works are expected to be completed by 2028.<br><br>Around, 50,000 household connections under Dakshinapinaki catchment of 110 villages jurisdiction are being provided were the sewerage system is completed with conveyance to the STPs for treatment as per NGT norms. After completion of ongoing STP's by 2025 another 30,000 household connections comes under sewerage network for treatment.<br>For those balance 70,000 household connections depends upon the completion and commissioning of Varthur STP is very much crucial for sewerage treatment along with works proposed under Karnataka Water Security & Disaster Resilience Programme. Till then, the residents are using their existing own soak pits being maintained by them, which are not disturbed by BWSSB. |

CE (WWM-East) CE (WWM-West) CE (Project)

Office of the Regional Officer
Karnataka State Pollution Control Board
Bengaluru Bommanahalli
"NISARGA BHAVAN" 2nd Floor
Thimmaiah Road, 7th 'D' Main, Shivanagar,
Opp. Pushpanjali Theatre, Bengaluru -560 010
Phone : (O) 080 -23221552
e-mail ID-bommanahalli@kspcb.gov.in

towards a cleaner Karnataka

No.PCB.RO-BMN.2025-26 867

Date: 10 NOV 2025

To,

The Member Secretary,
Parisara Bhavan,
Church Street,
Bengaluru-01

Sir,

Kind Attn: Chief Environmental Officer -2

Sub: Furnishing the details w.r.t O.A. 111/2020 to the Board office mail dated: 24.10.2025
Ref: Board Office mail dated: 24.10.2025.

******************

Adverting to the above subject, it is to be informed that, there is no discharge of industrial effluent from the industries and sewage from the high rise building into the River from any industries/high rise buildings coming under the jurisdiction of RO-Bommanhalli. In this regard, this office had mailed the same to the Board office on 24.10.2025.

This is for your kind information and further needful action.

Yours faithfully,
Ashok Kumar
Environmental Officer,
RO-Bommanhalli

Regional Office, Bengaluru - Mahadevapura
Karnataka State [illegible]ution Control Board
'NISARGA BHAVAN', [illegible]ayanagar, Thimmaiah Road,
7th 'D' Main, Shivanagar, Bengaluru - 560079.
Phone : 080-23224002
E-mail : bngmdpura@kspcb.gov.in



No : KSPCB/RO-MDP/OA No. 111 of 2022 (SZ)/2025-2026/967 Date : 10 NOV 2025

To:
The Member Secretary,
Karnataka State Pollution Control Board,
"PartisaraBhavan"
Church Street,
Bengaluru-560001.

**"Kind Attention: CEO-2, Bengaluru"**

Sir,

**Sub: Furnishing the information w.r.t Hon'ble NGT OA No. 111 of 2022 (SZ) - "Frothing of Chemical Foam in the River Thenpennai" – Reg.**

Ref: 1. Board Office E-mail dated: 24/10/2025.
2. This office E-mail dated: 24/10/2025

*******

With reference to the above, it is to be submitted that, as per the Board Office E-mail dated: 24/10/2025 in respect of Hon'ble NGT OA No. 111 of 2022 (SZ) - "Frothing of Chemical Foam in the River Thenpennai", at present, there are no discharge of effluent or sewage from industries /high rise buildings in to the river. However, this office had sent a mail in this regard on 24/10/2025.

This is for your kind information and further needful.

Yours faithfully,

ENVIRONMENTAL OFFICER
MAHADEVAPURA REGION

ENCL's: As above.

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Karnataka State Pollution Control Board
Regional Office : Sarjapura
"Nisarga Bhavana", 3rd Floor, Thimmaiah Road,
7th 'D' Main Road, Shivanagar, Bangalore - 560 010.
Telephone : 080-23230153
Email : sarjapura@kspcb.gov.in

ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ
ಪ್ರಾದೇಶಿಕ ಕಛೇರಿ : ಸರ್ಜಾಪುರ
"ನಿಸರ್ಗ ಭವನ", 3ನೇ ಮಹಡಿ, ತಿಮ್ಮಯ್ಯ ರಸ್ತೆ,
7ನೇ 'ಡಿ' ಮುಖ್ಯ ರಸ್ತೆ, ಶಿವನಗರ,
ಬೆಂಗಳೂರು - 560 010. ದೂ. : 080-23230153
ಇ-ಮೇಲ್ : sarjapura@kspcb.gov.in

ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ

towards a cleaner Karnataka

NO:PCB/RO SJR(BNG)/OA 111/2020/2025-26/ 671

24 OCT 2025

TO.

The Member Secretary,
Karnataka State Pollution Control Board,
Parisara Bhavana, No.49,
Church Street, Bengaluru – 560 001

**Kind Attn: The Chief Environmental Officer - 2,**

Sir,

Sub: Providing information on discharge of industrial effluent to Dakshinapinakini River reg

Ref: 1. Board office E-mail Dated 25-08-2025
2. Whatsup message from CEO-2 of the Board on 24-10-2025

*****

With reference to the above subject, it is to bring to your kind notice that, Dakshina Pinakini River is originated from Chikkaballapura District and then pass through Bengaluru Rural and Urban District. The small stretch of the river is passing in this office jurisdiction and finally entering to the Tamilnadu State.

The major source of water to this river is overflow from Yellamallappachetty lake, Varthur lake and Hoskote lake. There are no industries exists on the bank/catchment of the river of this office jurisdiction. Further, there are no major local bodies located on the Bank of river of this office jurisdiction. Mugaluru village is situated adjacent to the river Dakshinapinakini near Mugluru bridge and this village is not discharging the sewage/sullage effluent generated from the village area into Dakshinapinakini river.

This for your kind information and further needful action.

Yours faithfully

ENVIRONMENTAL OFFICER
RO-SARJAPURA(BENGALURU)

Karnataka State Pollution Control Board
Regional Office : Bangalore City East
"Nisarga Bhavan", 3rd Floor, 7th 'D' Main,
Thimmaiah Road, Shivanagar, Bangalore-560 010.
Tel.: 080-23224830
E-mail : bngcityeast@kspcb.gov.in

ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ
ಪ್ರಾದೇಶಿಕ ಕಛೇರಿ : ಬೆಂಗಳೂರು ನಗರ ಪೂರ್ವ
"ನಿಸರ್ಗ ಭವನ", 3ನೇ ಮಹಡಿ, 7ನೇ 'ಡಿ' ಮುಖ್ಯರಸ್ತೆ,
ತಿಮ್ಮಯ್ಯ ರಸ್ತೆ, ಶಿವನಗರ, ಬೆಂಗಳೂರು-560 010.
ದೂ.: 080-23224830
E-mail : bngcityeast@kspcb.gov.in

towards a cleaner Karnataka

No: KSPCB/BCE/2025-26/5392 Date: 11.11.2025

To,

The Member Secretary
KSPCB,
Parisara Bhavan,
No.49, Church Street,
Bengaluur-560001

Sir,

As per the records there are 67 industries and 35 apartments/ high raise buildings are falling in the catchment area of River Dakshina Pinakini and list enclosed as Annexure –I & Annexure –II. As per the latest status, there is no discharge of sewage or effluent from these units. Out of 67 industries, one unit M/s.Karnataka Meat & Poultry (BBMP Slaughter House), Tannery Road, K.G.Halli, Bengaluru-560045 has been issued with Closure direction for consent conditions violation.

Yours faithfully,

Environmental Officer
R.O.Bengaluru City East

# Annexure - I

## Details of industries in the catchment area of River Dakshina Pinakini as declared in the year 2020 (w.r.t. O. A. No. 111 of 2020)

| Sl. No. | Name and Address of the industry | Size (L/M/S) | Category (R/O/G) | Operating status | Compliance Complied/ Not Complied | Provided ETP/STP/CETP | Latest Inspection carried out | If not complied, action taken w.r.t. non-complying industries | Reason for non-compliance (such as discharge of effluents outside etc.) | EC levied on | EC amount | EC amount Paid | Court Cases, if any | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Hindustan Aeronautics Limited (HAL), Engineering Division, FB NO.9310, Old Madras Road, Bangalore - 560 093 | Large | Red | Operating | Complied | Yes | 08.08.2023 | - | - | - | - | - | - | - |
| 2 | Bharath Earth Movers Ltd.,(Bangalore Complex) P.B.No.7501. New Thippasandra, Bangalore-560075. | Large | Red | Operating | Complied | Yes | 18.09.2024 | - | - | - | - | - | - | - |
| 3 | I.S.R.O Satellite Centre, Post Box NO. 1795, Airport Road, Vimanapura Post, Bangalore-560017. | Large | Red | Operating | Complied | Yes | 13.08.2024 | - | - | - | - | - | - | - |
| 4 | Citi Coats,.No.19, Lidkar Quarters, K.G.Halli,Bangalore-560045 | Small | Orange | Operating | Complied | BWSSB sewer | 20.07.2023 | - | - | - | - | - | - | - |
| 5 | Karnataka Meat & Poultry(BBMP Slaughter House) Tannery Road, K.G.Halli Bangalore-45 | Medium | Red | Operating | Non complied | Yes | 20.12.2024 | Closure order is issued on 28.01.2022 | Yes | - | - | - | Criminal Case is filed vide No.CC 21/2024(1065/2013) | - |
| 6 | Mysore Super Reptile Corporation, No. 1/79, Yerrishop Tannery, K.G. Halli,Bangalore , | Small | Red | Closed | - | CETP | 13.07.2020 | - | - | - | - | - | - | - |
| 7 | New Bright Powder Coating, No.1/1,Dhanakoti Lane,Thimmaiah Road Cross,Bangalore. - 560051, | Small | Orange | Operating | Complied | BWSSB sewer | 01.03.2023 | - | - | - | - | - | - | - |
| 8 | BMTC Depot -10, Hennur Main Road, . Bangalore - 560043. | Small | Orange | Operating | Complied | Yes | 15.03.2022 | - | - | - | - | - | - | - |
| 9 | Clothes Line., No.117/2, R.Venkatswamy Block, Bharath matha layout, Venkateshwarapuram, Bangalore-560045. | Small | Orange | Operating | Complied | BWSSB sewer | 15.12.2021 | - | - | - | - | - | - | - |
| 10 | Lidkar Tannery (C.E.T.P), Tannery Road, K.G.Halli Bangalore. | Medium | Red | Closed | - | CETP | 13.12.2023 | - | - | - | - | - | - | - |
| 11 | Dhruvdesh Motors Pvt Ltd, No:24/1, 5th Main, Jayamahal Extension, Anantheswara Complex, Bangalore - 560046, | Small | Orange | Closed | Complied | Yes | 29.12.2018 | - | - | - | - | - | - | - |
| 12 | Bagmane Developers Pvt. Ltd.,(Retail - 1) Khatha No.66/1-3,Byrasandra Village,C.V.Raman nagar Post,Bangalore-560093 | Large | Red | Operating | Complied | Yes | 22.01.2025 | - | - | - | - | - | - | - |
| 13 | Khivraj Diamond Service, No.2&11 ,100ft Road HAL 2nd stage Indiranagar Bangalore-560038 | Small | Orange | Operating | Complied | Yes | 21.03.2024 | - | - | - | - | - | - | - |
| 14 | BMTC Depot-6, Indiranagar, Old Airport Road, Bangalore-560038 | Small | Orange | Operating | Complied | Yes | 11.01.2024 | - | - | - | - | - | - | - |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | Metro Ford,(A Division Of VST Auto Ancilleries Pvt.Ltd), # 113, 1st Main Road, Lingarajapuram, Bangalore - 560084 | Large | Orange | Closed | Complied | Yes | 23.06.2018 | - | - | - | - | - | - | - |
| 16 | Creative Corbon,# 51/1,Ezaikel Industrial Estate,K.G.Halli,Bangalore | Small | Red | Operating | Complied | BWSSB sewer | 19.02.2025 | - | - | - | - | - | - | - |
| 17 | Bangalore Metro Rail Corporation, 17, ED (O & M), BMRCL, Baiyappanahalli, Old Madras Road, Bangalore-560038 | Small | Orange | Operating | Complied | Yes | 05.04.2018 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 18 | Royal Touch, No.3/2, Ezakiel Industrial Area,K.G.Halli, AC Post,Nagavara Main Road,Bangalore-560045. | Small | Red | Operating | Complied | BWSSB sewer | 23.07.2024 | - | - | - | - | - | - | - |
| 19 | Shawar Motives Pvt.Ltd, # 24/48, M.M.Road,Nandidurga Road Cross,Jayamahal Extension,Bangalore-560006 | Large | Orange | Closed | Complied | Yes | 21.06.2017 | - | - | - | - | - | - | - |
| 20 | Toit Brehpub C/o PH4 Food and Beverages Pvt.Ltd, # 298, 100 feet Road, Indiranagar,Bangalore-50038 | Large | Orange | Operating | Complied | Yes | 17.07.2018 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 21 | Haiku Motors (P) LtdNo.10, Dr. Krishna Reddylayout, Domlur, Bangalore - 560071, | Medium | Orange | Operating | Complied | Yes | 14.06.2024 | - | - | - | - | - | - | - |
| 22 | Trident Automobiles Pvt. Ltd,540, Amarjyathi Layout, Koramangala, Indiranagar Ring Road, Domlur, Bangalore | small | Orange | Operating | Complied | BWSSB sewer | 05.12.2019 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 23 | KSRTC Divisional work shop, Central Work StationK.H.Road, Shanthinagar, Bangalore-27 | Medium | Orange | Operating | Complied | BWSSB sewer | 27.01.2022 | - | - | - | - | - | - | - |
| 24 | KSRTC Depot-I Sy.No.33, KH Road, Shanthi Nagar, Bangalore | Large | Orange | Operating | Complied | Yes | 28.08.2024 | - | - | - | - | - | - | - |
| 25 | Motor world pvt.,ltd., Nandi toyota, Muncipal no.88/364/51, sy.No.114/4, ward no.88, Banaswadi, B'lore-43 | Large | Orange | Operating | Complied | Yes | 23.10.2024 | - | - | - | - | - | - | - |
| 26 | Khivraj MotorsNo.10/2, Kasturba Road, Bangalore-01 | small | Orange | Operating | Complied | Yes | 21.03.2024 | - | - | - | - | - | - | - |
| 27 | Elite construction (p) Ltd., "The Biere Club"No:20/2, Vittal Mallya Road bangalore-560001 | Large | Orange | Operating | Complied | Yes | 24.01.2022 | - | - | - | - | - | - | - |
| 28 | Sundaram Motors,# 107, Kasturba Road, Bangalore-01 | Large | Orange | Operating | Complied | Yes | 30.01.2023 | - | - | - | - | - | - | - |
| 29 | K.S.R.T.C.Depot 2, BCD, Shantinagar, K.H.road, Bangalore-27 | Small | Orange | Operating | Complied | Yes | 18.04.2024 | - | - | - | - | - | - | - |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | N.J.K Enterprises (Unit-2)No.106/138,Nagawara Village,Kasba Hobli, Bengaluru | Large | Orange | Operating | Complied | CETP | 08.05.2020 | - | - | - | - | - | - | - |
| 31 | H.A.L. (IMGT Divn)P.B. No. 9338,Old Madras Road Bangalore560093. | Medium | Orange | Operating | Complied | Yes | 13.08.2024 | - | - | - | - | - | - | - |
| 32 | Talin Modular Furniture Systems No. 189 and 190, Kacharakanahalli, 15th Cross, HBR Layout , Benglauru | Medium | Orange | Operating | Complied | BWSSB sewer | 02.02.2021 | - | - | - | - | - | - | - |
| 33 | H.A.L. (Aerospace Divn)P.b.No.7502, New Thippasandra post, B'lore-75 | Large | Red | Operating | Complied | Yes | 13.08.2024 | - | - | - | - | - | - | - |
| 34 | Bimal Auto Agency India Pvt.,Ltd unit - II, Sy.No. 16 D main, 2nd cross, HAL 2nd stage , Kodihalli , Bangalore -38 | Medium | Orange | Closed | - | BWSSB sewer | 26.10.2017 | - | - | - | - | - | - | - |
| 35 | Bimal Auto Agency India pvt.,Ltd. Unit-I, 6th cross, Old Airport road, Kodihalli, Bangalore-68 | Medium | Orange | Operating | Complied | BWSSB sewer | 29.12.2022 | - | - | - | - | - | - | - |
| 36 | National Aerospace Laboratory, P.B.No.1779, Kodihalli, Airport road, Bangalore-17 | Large | Red | Operating | Complied | Yes | 04.09.2023 | - | - | - | - | - | - | - |
| 37 | Advaith Motors Private Ltd., No.12, Shamarao Compound, Mission road, Sampangiramanagar, Bangalore -27 | Medium | Orange | Operating | Complied | BWSSB sewer | 14.05.2024 | - | - | - | - | - | - | - |
| 38 | Arbor Brewpub, III floor, No.11A (New No.8), Magrath road, Ashoknagar, Bangalore -560025 | Medium | Orange | Operating | Complied | BWSSB sewer | 22.01.2020 | - | - | - | - | - | - | - |
| 39 | Hindustan Automobiles, No.227, 7th main road, HRBR layout, Kalyan Nagar, Bangalore-43 | Small | Orange | Operating | Complied | BWSSB sewer | 01.09.2018 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 40 | Vapour micro Breweries, No.773, Ramadevi plazza, 100 feet road, Indiranagar, HAL 2nd stage, Bangalore-560038 | Large | Orange | Operating | Complied | BWSSB sewer | 20.03.2023 | - | - | - | - | - | - | - |
| 41 | 3 monkeys ( A division of Sri.Lakshmiram micro breweries Pvt.,Ltd.,), No.6, Old Madras road, Gopalan signature mall, shop No.AF-4, 4th floor, Nagavarpalya, C.V.Ramannagar, Bangalore | Medium | Orange | Operating | Complied | Treated in M/s Gopalan Combined STP | 19.04.2022 | - | - | - | - | - | - | - |
| 42 | BMTC Depot -2Plot No. MYB-1114, Shanthinagar, Bangalore – 560027. | Small | Orange | Operating | Complied | Yes | 21.12.2023 | - | - | - | - | - | - | - |
| 43 | Foodale India Pvt.,Ltd.,No.4121/P, L.R. Arcade, Old Airport Road, HAL 2nd Stage, Bangalore | Large | Orange | Operating | Complied | CETP | 03.09.2020 | - | - | - | - | - | - | - |
| 44 | HAL (Facilities Management Division), Senior Officers Enclave and C&D quarters, Old Madras Road, Bangalore-560093 | Large | Orange | Operating | Complied | Yes | 30.12.2020 | - | - | - | - | - | - | - |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45 | Bangalore Brew Works (P) Ltd.,No.99/100, Residency Road, 10th level, Prestige tower, Bangalore-560025 | Medium | Orange | Operating | Complied | BWSSB sewer | 06.04.2023 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 46 | Bimal Auto Agency India Pvt Ltd.No.82, Banaswadi Main Road, Bangalore-560003 | Medium | Orange | Operating | Complied | BWSSB sewer | 04.03.2022 | - | - | - | - | - | - | - |
| 47 | Brewklyn Microbreweries Pvt Ltd (Brewklyn)No.30, CMR Road, H.R.B.R. Layout, Bangalore-560043 | Medium | Orange | Closed | - | CETP | 04.03.2022 | - | - | - | - | - | - | - |
| 48 | Massive Restaurants Pvt Ltd2nd Floor, No.24, Vittal Mallya road, Bangalore | Medium | Orange | Closed | - | BWSSB sewer | 17.02.2024 | - | - | - | - | - | - | - |
| 49 | Concavity SolutionsNo.158, 1st floor, 7th Main, 80 feet road, Subbayana palya, Banaswadi, Bangalore-560043 | Small | Red | Closed | - | BWSSB sewer | 08.01.2020 | - | - | - | - | - | - | - |
| 50 | Community India Hospitality and Resorts Pvt., Ltd., No.67/68, Residency road, Opposite Hyundai show room, Richmond town, Bangalore-560025 | Medium | Orange | Operating | Complied | Yes | 09.02.2024 | - | - | - | - | - | - | - |
| 51 | Puthur Infotech Pvt Ltd., No.55, 1st Floor, 5th Cross, Banaswadi Main Road, Bangalore-560043 | Small | Red | Operating | Complied | BWSSB sewer | 21.01.2025 | - | - | - | - | - | - | - |
| 52 | Wanderers Brewing Pvt.,Ltd, Site no. 7M-417, 2nd Block, HRBR layout, Bangalore | Small | Orange | Operating | Complied | Yes | 09.02.2024 | - | - | - | - | - | - | - |
| 53 | Mandovi Motors Pvt Ltd.,No.4C, Jolly Estate, Opposite RMZ Infinity, Next to Gopalan Mall, Old Madras Road, Bengaluru-560093 | Small | Orange | Closed | - | Yes | 14.06.2024 | - | - | - | - | - | - | - |
| 54 | Trident Automobiles Pvt.,Ltd., Sy no.05, 15th Cross, Kolandappa garden, Anepalys, Adugodi post, Bangalore | Medium | Orange | Operating | Complied | BWSSB sewer | 13.11.2017 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 55 | Chrome Motors., (Paradigem Motors Pvt.,Ltd)Site No .39/6, 14th Cross, Kollandappa Garden, Anepalya, Adugodi, Bangalore-560030 | Large | Orange | Operating | Complied | Yes | 01.03.2023 | - | - | - | - | - | - | - |
| 56 | Press 2 Dry Cleaning And Laundry Pvt LtdNo.8, The Leon,Ground Floor, 80'road, Hal 2nd Stage, Indiranagar, Bangalore | Medium | Orange | Operating | Complied | Yes | 22.04.2024 | - | - | - | - | - | - | - |
| 57 | Brewcraft Hospitality India Pvt.Ltd., No.60, Brigade Road, Bangalore-560001 | Medium | Orange | Operating | Complied | Yes | 10.04.2024 | - | - | - | - | - | - | - |
| 58 | Indian Oil Corporation (Aviation Fuel Station)HAL Airport, Bengaluru | Small | Red | Operating | Complied | BWSSB sewer | 12.07.2023 | - | - | - | - | - | - | - |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 59 | Mobile Tyre Tech, Sy No.34/1, Kammanahalli main road,St.Thomos town, Bangalore | Small | Orange | Operating | Complied | BWSSB sewer | 31.01.2024 | - | - | - | - | - | - | - |
| 60 | Teknik Motors (Royal Enfield Servicing Centre), No.10, 17 E Cross, Eshwara Layout, HAL 2nd Stage, Indiranagar, Bangalore. | Small | Orange | Operating | Complied | BWSSB sewer | 22.11.2018 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 61 | PPS Business Solutions Private LimitedNo.330/14/ 15/16/17/18, Domlur Layout, Ward No.:12, Bengaluru-560071 | Medium | Orange | Operating | Complied | BWSSB sewer | 04.08.2023 | - | - | - | - | - | - | - |
| 62 | Nasdaq Corporate Solutions (India) Private Limited, Affluance, No.72/1, St.Marks Road, Bengaluru | Large | Orange | Operating | Complied | BWSSB sewer | 03.10.2019 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 63 | BMTC Depot -3, Shanthinagar, Bengaluru-560027 | Small | Orange | Operating | Complied | Treated BMTC Depot 1 ETP | 10.06.2022 | - | - | - | - | - | - | - |
| 64 | Advaith Motors Private Limited, No.05, Narayanappa Garden, Binnamangala 1st Stage, Indiranagar, Bengaluru-560038 | Small | Orange | Operating | Complied | BWSSB sewer | 14.11.2019 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 65 | Leisure Entertainment Partnership Enterprises, No.1135, 100 Feet Road,HAL Stage Indiranagar, Bengaluru | Large | Orange | Operating | Complied | Yes | 09.02.2024 | - | - | - | - | - | - | - |
| 66 | Dhruvdesh Motors Pvt.,Ltd.,No.4, 2nd Block, Next to Petals Inn, R.T.Nagar, Bengaluru-560032 | Small | Orange | Operating | Complied | Yes | 07.03.2020 | - | - | - | - | - | - | - |
| 67 | Larsen & Toubro Limited., (BMRCL Metro Project) Phase-2, Shivajinagar, Bangalore-560051 | Large | Red | Operating | Complied | Disposed through Septic tank and Soak pit. Completely Recycled. | 24.02.2020 | - | - | - | - | - | - | - |

# Annexure - II

**Details of apartments/other establishments (other than industries) in the catchment area of River Dakshina Pinakini as declared in the year 2020 (w.r.t. O. A. No. 111 of 2020)**

| Sl. No. | Name and Address of the organizations | Size (L/M/S) | Category (R/O/G) | Operating status | Compliance Complied/ Not Complied | Provided ETP/STP | Latest Inspection carried out | If not complied, action taken w.r.t. non-complying organizations | Reason for non-compliance (such as discharge of effluents outside etc.) | EC levied on | EC amount | EC amount Paid | Court Cases, if any | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | August Ventures Pvt Ltd,Augest Park No:35,36,37,38&39,B.Narayan pur Village K.R.Puram Hobli, No:03 1st B croos Road Kaggadasapura Main Road, Bangalore | Large | Red | Operating | Complied | Yes | 13.02.2025 | - | - | - | - | - | - | - |
| 2 | Sri.N.H.Rustumji (Purvankura Project)Sy.No.98, 99/1,2, 100,101-2,3,4,5,6,7,8, Khatha No.92, Ward No.83, Benniganahalli, (Nagavarapalya), Kaggadasapura Main Road, Bangalore. | Large | Red | Operating | Complied | Yes | 13.02.2025 | - | - | - | - | - | - | - |
| 3 | H M Tropic TreesSy.No. 400/2, Ward No.97, 2nd Block, R.T.Nagar, Bangalore-560032 | Large | Orange | Operating | Complied | Yes | 05.07.2023 | - | - | - | - | - | - | - |
| 4 | Salarpuria Silver woods, No.15, Varthur Road, C.V.Ramanagar, Bangalore | Medium | Orange | Operating | Complied | Yes | 04.04.2024 | - | - | - | - | - | - | - |
| 5 | Gopalan Enterprises, Admiralty Court, previously known as Prabhakar & AssociatersAdmiralty Court, No.77, Appareddy Palya Indiranagar, Bangalore-56 0038 | Large | Orange | Operating | Complied | Yes | 29.05.2024 | - | - | - | - | - | - | - |
| 6 | Aeris Apartment Residents Association, (Old Name M/s Arattukulam Infrastructure and Construction Pvt Ltd),No.10/3, Opposite to C.V.Raman General Hospital, 80 feet Road, Indiranagar, Bangalore-560038 | Large | Orange | Operating | Complied | Yes | 04.04.2024 | - | - | - | - | - | - | - |
| 7 | Century Galaxy Developers,No. 2, Diamond District, Airport Road, Kodihalli, Bangalore | Large | Red | Operating | Complied | Yes | 17.08.2024 | Earlier they have not complied. Hence, case has been filed. Now they have complied | - | - | - | - | Case filed vide No, PCR No.01/2017 | - |
| 8 | Bairavi Properties Pvt. Ltd, (Ananda Bairavi Apartments Owners Welfare Association) Sy No. 228, Kacharakanahalli Hennur Main road, Bangalore-560084 | Large | Orange | Operating | Complied | Yes | 04.04.2024 | - | - | - | - | - | - | - |
| 9 | Prestige Estate poperty Ltd., Prestige leela palace residency, Sy.No. 23/4, Kodihalli village, old airport road, Varthur Hobli, Bangalore | Large | Red | Operating | Complied | Yes | 18.09.2024 | - | - | - | - | - | - | - |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | Public Works Department for Judical Quarter for Group B, C & D Officers of Hon'ble High CourtSy.No. 14, 15/1, 29/2, 30/1, & 30/2 of Benniganahalli Village, K.R.Puram Hobli, Bengaluru | Large | Red | Operating | Complied | Yes | 04.08.2023 | - | - | - | - | - | - | - |
| 11 | M.M. Samiulla & OthersMunicipal No.1, PID No.86-33-1, Banaswadi Road, Ward No.86, Maruthi Sevanagar, Bangalore | Medium | Orange | Operating | Complied | Yes | 02.01.2020 | - | - | - | - | - | - | - |
| 12 | Sathyadeva Builders, Sy. No.50/2, Byrasandra Village, Varthur hobli, Bangalore | Large | Orange | Operating | Complied | Yes | 05.04.2019 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 13 | Prestige Exotica Apartment Owners Association,#3, Cunningham Crescent Road, Banagalore-560052 | Medium | Orange | Operating | Complied | BWSSB sewer | 17.01.2017 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 14 | Shree Lakshmi Venkateshwara Construction, Khatha o.367/71/2, Kaggadasapura, HAL Airport Sub Zone, Kaggadasapura, Bangalore-560093 | Small | Orange | Operating | Complied | Yes | 02.08.2019 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 15 | ITC Employees Residential ApartmentPlot No.08, Jeevanahalli Main Road, Ward No.59 (Old Ward 86), Maruthisevanagar, Bengaluru-560005 | Medium | Orange | Operating | Complied | Yes | 12.03.2024 | - | - | - | - | - | - | - |
| 16 | HAL CTH Sy.No. 52 of GM Palya, HAL Estate, Bangalore-560017 | Large | Orange | Operating | Complied | Yes | 18.09.2024 | - | - | - | - | - | - | - |
| 17 | Spectra Raintree Apartment,No.41, Sy. No.2, Pid No.87-50-41, Lingarajapuram, Sakamma Layout, Hennur Main Road, St.Thomas Town Post, Bengaluru-560084 | Small | Orange | Operating | Complied | Yes | 27.12.2023 | - | - | - | - | - | - | - |
| 18 | Vista Merez - GPA Holder (The Tribute)No.8, PID No.76-18-8, C.J.D.souza road, Ward No.76, Richmond Town, Bangalore | Medium | Orange | Operating | Complied | Yes | 28.02.2020 | - | - | - | - | - | - | - |
| 19 | Ever Green Properties and IvestmentsNew PID No.32, Banaswadi Main road, Near Orion Mall, Jai Bharath Nagar, Bangalore | Medium | Orange | Operating | Complied | Yes | 17.10.2017 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 20 | RBI Staff Quarters, Annaswamy Mudaliar street, Opp. Halasur lake, Bangalore | Large | Red | Operating | Complied | Yes | 29.05.2024 | - | - | - | - | - | - | - |
| 21 | Syed Ashfaq Peeran And Altaf Ahmed Peeran, Plot No.11 (14 – Old), Norris Road, Richmond Town, Bangalore | Small | Orange | Operating | Complied | Yes | 20.01.2020 | - | - | - | - | - | - | - |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | Karnataka State Police Housing And Infrastructure Development Corporation, Sy.No.170/2,KSPH and IDCL Project At Near Ambedkar Statue, Old Race Course Road, Austin Town, Bangalore-560047 | Large | Red | Operating | Complied | Yes | 21.11.2019 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 23 | RBI Staff QuartersNo.10/3/8, Nrupathunga Road, Bangalore | Small | Orange | Operating | Complied | Yes | 04.06.2019 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 24 | Grove VenturesMunicipal No.34/1, Rustum Bagh Main Road, Sy.No.140,1402/1, Kodihalli Village, Bangalore-75 | Large | Orange | Operating | Complied | Yes | 29.03.2023 | - | - | - | - | - | - | - |
| 25 | Rajarajeshwari Buildcon Private Limited, Pid No.78-1-123, Khatha No.123, Infantry Road, Vasanth Nagar, Bengaluru | Large | Orange | Operating | Complied | Yes | 05.09.2018 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 26 | Embassy Grove,Municipal No.34, Rustum Bagh Main Road, Sy.No.140, 142/1, 143/1a And 144, Kodihalli Village, Bangalore-75 | Large | Orange | Operating | Complied | Yes | 29.03.2023 | - | - | - | - | - | - | - |
| 27 | Prestige Estate Projects Limited, "Prestige Heights" Municipal Property No.26, Spencer Road, New Ward No.78, Pulakeshi Nagar, Bengaluru | Large | Orange | Operating | Complied | Yes | 03.09.2024 | - | - | - | - | - | - | - |
| 28 | Prestige Estate Projects Limited, "Prestige Dejavu" Municipal No.51/1, Promenade Road, Coles Road, Frazer Town, Bengaluru | Large | Orange | Operating | Complied | Yes | 03.09.2024 | - | - | - | - | - | - | - |
| 29 | Prestige Pine Wood, Site Nos. 68,69,70,71,72,73,74,75,76, 77,78,79,80,81,82 and 83, Shinivagilu Amanikere Village, Begur Hoblie, Bengaluru South Taluk, Bengaluru | Large | Red | Operating | Complied | Yes | 21.01.2025 | - | - | - | - | - | - | - |
| 30 | M/s Genesis Homes, No.23/1, Benson Town, Benson Cross Road, Jayamahal, BBMP Ward No.63, Bangalore-560046 | Medium | Orange | Operating | Complied | Yes | 18.08.2018 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 31 | V.S.S Constructions, Sy.No.127/2, Khatha No.12, Banaswadi Village, K.R.Puram Hobli, Bengaluru East Taluk, Bengaluru | Medium | Orange | Operating | Complied | Yes | 13.02.2024 | - | - | - | - | - | - | - |
| 32 | Shankaranarayana & Others, Site No.2, 2nd Main Road, Guddadahalli, Hebbal, Bangalore Ward No.22, Bangalore | Large | Orange | Operating | Complied | Yes | 23.01.2019 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 33 | Embassy Classic Pvt., Ltd., Site No.400/4, 15th Cross, 2nd Block, R.T.Nagar, Bangalore | Large | Orange | Operating | Complied | Yes | 05.04.2019 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |

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| 34 | KSR Grand, Municipal No.03, Old No.702/2 & 702/3, Ramamurthynagar Main Road, Banaswadi, Bengaluru-560043 | Medium | Orange | Operating | Complied | Yes | 17.10.2019 | - | - | - | - | - | - | Yet to inspect and inspection report will be submitted shortly. |
| 35 | Mohan Tranquil,Site No. AC-204,206,208,210,East of NGEF Layout, Bengaluru- 560043 | Medium | Orange | Operating | Complied | Yes | 04.02.2020 | - | - | - | - | - | - | - |
| | | | | | | | | | | | | | Sd/- | |
| | | | | | | | | | | | | Environmental Officer<br>R.O.Bengaluru City East | | |

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ಪರಿಸರ ಅಧಿಕಾರಿಗಳ ಕಛೇರಿ
ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ
ಪ್ರಾದೇಶಿಕ ಕಛೇರಿ : ಬೆಂಗಳೂರು ನಗರ – ದಕ್ಷಿಣ
1ನೇ ಮಹಡಿ, "ನಿಸರ್ಗ ಭವನ", 7ನೇ 'ಡಿ' ಮುಖ್ಯರಸ್ತೆ,
ತಿಮ್ಮಯ್ಯ ರಸ್ತೆ, ಶಿವನಗರ, ಬೆಂಗಳೂರು-560079.
ದೂ: 080-23226670

Office of the Environmental Officer
Karnataka State Pollution Control Board
Regional Office : Bengaluru City - South
1st Floor, "Nisarga Bhavan", 7th 'D' Main
Thimmaiah Road, Shivanagar, Bengaluru-560079.
Tel. : 080-23226670

towards a cleaner Karnataka

NO. KSPCB/BNG CITY-SOUTH/EO/DEO/2025-26/410 DT: 21 JUL 2025

To

The Member Secretary,
KSPCB, Parisara Bhavana,
Church Street, Bangalore

Sir,

**Kind Attn: - CEO-2**

Sub: Submission of details of industries in the catchment area of River Dakshina Pinakini has declared in the year 2020 (w.r.t. O. A. No. 111 of 2020)-reg.

Ref: Board office email dtd: 19.07.2025

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With reference to the above cited subject, please find herewith enclosed Details of industries/Apartment/Organisations in the catchment area of River Dakshina Pinakini w.r.t. O. A. No. 111 of 2020 in the prescribed format pertaining to Regional Office, Bangalore City-South.

This is for your kind information.

Yours faithfully

Environmental Officer
Bangalore City-South.

## Details of industries in the catchment area of River Dakshina Pinakini as declared in the year 2020 (w.r.t. O. A. No. 111 of 2020)

| Sl. No. | Name and Address of the industry | Size (L/M/S) | Category (R/O/G) | Operating status | Compliance Complied/ Not Complied | Provided ETP/STP/CETP | Latest Inspection carried out | If not complied, action taken w.r.t. non-complying | Reason for non-compliance (such as discharge of | EC levied on | EC amount | EC amount Paid | Court Cases, if any | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Pall India Private LtdNo.1, Sarrakki Industrial Area, JP Nagar 1 st Phase, Blore | Red | Large | Closed | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2 | Norwich Clinical Services Private Ltd147/F, 8th Main, 3rd Block, koramangala, Banglore 34 | Red | Large | Operational | Complied | STP | 11.05.2024 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.06.2026 |
| 3 | Bosch Limited, PB No. 3000, Hosur Road, Adugodi, Bnagalore-560030 | Red | Large | Operational | Complied | STP | 02.02.2024 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.06.2026 |
| 4 | TBH Breweries India Pvt. Ltd., Municipal Nos. 2/3, 13, 16, 17, 35 & 36, 80 Feet Road, Koramangala Main Road, Bangalore | Orange | Large | Closed | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5 | Bangalore Milk Union Limite d [Bamul] Banglaore Dairy Dr. M.H. Marigowda Road, Banglaore | Red | Large | Operational | Complied | ETP/STP | 01.08.2024 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.06.2026 |
| 6 | Concord Motors LtdNo.9/8, Hosur Road, No. 63, Diary Circle, Bangalore | Orange | Large | Closed | --- | --- | | --- | --- | --- | --- | --- | --- | --- |
| 7 | Sagar Auto mobilesNo. 39/2, Bg Road, Bangalore | Orange | Large | Operational | Complied | ETP | 07.05.2023 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.09.2031 |
| 8 | Yard house Brewery Pvt Ltd, No. 749, 10th Main, 80 feet Road, 4th Block, Koramangala, Bangalore-560034. | Orange | Medium | Closed | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 9 | Brewsky, No. 55, 15th Cross, 19th Main, Sarakki Extension, JP Nagar, Bangalore-78. | Orange | Medium | Operational | Complied | CETP | --- | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.09.2030 |
| 10 | Saphire Motors Pvt Ltd., plot No.11/17 1st cross, 20th main, Koramangala Bangalore | Orange | Small | Operational | Complied | ETP | 22.02.2022 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.09.2031 |
| 11 | Suraksha Car Care Pvt LtdNo. 8 & 9, 4th Block, Next to BDA Complex, Koramangala, Banglaore-34 | Orange | Small | Operational | Complied | ETP | 18.09.2020 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.09.2030 |
| 12 | Padmavathi LubricantsNo. 19/20, Arekempanahally, Hosur Road, Bangalore | Red | Small | Operational | Complied | There is no generation of trade effluent | --- | --- | --- | --- | --- | --- | --- | CFO expired on 30.06.2023. Notice was issued to industry. |
| 13 | Techno Powder Coaters,No.20, M.G.Industrial Estate, 1st Cross, Pukharaj Layout, Adugodi, Baneerghatta Road, Bangalore - 560030, | Red | Small | Operational | Complied | ETP | 12.12.2024 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.06.2024. applied for renwal and forwarded to Board office |
| 14 | Vivek Textles processingNo.324/1, Hosur Road, Madiwala, Banglaore-68. | Red | Small | Operational | Complied | ETP | 05.05.2022 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.06.2027 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | Nandini Milk Products unit of KMF, KMF Complex,Dr. M.H. Marigowda Road, Banglaore | Red | Small | Operational | Complied | ETP | 01.08.2024 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.06.2027 |
| 16 | Sri Lakshmi Dyeing WorksNo.2, N Cross, New Gurappanapalya, Tavrekere, Bangalore 560 029 | Red | Small | Operational | Complied | CETP | 01.04.2025 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.06.2028 |
| 17 | Bangalore Metropolition Transport Corpn ltd(BMTC)BMTC Depot-15, Koramangala, Bangalore | Orange | Small | Operational | Complied | ETP | 07.12.2024 | --- | --- | --- | --- | --- | --- | CFO expired on 30.09.2024. Renewal notice was issued. |
| 18 | Bangalore Metropolition Transport Corpn ltd(BMTC)BMTC Depot-20, Depot-20 Banashankari, Bangalore. | Orange | Small | Operational | Complied | ETP | 19.09.2024 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.09.2032 |
| 19 | m/s. Pump House pvt. Ltd,No. 607, 15th Cross, JP. Nagar 1st phase, Sarakki 1st Stage, Bangalore - 70 | Orange | Medium | Operational | Complied | ETP | 22.10.2024 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.09.2032 |
| 20 | M/s. Maverix Plastforms Pvt. Ltd,Municipal No. 3, 2nd Cross, N.S. Palya, BTM Layout 2nd Stage, Bannerghatta road, Bangalore - 5670076 | Orange | Medium | Operational | Complied | ETP | 27.6.2023 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.09.2027 |
| 21 | GVK Biosciences Pvt Ltd,Plot No. 692, 22nd Main, 15th Cross, Sai Geethanjali Road, Jaya Prakash Nagar, 2nd Phase,, Bangalore | Orange | Large | Closed | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 | Central Silk Board,B.T.M.Layout, Bangalore-65. | Red | Large | Operational | Complied | ETP | --- | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.06.2027 |
| 23 | Metal Profile (India) ,No.6, 6th cross , Bilekahalli, NS Palya, BTM 2nd Stage, Bangalore | Red | Small | Closed | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 24 | National Dairy Research Institute,Southern Campus, Adugodi Banglaore | Orange | Small | Operational | Complied | ETP | 23.01.2025, 08.09.2025 | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.06.2022. Applied for further period and forwarded to RSEO, Bangalore City. |
| 25 | M/s. Lotus Labs Pvt. Ltd,No. 14/2, Jyothinagar, 100 feet Road, Johns Nagar, 3rd Block, Koramangala, Bangalore | Red | medium | Closed | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 26 | M/s. Autostrip India (P) Ltd,No. 25/17/1 (21)(27), 9th Cross, Hosur main road, Arekempanahalli, Wilson Garden, Benglauru - 560027 | Orange | Medium | Operational | Complied | There is no generation of trade effluent | --- | --- | --- | --- | --- | --- | --- | CFO is expired on 30.09.2022. Renewal notice was issued |

Sd/-
Environmental Officer
Bangalore City-South

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## Details of new industries identified in the catchment area of River Dakshina Pinakini as declared after 2020

| Sl. No. | Name and Address of the industry | Size (L/M/S) | Category (R/O/G) | Operating status | Compliance Complied/ Not Complied | Provided ETP/STP/ connected to CETP | Latest Inspection carried out | If not complied, action taken w.r.t. non-complying industries | Reason for non-compliance (such as discharge of effluents outside etc.) | EC levied on | EC amount | EC amount Paid | Court Cases, if any | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M/s. Aorice Hallmarking, No. 19, 3rd floor, 5th cross, 5th block, 60 feet road, Koramangala, Bangalore | Orange | Small | Operational | Complied | CETP | --- | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.09.2030 |
| 2 | M/s. Laundry Labs India Pvt. Ltd, No. 4, 3rd Cross, 2nd main, KR Gaden, Koramangala, 8th block, Bangalore - 95 | Orange | Small | Operational | Complied | ETP | --- | --- | --- | --- | --- | --- | --- | CFO is valid upto 30.09.2030 |
| 3 | M/s. B.L. Kashyap & Sons Limited, No. 37-42, 52-61,Garuda Embassy Grand Central Ejipura, Koramangala, Bangalore- | Green | Small | Operational | Complied | There is no generation of trade effluent | --- | --- | --- | --- | --- | --- | --- | CFO is valid upto 31.12.2027 |
| 4 | M/s. Nandhana Foods Pvt. Ltd, No. 525, K.R. Garden, 8th block, Koramangala, Bangalore-560095 | Green | Small | Operational | Complied | There is no generation of trade effluent | --- | --- | --- | --- | --- | --- | --- | CFO is valid upto 31.12.2035 |

## Details of apartments/other establishments (other than industries) in the catchment area of River Dakshina Pinakini as declared in the year 2020 (w.r.t. O. A. No. 111 of 2020)

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| Sl. No. | Name and Address of the organizations | Size (L/M/S) | Category (R/O/G) | Operating status | Compliance Complied/ Not Complied | Provided ETP/STP | Latest Inspection carried out | If not complied, action taken w.r.t. non-complying organizations | Reason for non-compliance (such as discharge of effluents outside | EC levied on | EC amount | EC amount Paid | Court Cases, if any | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Ansal Krishna Apartment, Laskar Hosur road, Adugodi, Bangalore - 30 | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 2 | M/s. Alpine Agency Apartment, No. 35/1, 10th C Main, Jayanagara 1st block, bangalore - 11 | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 3 | M/s. Bysani Sky way owners assocaition, No. 14/1, Mountain road, Jayanagar 1st block, bangalore | Orange | Medium | Operational | ---- | BWSSB sewer | 07.05.2022 | Complied | ---- | ---- | ---- | ---- | ---- | Consent valid upto 31.12.2037 |
| 4 | M/s. Embassy Tranquil Apartment, No. 22, 8th main, 3rd block, Koramangala, Bangalore - 34 | Orange | Medium | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | M/s. Kalpavruksha Residency, No. 180, Tavarakere Main Road, 1st Stage, BTM Layout, Bangalore-29 | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 6 | M/s. Kantha Residecy, No. 92/2, 27t main, 4th cross, BTM Layout, 1st Stage, Bangalore -68 | Red | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 7 | M/s. Madhuban & Brindavan Apartment owners association, Madhuban Apartments, Adugodi, Hosur road, Bangalore - 30 | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 8 | M/s. Mantrhri Gardenia Apartment, Near Madavan Park, Jayanagar 1st block, Bangalore - 11 | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 9 | M/s. Mantrhri Pride Owners Association, No.2, Mountain Road, 1st Cross, Near Madavan Park, Jayanagar 1st block, Bangalore - 11 | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | M/s. Mythreyi Naimishya, No. 15, Next to Mico Back gate, BG Road, Bagnalore -30 | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- 185 | | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 11 | M/s. Oakwood Apartment Owners association, No. 13-16, 3rd block, 8th main, Koramangala, Bangalore | medium | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 12 | M/s. Raja Prakruthi Apartment, No. 157, 4th C Cross, 1st Block, Jayanagar, Bangalore - 11 | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 13 | p | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 14 | M/s. Savitri Elegent Apartment, No. 173, Lalbagh Siddapura, Bangalore | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | M/s. Seshabhams Residence - II, 1A Cross, 4th main, NS Palya, 2nd Stage, BTM Layout, Bangalore -76 | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 16 | Mahaveer Coral, No.14/2, Khata No. 202/185, 5th Phase, JP Nagar, bangalore | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 17 | Makana Tower, Tavarekere Main Raod, BTM 1st Stage, Bangalore - 81 | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 18 | Raheja Residency, III bLock, 7th Main, Koramangala, Bangalore | Red | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |
| 19 | Vandana Grand,#81, 13th Cross,Venkatapura Extension, Koramangala, Bangalore-34. | Orange | Large | Operational | ---- | BWSSB sewer | ---- | ---- | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |

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| 20 | Welson Manner Apartment Owners association, No. 15, Arekempanahalli, Wilson garden, 13th cross, Bangalore - 27 | Red | Large | Operational | ---- | BWSSB sewer | ---- | ---- 187 | ---- | ---- | ---- | ---- | ---- | As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism. |

**Sd/-**
**Environmental Officer**
**Bangalore City-South**

## Details of new apartments/other establishments (other than industries) identified in the catchment area of River Dakshina Pinakini after 2020

| Sl. No. | Name and Address of the organizations | Size (L/M/S) | Category (R/O/G) | Operating status | Compliance Complied/ Not Complied | Provided ETP/STP | Latest Inspection carried out | If not complied, action taken w.r.t. non-complying organizations | Reason for non-compliance (such as discharg | EC levied on | EC amount | EC amount Paid | Court Cases, if any | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M/s. RMZ City Estates Pvt. Ltd (Prestige City Properties )Prestige Star tech Development pf Cp,,ercoa; Building, No.140, Industrial House, Koramangala, Hosur Road, Bangalore-95 | Large | Red | Operational | Complied | STP | | ---- | ---- | ---- | ---- | ---- | ---- | CFO expired on 30.06.2024. Applied and Forwarded to Board office |
| 2 | Chalet Hotels Pvt. Ltd,at Municipal No. 21. 22, 42, 52 & 1B, Koramangala Industrial Layout, Jakkasandra, BBMP Ward No. 68, Sarjaura Road, Bangalore | Large | Red | Operational | Complied | STP | | ---- | ---- | ---- | ---- | ---- | ---- | CFO is valid upto 30.06.2027 |
| 3 | M/s. Somu Properties, No. 77, Near jyothi Nivas College, Koramangala, Bengaluru | Large | Green | Operational | Complied | STP | | ---- | ---- | ---- | ---- | ---- | ---- | CFO expired on 30.09.2022. Renewal notices was issued |
| 4 | M/s. A Ramareddy, No. 95, Industrial layout, Koramangala, Bengaluru -560034. | Large | Green | Operational | Complied | STP | | ---- | ---- | ---- | ---- | ---- | ---- | CFO is valid upto 31.12.2033 |
| 5 | M/s. Commercial complex by M/s. Regent Properties Development, No. 414, 4th block, Koramangala, Bangalore -560034 | Medium | Green | Operational | Complied | STP | | ---- | ---- | ---- | ---- | ---- | ---- | CFO is valid upto 31.12.2031 |
| 6 | M/s B Krishnan, SITE NO 423 , PID NO-68-6-423, SITE NO 423 , 8th MAIN 4th BLOCK, KORAMANGALA, Bangalore | Large | Green | Operational | Complied | STP | | ---- | ---- | ---- | ---- | ---- | ---- | CFO is valid upto 31.12.2034 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | M/s. Veracious Enrica Apartments, Sy.no 15/3, Nirguna mandir layout, near Shanthinagar co-operative Society, S.T. Bed, Srinivagilu village, Koramangala, Bangaluru-560034 | Medium | Orange | Operational | Complied | STP | 05.03.2025 | ---- | ---- | ---- | ---- | ---- | ---- | CFO is valid upto 30.09.2030 |
| 8 | M/s. Prasanna Trust, No.1, Nirguna Mandir Layout, ST Beda area, 1st block, Koramangala, Banglaore - 560047 | Small | Green | Operational | Complied | STP | | ---- | ---- | ---- | ---- | ---- | ---- | CFO is valid upto 19.10.2121 |
| 9 | M/s.Vikas Poddar, No. 509, 15th Main, 3rd Block, Koramangala, Bengaluru | Large | Green | Operational | Complied | STP | | ---- | ---- | ---- | ---- | ---- | ---- | CFO is valid upto 31.12.2036 |
| 10 | M/s. Geeta Poddar, NO. 378,Koramangala 3rd block, Bangalore-560034 | Large | Green | Operational | Complied | STP | | ---- | ---- | ---- | ---- | ---- | ---- | CFO is valid upto 31.12.2036 |
| 11 | M/s. Sumanth Donthi And Anji Reddy Mettu, No.54, 6th Block, koramangala, Bangalore | Medium | Green | Operational | Complied | STP | | ---- | ---- | ---- | ---- | ---- | ---- | CFO is valid upto 31.12.2036 |
| 12 | M/s. Bhabatarani Griha Nirman Pvt. Ltd, Plot No. 57, 2nd Block, Koramangala, Bangalore | Large | Green | Operational | Complied | STP | | ---- | ---- | ---- | ---- | ---- | ---- | CFO is valid upto 31.12.2037 |
| 13 | M/s. Raja Housing Ltd, Sy. No. 59/01, Koramangala road, Adugodi, Ward No. 67, PID No. 67-87-11, Bangalore | Large | Green | Operational | Complied | STP | | ---- | ---- | ---- | ---- | ---- | ---- | CFO is valid upto 31.12.2037 |

Sd/-
**Environmental Officer**
**Bangalore City-South**

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Annexure R-6

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Research article

# Study towards understanding foaming and foam stability in urban lakes

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ABSTRACT

Foaming water bodies have become a matter of great concern globally. Foam disrupts aquatic ecosystems, emits an offensive smell, disrupts the day-to-day activities in neighbouring localities, and is visually unpleasant. The downstream water bodies are also exposed to the risk of foaming. Even though widespread, the foaming phenomena of surface water bodies are not adequately studied. The present study focuses on the foaming Lake of Bellandur in South India - wherein the sources and concentration of surfactants, effect of phosphorous, effect of bacteria, and its synergy with surfactants were studied. The study revealed that the significant source of pollution in the Lake was the entry of untreated sewage, which consisted of surfactants. The anionic surfactant concentration in the Lake was 17 ± 3 ppm, and surface tension remained around 50 mN/m, similar to the treatment plant inlet. The Phosphorus concentration in the Lake was high at 10 ± 3 ppm, with the primary source being feces and urine. Phosphorus indirectly affected the surfactant concentration of the Lake. Foam stability studies showed that mixed bacteria (filamentous) from Bellandur, in its stationary phase-played a crucial role in adding to the stability of the foam. The highest contributing filamentous bacterial family was found to be *Flavobacteriia*.

## 1. Introduction

Foam is a colloid where gas is dispersed in a liquid (Walstra, 1989). Foaming of surface water bodies, such as lakes and rivers, is a global issue that garners huge public and media attention due to the visual manifestation of the underlying pollution (Wilson et al., 1995). Internationally, the Rhine river, the Austria-Hungary transboundary river, Lake Mendota, and Lake Maggiore have been studied for foaming (Elzerman and Armstrong, 1979; Ruzicka et al., 2009; Stefani et al., 2016; Wegner and Hamburger, 2002). In India, major rivers like the Yamuna of Delhi, the Sea Beach of Marina in Chennai, and the Bellandur/Varthur Lakes of Bengaluru froth extensively (Kumar et al., 2020; Shetye et al., 2021; Siddiqui et al., 2020). The formation of stable foam on surface water bodies is a complex biochemical phenomenon whose root causes remain inconclusive (Stefani et al., 2016). These foams are stable for up to a few days, reach up to a height of a few feet and cause damage to the aquatic ecosystem. Stable foam clouds overflow onto roadways and sidewalks thereby disrupting the traffic and causing pedestrian discomfort. There are times when these foams catch fire and emit soot (Das et al., 2019). Understanding the reasons for such stable foam formation in surface water bodies is the subject matter of this work.

Rampant unplanned urbanization and advancement of science have resulted in the discharge of complex bio-active or surface-active chemical compounds into the aquatic environment, which is known to cause foaming (Schilling and Zessner, 2011). Also, the generation of surface-active compounds, for example, the release of saponin (100–1800 ng/L), mono and digalactosyldiacylglycerol lipids, from aquatic plant *Ranunculus fluitans*, can lead to foaming (Wegner and Hamburger, 2002) of water bodies.

Previous studies showed that the foaming waters had high proportions of dissolved organic Carbon, Nitrogen, and Phosphorus (i.e., 76, 59, and 41%, respectively of total elemental composition) compared to subsurface waters (Eisenreich et al., 1978). Monosaccharides such as Arabinose, Xylose, Mannose, Galactose, and Glucose in 20:1:1:10:1.6 M ratios, were reported to be present in foaming waters. Agal polysaccharide exudates (natural surfactants) were found to be enriched in the foam where algal biovolume was positively correlated to the foaming events in such water bodies (Stefani et al., 2016). Blauw et al. (2010) established a correlation between foaming and *Phaeocystis globosa* bloom, with threshold foaming criteria of >10 million cells/L in Dutch coastal waters. All these reported studies indicated the natural origin of foam. Whereas Ruzicka et al. linked the foam formation in the Austria-Hungary transboundary river, to effluent from tanneries with surface tension values as low as 50 mN/m (Ruzicka et al., 2009). This is the only work that reported surface water foaming due to an

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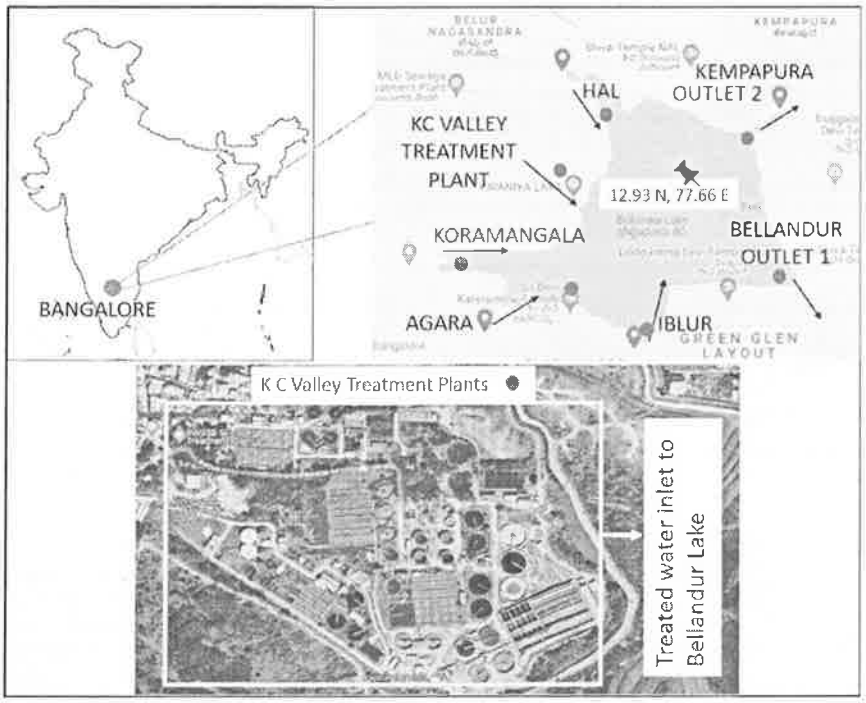


**Fig. 1.** Geographical position of Bellandur Lake - a foaming urban lake in India (sampling points marked in Red, Below: KC Valley Treatment plant/treated water inlet to Bellandur Lake). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

anthropogenic cause.

Earlier works on the formation of stable foams were conducted on sewage treatment plant waters, wherein the presence of bacteria was recorded in foams (Hwang and Tanaka, 1998; Petrovski et al., 2011a). Filamentous bacteria such as *Nocardia amarae, Gordonia amarae* and *Microthrix. Parvicella* were found to increase foam stability (Dhaliwal, 1979; Franzetti et al., 2009; Hwang and Tanaka, 1998; Pagilla et al., 2002). Though these studies attempt to identify the mechanism for foaming, the reasons for higher foam stability in surface waters are still unknown. To date, there exists no literatures that provide long-term water quality analysis of foaming surface water bodies and links it to foaming events. The influences of nutrients loading, the release of natural surfactants from aquatic plants, and the growth/presence of bacteria leading to stable foam formation in surface water bodies remain poorly understood. The synergies between the grown bacteria and the surfactants in a froth-infested waterbody have not been adequately studied yet. Furthermore, there exists a limited understanding of the seasonality of the foaming events.

The present study is the first of its kind, aiming to analyze the foaming of an urban Lake, to comprehend the foaming problems in relation to water quality parameters. Firstly, the study's main objective is to assess the extent of pollution of the foaming Lake and the water quality parameters that are positively correlated to the foaming events. A structural equation model is created to develop an understanding of the complex direct and indirect pathways of foaming of surface water and relate it to water quality parameters. Secondly, the sources of surfactants in the foaming Lake and their concentration are identified along with the Phosphorus budget of the foaming Lake. Finally, the role of bacteria in increasing the stability of the foam is also addressed in detail. Here, a taxonomic analysis was done to identify bacterial families aiding the process of foam stability

## 2. Materials and methods

### 2.1. Study area

The study location of the present study was the Bellandur Lake of Bengaluru (Fig. 1), a sewage-fed urban lake which is notorious for stable foam in the south Indian state of Karnataka. It is one of the largest manmade lakes in South-East Asia that covers an aerial extent of 892 acres (3.6 $km^2$) in the sprawling metro city of Bengaluru. It is at an elevation of 921 m above sea level and has 160 $km^2$ of the catchment area. Bengaluru had a population density of 12,000 people/$km^2$ in 2011 (Kumar, 2011). Currently, Bengaluru's population is estimated to be around 12 million (1.2 crores) and the population of the Bellandur catchment is 5.37 million (53.7 lakh). Bellandur Lake received around 530 million litres per day (MLD) of water in 2019, which translates to 30–40% of Bengaluru's daily wastewater generation. The sources of water in the Lake were - treated water from nearby STPs (KC valley STPs), a significant amount of raw sewage, and 859 mm annual rainfall. Apartments along the Bellandur shoreline release untreated sewage to Bellandur Lake. During the study period, a STP located next to Bellandur Lake released around 308 MLD of its treated water to Bellandur and is the primary source of accounted inflow of treated water.

### 2.2. Sample collection

The water samples were collected for one whole year in pre-cleaned and sterilized containers from all inlets and outlets of Bellandur Lake in 2019–2020, from different locations, as shown in Fig. 1. Sewage samples were also collected from treatment plants around Bellandur (Fig. 1) and also from the sewage treatment plant located inside the campus of the Indian Institute of Science (IISc) at Bengaluru to get a comparative estimate of the water quality of the Lake with respect to STP water. Surface water samples were collected from 30 to 40 cm below foam (air-water interface). The surface sediment (0–20 cm deep) samples were collected from a distance of 0.75 km from the shoreline/bank. The sediment

samples were collected during November–January once every month. The sampling bottles were washed with hot concentrated nitric acid instead of detergents to avoid the interference of surfactants and were left to dry and cool down overnight.

### 2.3. Water quality analysis

The standard protocol prescribed by the American Public Health Association (APHA, 2012) was followed to estimate water quality parameters as represented in Table S1 (supplementary). Cationic detergents were estimated using the anionic dye Disulphine blue following the principles of ion-pairing described by Hanif et al. (2012). Surface tension was used for qualitative estimation of the presence of surface-active agents.

To quantify the biological productivity, the Trophic Status Index (TSI) of the Bellandur Lake was estimated using Carlson's Trophic Status Index (Carlson, 1977) as per equations (1)–(3); where *Chl* is the chlorophyll concentration in μg/L, P is total Phosphorus in μg/L and TN is total Nitrogen in mg/L.

$$TSI\ (TN) = 54.45 + 14.43\ ln(TN)\ (in\ mg\ /\ L) \quad (1)$$

$$TSI\ (Chl) = 9.81\ ln(Chl) + 30.6(in\ \mu g\ /\ L) \quad (2)$$

$$TSI\ (P) = 14.42\ ln(TP) + 4.15(in\ \mu g\ /\ L) \quad (3)$$

### 2.4. Studies on phosphorus budget

#### 2.4.1. Estimation of phosphorus in macrophytes

The Total Phosphorous (P) levels in macrophytal biomass of water hyacinth (*Eichhorinia crassipes)* was analyzed. Water hyacinth was ignited at 550 °C, and digested in 1 M HCl (APHA, 2012), followed by spectrophotometric analysis for P evaluation, using APHA 4500-P Method E.

#### 2.4.2. Estimation of phosphorus in sediments

The surface sediment sample was analyzed for P following the protocol reported by (Ruban et al., 1999). Where the Bellandur sediment samples were calcinated at 450 °C for 3 h. Following which an acid treatment was done using 3.5 mol/L HCl, and finally, through the ammonium molybdate–stannous chloride method, Soluble Reactive Phosphorus (SRP) was estimated.

#### 2.4.3. Estimation of phosphorus released from the sediments

The Phosphorus release in this study was performed in batches of 50 mL screw-cap centrifuge tubes at 28 °C i.e., room temperature as per SUN et al., 2009. 25 mL of distilled water was added to the 0.25 g of the dried sediment sample. Tubes were incubated at an orbital shaker at 200 rpm for 20, 40, 60, 100, 150, 200, and 300 min, till a steady state was achieved. The resultant supernatant solution was centrifuged at 4000 rpm for 10 min. The supernatant was then filtered through a cellulose-nitrate filter membrane of 0.45 μm pore size. The SRP analysis was done on the filtrate in triplicates using the ammonium molybdate-stannous chloride method.

#### 2.4.4. Statistical analysis

The 'PATHj' module of opensource statistical software 'jamovi version 2.3.13.0' was used for Structural Equation Modelling of foaming path analysis. To run the analysis, variables and their respective roles were specified. 'Endogenous Variables' in this model were surface tension, surfactant concentration ([Surfactant]), and chlorophyll (CHL). Here chlorophyll value was used as a dummy for algal content. 'Exogenous Covariates' used were BOD, COD, and Phosphorus (P). Experimentally observed data from Table 1 were used for the analysis. Model specifications are as follows:

CHL ~ P.

'Surface tension' ~ '[Surfactant]'

'[Surfactant]' ~ COD + BOD + P + CHL.

### 2.5. Foam stability studies

#### 2.5.1. Characterization of bacterial inoculum used for foam stability

Bacterial culture was prepared to study the effect of bacteria which act as a foam stabilizing agent in Bellandur Lake. A synthetic wastewater media was prepared for the inoculation of bacteria that mimicked Bellandur Lake water. This was done by adding 1000 mg of Sodium acetate as a carbon source, 50 mg ammonium sulphate as a Nitrogen source, and 100 mg dipotassium hydrogen phosphate to 1 L of distilled water (Sridhar and Rami Reddy, 1984). 5 mL of Bellandur Lake water was added as inoculum to 245 mL of 'synthetic wastewater' and incubated at 28 °C to study bacterial growth dynamics in mixed culture. Bellandur water originally had $398\times10^3$ CFU/100 mL of Total coliform. Filtrates were obtained by filtering the whole culture through 0.45 μm glass-fibre membrane filters, for surface tension measurements. The initial weight of 0.45 μm filter paper and final weight after filtering the media were noted. The filter paper was dried, and the change in its weight was used as the measure of bacterial dry mass.

Taxonomic analysis of bacteria present in Bellandur water was done by 16 S microbiome profiling. For microbiome profiling, the water sample was sent to Eurofins Genomics India Pvt. Ltd. (Bangalore, India). The metagenomic DNA was isolated from the sample using the Nucelospin kit, and the quality of the isolated DNA was checked on Nanodrop 2000 UV–vis spectrophotometer (Thermo Scientific, Wilmington, USA) by determining A260/A280 ratio. Then the amplicon for the 2×300 MiSeq library was prepared using the Nextera XT index kit (Illumia Inc.) as per the 16 S metagenomic sequencing library preparation protocol (Part #15044223 Rev.B). The primers used in the present study for amplification were 16 S rRNA F (GCCTACGGGNGGCWGCAG) and 16 S rRNA R (ACTACHVGGGTATCTAATCC). After amplification 3 μl of PCR product was resolved in 12% Agarose Gel at 120 V for 60 min, or till samples reached 3/4th of gel. Amplicon library was then purified by AMPure XP beads and quantified using a Qubit fluorometer. The Bioinformatic data analysis was done using the QIIME software. Identification of foam stabilizing bacteria was made by comparison with existing literature.

#### 2.5.2. Effect of bacteria on foam stability

The synthetic wastewater and varying concentrations (2 ppm, 8 ppm, 10 ppm, 15 ppm) of pure Sodium Dodecyl Benzene Sulphonate (SDBS) were used to analyze the synergistic effect of pure surfactant and bacteria in enhancing foam stability. The water sample in the study was shaken gently in a graduated cylinder. The shaking constituted 60 counts of up-down tumbles of the graduated cylinder in 80 s, to maintain the uniformity of the mixing. The height of foam was noted with respect to time until it subsided. 'Foam stability index' (FSI) was formulated as a parameter to assess the extent of foam stability (Fryer and Gray, 2012) and was finally compared with surface tension.

$$FSI = Initial\ height\ of\ foam * Time\ taken\ to\ subside\ to\ 10\%\ of\ maximum\ height \quad (4)$$

Further, a Student's t-test was conducted to analyze the statistical significance of the difference in foam stability in the presence and absence of bacteria. It is shown in detail in supplementary.

#### 2.5.3. Scanning electron microscopy (SEM)

Foam samples were collected from the study discussed in section 2.5.2. The foam samples were centrifuged at 5000×g rpm for 10 min and washed with the sterilized synthetic wastewater. Bacterial cells were then immersed in 2.5% glutaraldehyde for 12 h. Samples were then rinsed with Milli-Q water and dehydrated using ethanol at varying concentrations of 30%–100%. This was done at room temperature. Finally, the samples were desiccated in a vacuum desiccator. Desiccated

samples were coated with gold, before imaging by scanning electron microscopy (SEM) using 'Ultra55 FE-SEM Karl Zeiss EDS'.

## 3. Results and discussion

### 3.1. Characterization of foaming Bellandur Lake – identifying water quality parameters of concern

From Table 1 it can be noted that the pH varied between 6.7 and 8.2, turbidity varied between 39.3 and 121 NTU and suspended solids mostly ranged between 20 and 63 ppm while rising to 180 ppm only once. Conductivity ranged between 850 and 1220 μs/cm. Bellandur Lake had high $BOD_5$ and COD ranging from 53 to 113 ppm and 101–274 ppm, respectively. The $BOD_5$ to COD ratio was around 0.5, indicating that the Lake water had similar organic content as municipal sewage. The high COD and $BOD_5$ scavenged the dissolved oxygen (DO) out of the Bellandur water. The year-round water quality analysis revealed that DO levels were extremely low, mostly below 1 ppm, and the Lake was nearly in anaerobic conditions throughout the year. The ammonia to nitrate ratios was extremely high, making it even more evident that the Lake was in an extreme dearth of DO. The Bellandur Lake had high concentrations of nutrients (Nitrogen and Phosphorus), which led to eutrophication. The macrophyte cover further prevented Bellandur from replenishing the lost DO from the atmosphere as the air-water interface was blocked due to the macrophyte layer.

Bellandur Lake is infamous for emanating hideous foam that disperses over distances as far as 200 m and the formed foam was highly stable. When surplus water spills over the waste weirs and falls over a 5 m drop into the downstream valley, the water turbulence induced foam. Squall winds and heavy monsoon showers churn the surface waters, and hence most of the foaming events are seen post-rain in Bellandur. It was hypothesized that the presence of surface-active agents at the air-water interface caused a reduction in the surface tension of water. This resulted in the air getting trapped, easily forming bubbles aggregating into foam. Pure water has a surface tension of 73 mN/m (Walstra, 1989) whereas, the surface tension of Bellandur water ranged from 46 mN/m to 56 mN/m, as shown in Table 1. This was an obvious indication of the presence of surface-active agents in Bellandur. As shown in Table 1, the anionic surfactant concentration ranged from 8 to 20 ppm, and the cationic surfactant concentration in the Lake was always below 1 ppm.

As shown in Table 1, Bellandur water indicated low calcium hardness of mostly between 79 and 132 ppm and rarely went up to 200 ppm. In hard water, the surfactants are known to bind with the calcium or magnesium ions and get precipitated avoiding foaming. However, in soft water, the surfactants do not precipitate and thus foaming due to surfactant is more likely (Cohen et al., 1993). The low hardness levels of Bellandur Lake water coupled with a high concentration of anionic surfactants supported foaming in Bellandur Lake.

The TSI values of Bellandur Lake were extremely high i.e., TSI (TN) was >133 mg/L, and TSI (*Chl*) was >74. The TSI values are an indirect measure of nutrient enrichment in lakes, ponds and reservoirs (Carlson, 1977). Using TSI values, lakes are ranked on the eutrophic status enabling the water managers to narrow down on the that may require rejuvenation or conservation activities. According to USEPA, the TSI (TN) values < 40 mg/L usually represent an oligotrophic condition. The TSI (TN) values > 60 mg/L denote a eutrophic state in the lake. Whereas values in the 40–50 mg/L range denote mesotrophic conditions. If TSI (TN) values reach >70 mg/L then the lake is classified under hyper-eutrophic status (Cloutier and Sanchez, 2007). Both the TSI (TN) and TSI (*Chl*) indicate the poor-quality status of Bellandur and emphasized the

**Table 1**
Year-round water quality assessment at Bellandur Lake outlet.

| S. No. | Parameters | Permissible limit | Feb'19 | Mar'19 | Apr'19 | May'19 | Aug'19 | Sept'19 | Oct'19 | Nov'19 | Dec'19 | Jan'20 | Feb'20 | Mar'20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | pH | 5.5–9 | 8.1 | 7.4 | 7.6 | 7.5 | 6.9 | 7.1 | 7.5 | 7.3 | 7.2 | 7.4 | 7.8 | 7.2 |
| 2 | Turbidity (NTU) | | 121 ± 2 | 61.3 ± 20 | 67 ± 1 | 39.3 ± 0 | 40 ± 0 | 47 ± 2 | 59 ± 1 | 38 ± 1.5 | 76 ± 1 | 73 ± 2 | 70 ± 1.2 | 66.4 ± 0 |
| 3 | TSS (ppm) | <100 | 50 ± 1 | 180 ± 30 | 20 ± 1.1 | 30 ± 0.9 | 35 ± 2 | 50 ± 0.9 | 45 ± 1.6 | 21 ± 1.1 | 63 ± 0.9 | 60 ± 1.1 | 61 ± 2 | 55 ± 0.9 |
| 4 | DO (ppm) | >3 | 0.8 ± 0 | 0.41 ± 0 | 0.55 ± 0.1 | 1.03 ± 0.1 | 1.1 ± 0.1 | 1.4 ± 0.1 | 1.5 ± 0.1 | 1 ± 0.1 | 0.69 ± 0.1 | 1 ± 0.1 | 0.3 ± 0.1 | 0.8 ± 0.1 |
| 5 | $BOD_5$ (ppm) | <30 | – | – | – | 89 ± 2 | 60 ± 7 | 70 ± 9 | 93 ± 3 | 108 ± 5 | 118 | 99 | 104 ± 2 | 112 ± 1.5 |
| 6 | COD (ppm) | <250 | 157 ± 5 | 136 ± 2 | 107 ± 6 | 170 ± 2 | 180 ± 2.5 | 173 ± 3 | 210 ± 1 | 198 ± 3 | 210 ± 5 | 226 ± 4 | 217 ± 5 | 269 ± 5 |
| 7 | EC (μs/cm) | <2250 | 902 ± 0 | 980 ± 0 | 1162 ± 0 | 1178 ± 0 | 850 ± 0 | 861 ± 0 | 1180 ± 0 | 996 ± 0 | 1204 ± 0 | 1115 ± 0 | 1192 ± 0 | 1220 ± 0 |
| 8 | TDS (ppm) | <2100 | 451 ± 0 | 489 ± 0 | 581 ± 0 | 589 ± 0 | 425 ± 0 | 430 ± 0 | 590 ± 0 | 498 ± 0 | 602 ± 0 | 557.5 ± 0 | 596.5 ± 0 | 610 ± 0 |
| 9 | Anionic surfactant (ppm) | | 19 ± 1 | 16.7 ± 0.8 | 13 ± 1.1 | 14.8 ± 0.2 | 13.6 ± 0.3 | 12 ± 0.4 | 15 ± 0.2 | 12 ± 0.1 | 18 ± 0.4 | 16 ± 0.5 | 10 ± 0.2 | 8.5 ± 0.5 |
| 10 | Surface tension (mN/m) | | 46 ± 0.1 | 48.6 ± 0.1 | 52 ± 0.1 | 47. ±0.1 | 51 ± 0.1 | 53 ± 0.1 | 51 ± 0.1 | 54 ± 0.1 | 47 ± 0.1 | 49 ± 0.1 | 56 ± 0.1 | 57 ± 0.1 |
| 11 | Hardness of $CaCO_3$ (ppm) | <300 | 82 ± 3 | 132 ± 5 | 115 ± 7 | 79 ± 1 | 119 ± 0.5 | 165 ± 0 | 158 ± 1 | 204 ± 1 | 100 ± 0.5 | 115 ± 0.9 | 125 ± 0 | 146 ± 0 |
| 12 | $NO_3^-$ N (ppm) | <10 | 1.1 ± 0.3 | 4.4 ± 0 | 6 ± 0 | 7.3 ± 0 | 14 ± 0.3 | 12 ± 0.2 | 7.9 ± 0.1 | 9 ± 0.3 | 11 ± 0 | 7.7 ± 0.2 | 8 ± 0 | 8.3 ± 0 |
| 13 | $NH_3$–N (ppm) | <50 | 4 ± 0 | 5.5 ± 0.7 | 20 ± 2 | 22 ± 3 | 23 ± 1 | 41.1 ± 0 | 37 ± 1.3 | 30 ± 0.8 | 36 ± 0 | 24 ± 2 | 20 ± .5 | 25 ± 0.7 |
| 14 | Phosphorus (ppm) | | – | – | 9.8 ± 0 | 11.1 ± 1 | 8 ± 0.2 | 7.6 ± 0.3 | 10 ± 0.4 | 12.4 ± 0.2 | 11 ± 0.4 | 12.2 ± 0 | 11.3 ± 0 | 13.4 ± 0 |
| 15 | Chlorophyll-a (ppm) | – | – | – | 0.14 ± 0 | 0.2 ± 0 | 0.08 ± 0 | 0.11 ± 0 | 0.18 ± 0 | 0.12 ± 0 | 0.17 ± 0 | 0.11 ± 0 | 0.09 ± 0 | 0.15 ± 0 |
| 16 | $SO_4^{2-}$ (ppm) | <100 | – | – | 13 ± 0 | 12.7 ± 0 | – | 10 ± 0 | 6 ± 0 | 8 ± 0 | 9.2 ± 0 | 7 ± 0 | 6.5 ± 0 | 7.7 ± 0 |

*Lake inaccessible due to municipal work [June 2019 and July 2019].
- reliable estimates could not be made.
The Surface Water Quality Standards (as per IS: 2296, Class E) were used as reference permissible limits (EPA, 1986).

**Table 2**
Surfactant, surface tension, and Phosphorus at inlet and outlet of Lake and STP.

| S No | Location | P (mg/L) | | Anionic surfactant (mg/L) | | Surface Tension (mN/m) | |
|---|---|---|---|---|---|---|---|
| | | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet |
| 1 | IISc swimming pool treatment plant[c] | 7.5 ± 1 | 0.8 ± 0.1 | 16.7 ± 1.7 | 1.5 ± 0.2 | 52 ± 2 | 71.6 ± 0.1 |
| 2 | IISc hostel treatment plant[c] | 9.7 ± 0.5 | 1 ± 0.1 | 16 ± 2 | 1.7 ± 0.2 | 51 ± 1.2 | 71.6 ± 0.1 |
| 3 | KC valley 60 MLD STP[a] | 18.1 ± 0.7 | 0.78 ± 0.1 | 18.1 ± 1 | 0.7 ± 0.2 | 49 ± 0.4 | 71.8 ± 0.1 |
| 4 | KC valley 30 MLD STP[a] | 16.1 ± 1.1 | 0.6 ± 0.1 | 17.1 ± 1 | 0.5 ± 0.1 | 50 ± 0.1 | 71.9 ± 0.1 |
| 5 | KC valley 90 MLD STP[a] | 17.4 ± 1.4 | 0.5 ± 0.1 | 18.1 ± 1.1 | 0.6 ± 0.1 | 50 ± 0.7 | 71.7 ± 0.1 |
| 6 | KC valley 248 MLD STP[a] | | 0.5 ± 0.1 | | 1.0 ± 0.1 | | 71.5 ± 0.1 |
| 7 | KC valley Treated water[a] | | 1.6 ± 0.3 | | 0.7 ± 0.1 | | 71.9 ± 0.1 |
| 8 | Raw sewage from HAL[b] | 10.5 ± 2 | | 17 ± 1 | | 48.7 ± 7.1 | |
| 9 | Raw sewage from Iblur[b] | 9.5 ± 0.5 | | 16.6 ± 1.6 | | 48.6 ± 6.6 | |
| 10 | Raw sewage from Kempapura[b] | 10.7 ± 1.2 | | 16.2 ± 1.2 | | 40.2 ± 6 | |
| 11 | Raw sewage from Agara[b] | 10.6 ± 0.6 | | 17.5 ± 1.5 | | 46.9 ± 6 | |
| 12 | Raw sewage from Ambedkar nagar[b] | 13 ± 1 | | 16 ± 1 | | 49.9 ± 7.4 | |
| 13 | Bellandur outlet | | 10 ± 2 | | 16.5 ± 2 | | 48.7 ± 4 |

[a] These are treatment plants which send treated water to Bellandur lake as shown in Fig. 1.

[b] These are different raw sewage entry locations into Bellandur lake as shown in Fig. 1.

[c] These are treatment plants on the IISc campus, studied for sake of elaborate comparison.

contemporary ecological crisis. Visual inspection of the Lake made it clear that the macrophyte cover (*Eichhornia crassipes*) was about 49–70% on the lake surface and it blocked the air-water interface making it ineffective for oxygen diffusion from the atmosphere into the water (Bareuther et al., 2020). The presence of invasive species was indicative of extreme nutrient enrichment in water. The year-long water quality analysis shown in Table 1, coupled with visual inspection (Fig. S1), showed that Bellandur had i) high surfactant concentration ii) low hardness, iii) low surface tension iv) high Phosphorus and Nitrogen content leading to v) high Chlorophyll content and vi) extremely low DO.

### 3.2. Relation between water quality parameters and foaming

The source of surfactants in the Lake, its effect on the surface tension of the Lake water and foaming is discussed in this section. This will be followed by Phosphorus - its sources and its effects on foaming.

#### 3.2.1. Surfactant and surface tension

As shown in Tables 1 and 2, Bellandur Lake had a high anionic surfactant concentration and to trace back the source of surfactant-water samples from all the inlets to Bellandur Lake and a few water treatment plants discharging its water to Bellandur were analyzed. As evident from Table 2, the anionic surfactant concentrations were between 15 and 19 mg/L in the inlet water to the Lake and the outlet water from the Lake had 14–19 mg/L of anionic surfactants. This data showed that there was close to zero degradation of surfactants entering the Lake. In general, though most detergents are biodegradable (Ivankovic and Hrenovic, 2010), low DO levels in Bellandur Lake made the biodegradation of surfactants impossible in the available 8–10 days of hydraulic residence time in Bellandur Lake. Thus, surfactants entering Bellandur Lake remained non-degraded.

Anionic detergents are the most used synthetic detergent, and their source can be directly linked to anthropogenic pollution. The anionic surfactant concentration in Lake (10–19 ppm) was similar to inlet water of STP (15–19 ppm), as seen in Table 2. The presence of anionic surfactant in household waste in high concentrations indicates that entry of untreated sewage as the source of surfactant to the Lake. Further data as of 2019 (BDA, 2019) shows that around 46% of the water entering Bellandur Lake was untreated (i.e., 243 MLD), further supporting this analysis.

As shown in Table 2, the surface tension of the treated water from KC valley STPs was 72 mN/m whereas all other inlet waters had a lower surface tension in the range of 40–50 mN/m. The high concentration of anionic surfactants present in the water samples was believed to reduce the surface tension of the water, which is also known to promote foaming.

In summary, this analysis shows that anionic surfactants coming

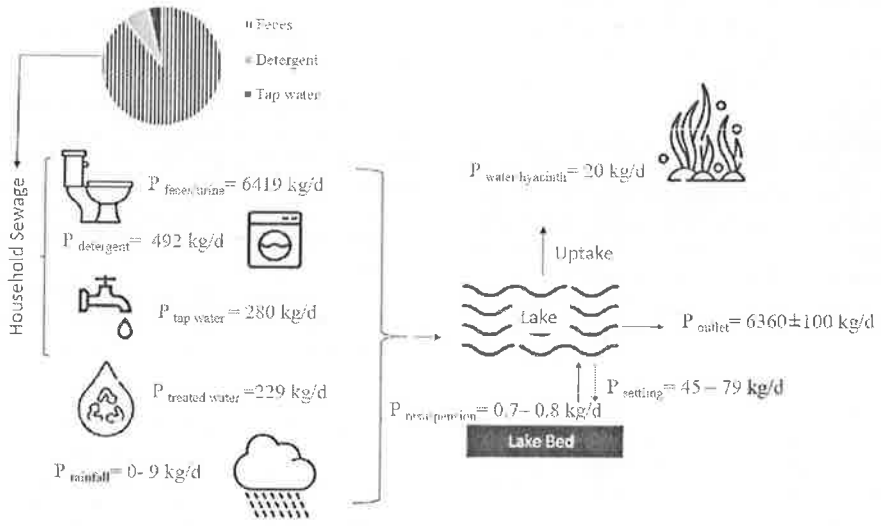


**Fig. 2.** Phosphorus mass balance of Bellandur Lake [detailed calculations in supplementary section S2].

**Table 3**
Composition of most commonly used detergent in Bangalore.

| | | mg/10 mg detergent | | | | | |
|---|---|---|---|---|---|---|---|
| S.No. | Sample | Fluoride ($F^-$) | Chloride ($Cl^-$) | Nitrate ($NO_3^-$) | Phosphate ($PO_4^{3-}$) | Phosphorus (P) | Sulphate ($SO_4^{2-}$) |
| 1 | A | 0 | 1.7 | 2.9 | 0.9 | 0.4 | 1.1 |
| 2 | B | 0 | 0.3 | 2.9 | 0.9 | 0.3 | 1.0 |
| 3 | C | 0 | 1.9 | 2.9 | 0.9 | 0.3 | 0.2 |
| 4 | D | 0 | 3.3 | 3.0 | 0.9 | 0.4 | 0.7 |
| 5 | E | 0 | 3.4 | 3.0 | 0.9 | 0.3 | 1.0 |

* The ionic compositions of detergents were analyzed using ion chromatography.

from anthropogenic sources enter Bellandur Lake resulting in lower surface tension. The low DO and low hydraulic residence time of the Lake lead to decreased degradability of surfactants in the Lake and thus a high surfactant concentration was found in the outlet of the Lake, leading to foaming at the outlet weir.

*3.2.2. Effect of Phosphorus on foaming*

Earlier reports on Bellandur Lake claimed that the foam in the Bellandur results from phosphatic detergents, without any scientific backing to such claims of foam being of phosphatic origin (Ramachandra et al., 2015). This study attempts to uncover the authenticity of such claims. It can be observed from Table 2 that P levels in the different STP inlets were in a similar range as that of Bellandur. Surveys conducted during this study period showed that the STPs never faced the foaming issue, whereas Bellandur Lake foaming was a significant issue, especially soon after rains. There was no significant seasonal variation in P levels in Bellandur Lake between wet and dry seasons. However, P decreased only slightly at the outlet of the Lake, as shown in Table 2. Thus, it was decided to further quantify the role of Phosphorous on foaming.

*3.2.2.1. Phosphorus mass balance in Bellandur Lake.* Primary sources of Phosphorus to the aquatic systems include biological sources, synthetic detergents and sewage. To estimate the relative contribution of each source, a Phosphorus budget (Fig. 2) was established for Bellandur Lake. The same is explained below.

*3.2.2.2. Phosphorous from commercial detergents.* Table 3 summarizes the composition of the anions present in five common detergents. It was observed that fluoride was not a part of the chemical composition. It further revealed that the 10 ppm sample had around 0.29–0.39 ppm of Phosphorus i.e., 3% by weight. The data presented in Table 3 suggested that among the five detergents studied chloride was found in a wide range from 2% to 30%, Nitrate was around 28–30%. And Sulphate ranged between 1 and 10%. The per capita Phosphorous from detergent in the Lake was calculated by surveying 52 people in and around Bangalore. It was concluded that per person uses 3.5 kg of detergent annually, on an average and per capita phosphorous from detergent calculated was around $\frac{0.25\ gP}{day*capita}$.

Earlier, sodium tripolyphosphate (STPP) was used in detergents at higher concentration; as a 'builder' which help to soften the hard water and was a major source of Phosphorous in detergents. It was used to stop the dirt particles from sticking to the garment as phosphates stabilize the alkalinity of the surfactants (Kundu et al., 2015). On recognizing the environmental hazards (eutrophication) associated with the use of STPP, the permissible concentration for it was reduced to 2.5% (2018) in India (Department of Consumer Affairs India, 2018). The Phosphorus percentage (3%) shown in Table 3, is close to this permissible limit.

*3.2.2.3. Other sources of phosphorus in Bellandur.* Other sources of Phosphorus in Bellandur Lake were untreated sewage, rainfall and sediments. The large influx of partially treated/untreated domestic wastewater with high P loads into the urban water bodies resulted in eutrophication as shown by TSI in section 3.1. These algae and macrophytes immobilize the P and contribute to the sedimentary P flux, after death/decay through settling. Fig. 2 depicts the dynamics of P in a typical foaming urban lake and the relative contribution of all the sources of P was analyzed. The detailed contribution from each source is explained in the supplementary section.

The per capita P from household laundry detergents contribution estimated from this study was extremely low at around 0.25 gP/c/d. Whereas the per capita contribution of P from untreated sewage was 30–60 times more. Thus, the theory of phosphatic detergents responsible for Bellandur foaming has now been falsified as per this study.

*3.2.3. Phosphorus – an indirect cause of foaming*

The Bellandur water appeared greenish, and the water body was covered with floating macrophytes, mostly water hyacinth. It is reported that P levels between 0.2 and 0.5 ppm are adequate for algal blooms in water bodies (Kundu et al., 2015), whereas Table 2 clearly shows that Bellandur Lake had high Phosphorus of around 8–12 ppm. The P levels in Bellandur Lake were around 2–6 ppm in the early 2000s and it increased to thrice its level within two decades (Das et al., 2019). Algal cells contain several types of chlorophylls (green colour pigments). Chlorophyll-a was the most dominant one and hence a direct measure of agal concentration. Chlorophyll-a concentration in the Bellandur water sample ranged from 0.09 ppm to 0.2 ppm, generally correlating to about $13.8\times10^7$ cells/mL of chlorophycean algae [ calculated using (Wang et al., 2017)]. The Chlorophyll-a concentrations >75 ppb a lake is considered hypereutrophic (Jamwal, 2017).

High Nitrogen and Phosphorus levels (as represented in Table 2) in Bellandur were indicative of extreme pollution and nutrient enrichment in water. Nitrogen and Phosphorus are the major regulators that control the propagation of algae. Phosphorus, being a limiting nutrient, plays a huge role in triggering algal blooms. The nutrients favour the growth of macrophytes, preventing algal blooms while consequently decreasing the oxygenation rates of the waterbody. The equation below quantifies autotrophic algae growth in nutrient-enriched water.

$$106\ CO_2 + 16\ NO_3^- + HPO_4^- + 122\ H_2O + 18\ H^+ \rightarrow C_{106}H_{263}O_{110}N_{16}P\ (algae) + 138\ O$$ (Li et al., 2019) )

Earlier studies had also revealed the presence of high concentrations of algae when the macrophyte cover occupied less than 30% of the water surface area (Mahapatra et al., 2011). Earlier studies had shown that the foaming of water bodies was a consequence of macrophytes and microphytes. Studies conducted on persistent foaming in the Rhine river revealed natural surfactants released from *Ranunculus fluitans* were responsible for foaming (Wegner and Hamburger, 2002). Similarly, studies with help of GC-MS on Lake Maggiore identified the presence of algal polysaccharide exudates (natural surfactants) enriched in foam. Here, algal biovolume was mostly positively correlated to the foaming events (Stefani et al., 2016). Blauw et al. (2010) attempted to make a deterministic fuzzy logic model correlating *Phaeocystis globosa* (algae) blooms and coastal foaming events in the Netherlands. The model predicted 90% of foaming events over four years correctly with a few false positive results. Certain higher plants were found to be responsible for marine foaming. Studies on sea foam from Peck's Cove, New Brunswick threw light on the enrichment of organic carbon, phenolics, amino acids,

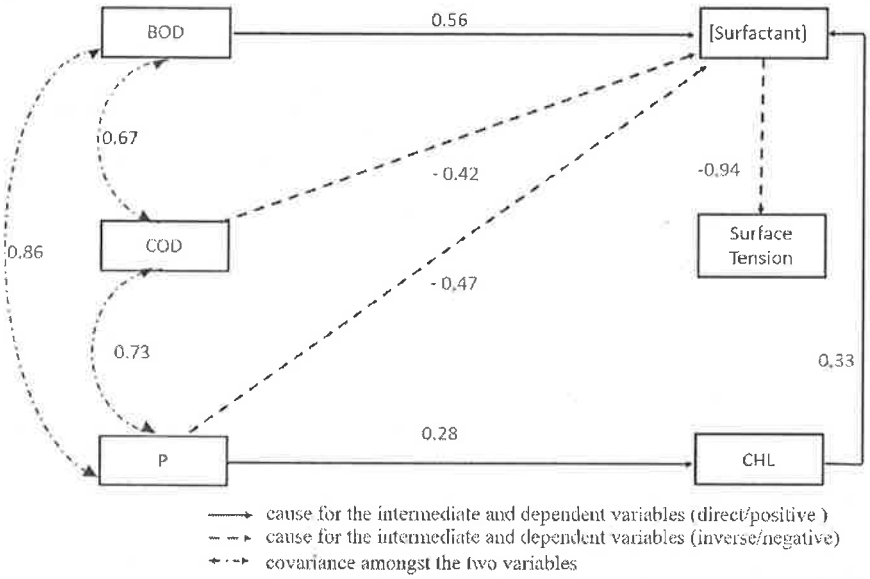


**Fig. 3.** Path analysis diagram (Structural Equation Modelling) for foaming urban Lake with beta values. [Path coefficients in the path diagram are 'standardized regression coefficients (beta), showing the intensity of the effect of exogenous variables on surfactant concentration in the Lake water. The negative beta values denote inverse relation, whereas the positive values represent direct proportional relation.].

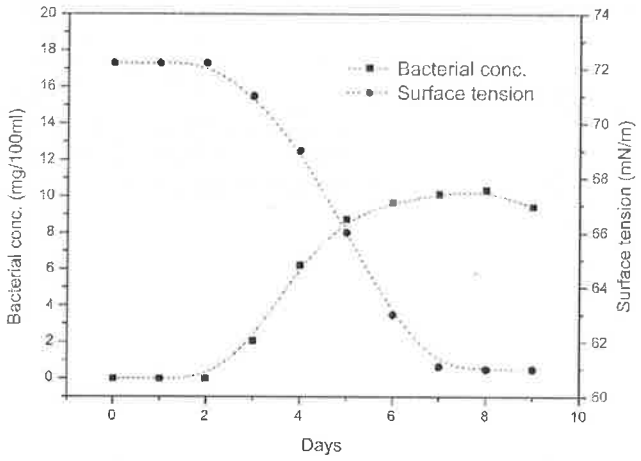


**Fig. 4.** Growth characteristics and surface tension dynamics of mixed culture.

amino sugars and particulates in foam (Craig et al., 1989). It was hypothesized that higher vascular plant detritus was the source of phenolics and organic carbon because such compounds are not common in marine algae. This result was in line with the previous report (Coffey, 1986) which correlated carbon content in seafoam with local spartina marshes and terrestrial C3 plants.

Fig. 3 shows Structural Equation Modelling (Path Analysis) of the intricate pathways affecting the foam formations in Urban Lake. The BOD and Phosphorus were sourced from untreated sewage, so they have high covariance amongst each other. The path analysis diagram (Fig. 3) showed that Phosphorus was not a direct cause of foaming, i.e., the negative beta value of P corresponding to [surfactant]. But P indirectly influenced foaming through eutrophication, i.e., the path P →CHL →[surfactant] showed positive beta values. BOD also directly affected the surfactant concentration of the Lake, shown by positive beta values. The surfactant concentration had a very significant and inverse influence on the surface tension of the Lake water. Thus, the pathway analysis showed that Phosphorus indirectly affects the foaming of a surface water body. Bellandur had macrophytes and microphytes, which may be an additional source of surfactants. As previous literature suggests that dead and decaying plants or living plants/algae release surface active metabolites. The plant growth was directly related to P concentration which was again sourced majorly from untreated sewage.

### 3.3. Synergy between bacteria and surfactant in inducing foam stability

Bacterial culture from Bellandur Lake was also tested for its synergistic effect on foam stability under two categories:

#### 3.3.1. Characteristics of mixed bacterial culture used for foam stability

As discussed in section 2.5.1, Bellandur Lake water was inoculated in synthetic wastewater (media) for the growth of bacterial species. The resultant mixed culture was studied for its effect on foam stability. The growth curve for mixed culture and surface tension at each phase of growth was plotted and represented in Fig. 4. The curve in Fig. 4 gives information about the growth characteristics of bacteria and also gives an idea of bacterial concentration in synthetic wastewater. An initial lag phase, which was the acclimatization stage was observed in the curve, as indicated by a negligible change in biomass with respect to time. This was followed by an exponential/logarithmic growth phase, during which biomass concentration amplified rapidly, leading to the stationary phase, where the biomass growth rate and the death rate were similar. Finally, the concentration of biomass declined, i.e., reached a death phase. Bacterial concentration at the stationary phase was 10.1 mg/100 mL as represented in Fig. 4.

Surface tension studies is a very important parameter to be considered in the context of foaming and have also been studied to monitor and validate the production of bio-surfactants by bacteria (Petrovski et al., 2011b). A lowering in the surface tension is considered synonymous with the production of surface-active agents. Fig. 4 shows the data for reduction in surface tension with time which indicated the production of surface-active agents during the exponential growth stage of bacterial culture. A very evident decrease in surface tension was noticed in synthetic wastewater from the 1st day to the 7th day when it was allowed to grow microorganisms. From the 7th day onwards, the surface tension stabilized. Bacterial synergy was thus considered a candidate for further investigations in terms of foam stability.

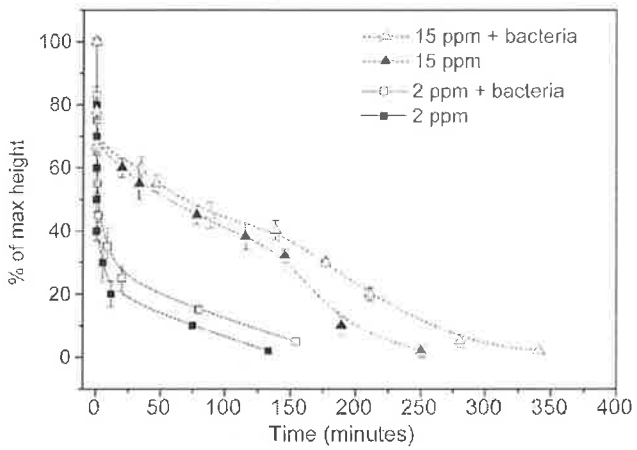


**Fig. 5.** Foam persistence study at different SDBS concentrations (2 ppm and 15 ppm), with and without bacteria [Graph for 8 ppm and 10 ppm available in Supplementary Fig. S3].

### 3.3.2. *Effect of bacteria on foam stability at varying surfactant concentrations*

Foam stability is synonymous with higher foaming heights and longer dissipation time. Fig. 5 represents the height vs time plot for pure SDBS foam culture at different concentrations (2 ppm and 15 ppm) with respect to foam persistence in the presence of bacterial culture. The graph (Fig. 5) shows that the higher stability of foam was attributed to the high concentration of SDBS i.e., the foam took a longer time to subside/collapse. This is due to the drag that surfactant (SDBS) provides to the film drainage. In the present study, a fixed concentration of mixed culture was added to SDBS, to test the synergy of bacteria and surfactant in providing foam stability. The 6th and 7th day samples (stationary phase bacteria) showed a pronounced effect on foam stability. It was observed that all the samples with mixed culture displayed an increased collapse time. Whenever the bacterial concentration in the mixed culture reached beyond 10.1 mg/100 mL and surface tension dropped to 61 mN/m, foam stability was observed. But since surface tension remained the same at the death phase, but bacterial concentration decreased; it was hypothesized that bacterial number played a positive role in foam stability. Moreover, Bellandur Lake had a residence time of 8–10 days and bacterial stability to foam was seen on the 6–7th day of the growth phase. This translates into the fact that, bacteria could reach the stationary phase before it is washed out and hence enhance the stability of foam in Bellandur Lake.

In this study, FSI was developed as a parameter to quantify foaming intensity. From Fig. 6a it was evident that FSI/stability was higher in presence of mixed bacterial culture along with surfactants. The difference in the FSI values between two treatments [FSI (without bacteria) and FSI (with bacteria)] was statistically significant at every tested point (refer to Supplementary Tables S2 and S3). As mentioned in the previous section 3.3.2, the increase in foam stability wasn't linear. Fig. 6b also shows a comparative analysis between FSI and Surface Tension. The FSI remained high when the surface tension was lower. i.e., the collapse time of the froths had an inverse correlation to the surface tension measurements. Thus, out of all water quality parameters, the parameter which can predict foam potential was identified as the surface tension of the water.

### 3.3.3. *Effect of bacterial concentration and type on foam stability*

Section 3.3.2 showed that – "Bacteria at stationary phase added to foam stability". In this section-the role of bacterial concentration at the stationary phase, on foam stability, was studied. Foam stability was studied at 15 ppm SDBS solution since this concentration represented Bellandur's anionic surfactant concentration. From Fig. 7a it can be seen that with increasing bacterial concentration, the foam stability increased, i.e., the time taken to subside increased. The 15 ppm SDBS sample without bacteria required 251 min to subside to 2% of the original foam height, whereas 15 ppm SDBS sample along with 31 mg/100 mL of mixed culture needed 396 min to subside to the same height. This indicated that the bacterial concentration played a positive role in foam stability.

SEM analysis (Fig. 7b) of the foam samples confirmed the presence of filamentous bacteria in the mixed culture. Filamentous bacteria, observed through microscopy techniques, had been associated with foaming in wastewater treatment plants. These filamentous bacteria identified in treatment plant foams were *Rhodococcus* spp., *Nocardia*

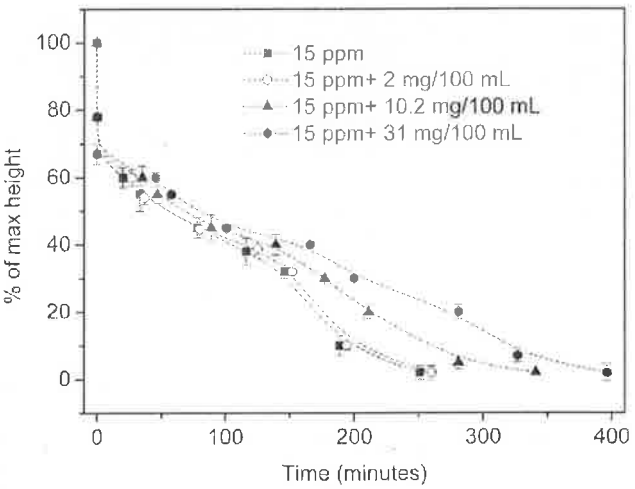


**Fig. 7a.** Foam stability of 15 ppm SDBS at varying bacterial concentration.

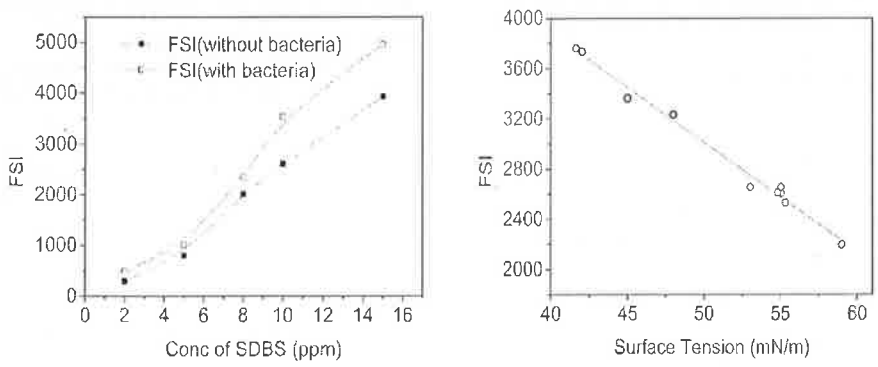


**Fig. 6.** a) Foam Stability Index with respect to concentration of surfactant b) Foam Stability Index with respect to surface tension.

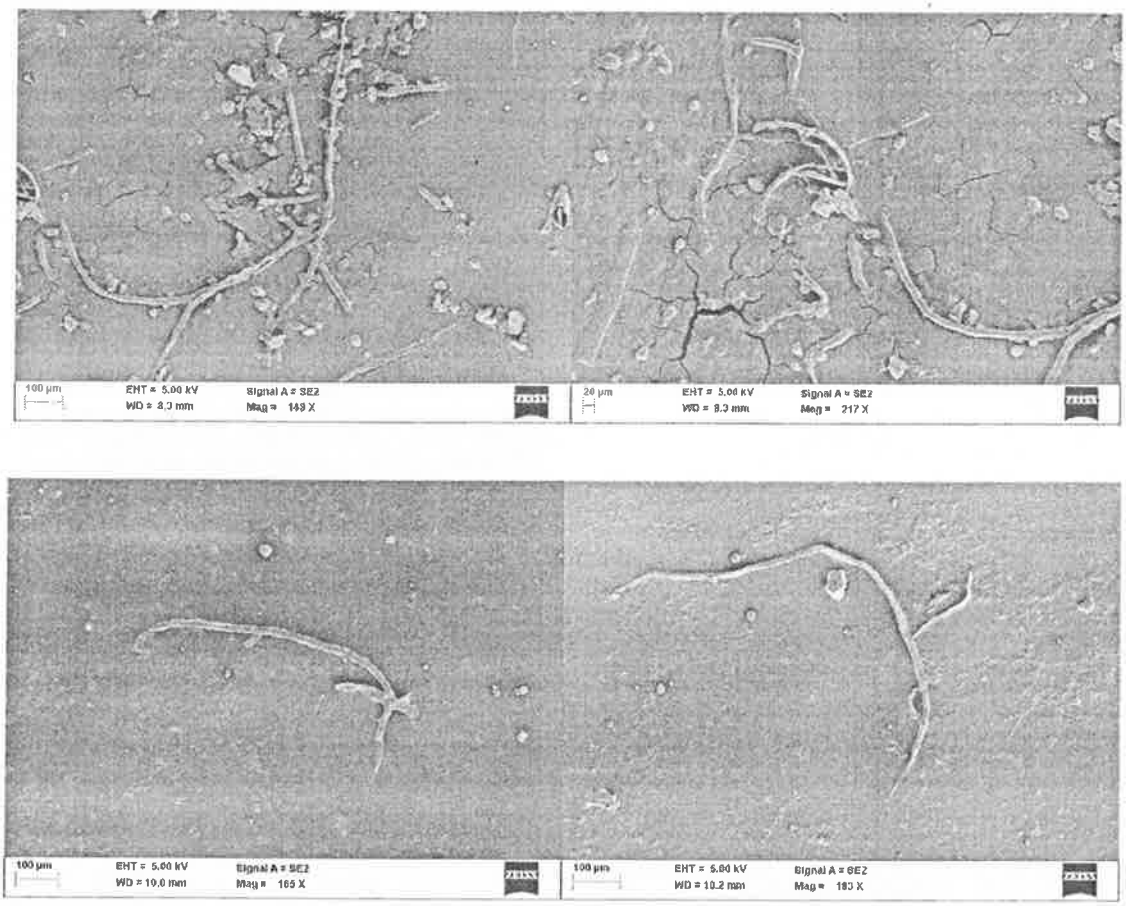


**Fig. 7b.** SEM image of filamentous bacteria in foam.

**Table 4**
Relative Abundance of 'Filamentous' and 'Occasionally Filamentous' bacterial genus/family/phylum in mixed culture.

| Sl No | Phylum | Family | Genus | % Abundance |
|---|---|---|---|---|
| 1 | *Bacteroidetes* | *Flavobacteriia* | *Chryseobacterium* | 7.07% |
| 2 | *Firmicutes* | *Clostridia* | *Clostridium* | 6.26% |
| 3 | *Bacteroidetes* | *Flavobacteriia* | *Flavobacterium* | 4.33% |
| 4 | *Proteobacteria* | *Alphaproteobacteria* | *Phenylobacterium* | 2.33% |
| 5 | *Proteobacteria* | *Gammaproteobacteria* | *Shewanella* | 0.11% |
| 6 | *Actinobacteria* | *Nocardiaceae* | *Rhodococcus* | 0.03% |
| 7 | *Actinobacteria* | *Mycobacteriaceae* | *Mycobacterium* | 0.02% |
| 8 | *Actinobacteria* | *Nocardioidaceae* | *Nocardioides* | 0.003% |
| 9 | *Proteobacteria* | *Rhodospirillaceae* | - | 0.11% |
| 10 | *Actinobacteria* | *Nocardiaceae* | - | 0.03% |
| 11 | *Actinobacteria* | *Nocardioidaceae* | - | 0.01% |
| 12 | *Chloroflexi* | - | - | 0.17% |
| 13 | *Planctomycetes* | - | - | 0.01% |

*amarae, Nocardia pinensis, Nocardia asteroides, Nocardia caviae,* and *Microthrix parvicella* (Blackall et al., 1991; Hwang and Tanaka, 1998; Liu et al., 2018; Madoni et al., 2000; Seviour et al., 1990). These studies have shown that bacteria (or any moderately hydrophobic particle) selectively partition out to the foam phase. These bacteria then prevent the drainage of liquid in the foam film, thereby stabilizing the foam (Heard et al., 2008). The filamentous morphology is said to aid the process of floatation and adherence to bubbles, hence enhancing foam stability (Schilling and Zessner, 2011). Table 4 shows a list of 'Filamentous' and 'Occasionally Filamentous' bacterial genus/-family/phylum identified in this study. 20.2% of the bacterial

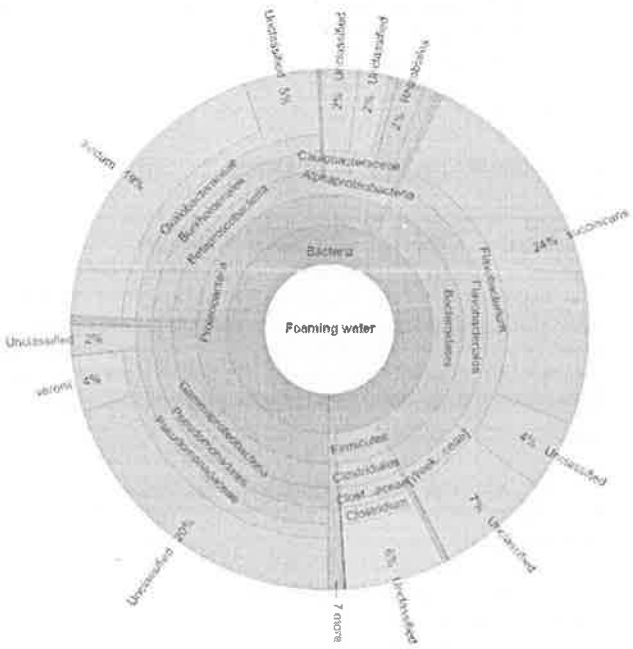


**Fig. 7c.** Krona chart for bacterial communities in Bellandur water sample.

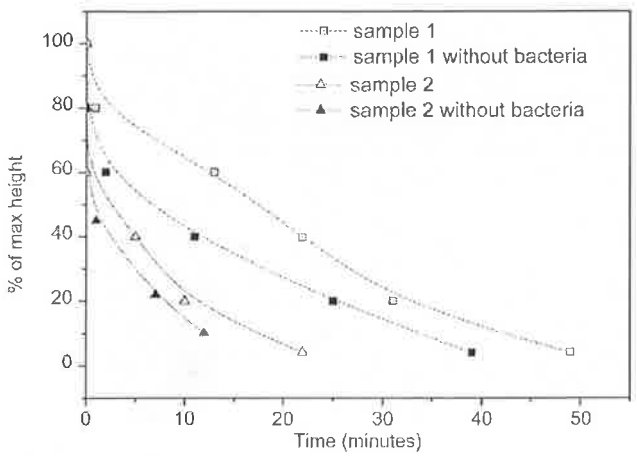


**Fig. 8.** Proof of concept: foam persistence study on Bellandur Lake samples, with and without bacteria.

community were 'Filamentous' or 'Occasionally Filamentous' in nature, and the highest abundant bacterial family was *Flavobacteriia* (11.4%). Fig. 7c shows a Krona chart (multilayered pie-chart) showing absolute abundance of each level of hierarchy within the bacterial community. This study, for the first time, confirms the presence of filamentous bacteria in the foaming surface water body.

*3.3.4. Reversing stable foaming in environmental samples: proof of concept*

To demonstrate that, mixed-culture added to foam stability, the collapse time vs height experiments were repeated on Bellandur Lake water samples (with and without the bacteria), and the results are represented in Fig. 8. Initially, Bellandur Lake water was analyzed for its foaming behaviour. For the next step, Bellandur water was centrifuged at 5000 g for 10 min to extract out bacteria. The supernatant was shaken to form a foam (following the protocol as explained in section 2.5.2), and foaming potential was studied. From Fig. 8 it can be seen that on the removal of bacteria from the Bellandur water sample (represented by 'filled symbols'); foam stability decreased as represented by faster foam collapse time. This result shows that presence of bacteria add to the stability of foam in Bellandur Lake.

## 4. Conclusion

This study attempted to record the long-term water quality of a foaming urban lake and link frequent foaming events to water quality of the lake. The results indicate that:

1) the Lake water had high levels of surfactants in the range of 8–20 ppm and was anaerobic in nature throughout the year. The major source of surfactant in the Lake was untreated household sewage discharged into the Lake. Even though the Lake had a residence time of 10 days, the surfactants did not degrade because of the extremely low DO (<1 ppm) in the lake. High levels of Phosphorus in the Lake water was observed and the Phosphorus budget linked it to untreated sewage, which was a major reason for the eutrophication of the Bellandur lake. Phosphorus is indirect source of surfactant.
2) bacterial mixed culture from Bellandur Lake synergistically contributed to the enhanced stability of the foam formed. Further, it was observed that filamentous bacteria were present in Bellandur water; this aided the foam stability. The most abundant filamentous bacterial family was *Flavobacteriia*.
3) since no standardized emission criteria for foam-abatement in urban surface water bodies exists, water quality parameters namely (i) Hardness, (ii) Surface Tension and (iii) Surfactant concentration should be included in effluent discharge standards.

Further studies on the possibility of biosurfactants from bacterial sources and aquatic weeds in foaming lakes needs to be explored. Stationary phase culture contains dead bacteria, living bacteria, and a considerable amount of Extracellular Polymeric Substances (EPS). Future research may focus on the potential role of cell wall traits and exuded EPS of bacteria on the foam stability in urban aquatic habitats. Another relatively unexplored area in surfactant chemistry is its interaction with lake sediment. Establishing adsorption and desorption isotherms of surfactants on the sediments would help quantify foaming after rain events. Also, the surfactants present in the urban lakes should be linked to its sources such as anthropogenic and naturogenic.

## Author contribution

Reshmi Das: Conceptualization, Methodology, Conducting Experiment, Data Curation, Data Analysis, Writing – original draft. Chanakya Hoysall: Planning & Reviewing.Laksminarayana Rao: Fund Acquisition, Project Administration, Resources, Reviewing & Editing draft.

## Declaration of competing interest

The authors declare no known competing financial interests/personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

All data that has been used is shared in manuscript and supplementary file

## Acknowledgement

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvman.2022.116111.

## References

APHA, 2012. Standard Methods for the Examination of Water and Wastewater, 22th Edition. American Public Health Association, American Water Works Association, Water Environment Federation.

Bareuther, M., Klinge, M., Buerkert, A., 2020. Spatio-temporal dynamics of algae and macrophyte cover in urban lakes: a remote sensing analysis of bellandur and varthur wetlands in Bengaluru, India. Rem. Sens. 12 (22), 1–25. https://doi.org/10.3390/rs12223843.

BDA, 2019. Bangalore Development Authority ACTION PLAN FOR BELLANDUR AND VARTHUR LAKE.

Blackall, L.L., Harbers, A.E., Greenfield, P.F., Hayward, A.C., 1991. Foaming in activated sludge plants: a survey in Queensland, Australia and an evaluation of some control strategies. Water Res. 25 (3), 313–317. https://doi.org/10.1016/0043-1354(91)90011-R.

Blauw, A.N., Los, F.J., Huisman, J., Peperzak, L., 2010. Nuisance foam events and Phaeocystis globosa blooms in Dutch coastal waters analyzed with fuzzy logic. J. Mar. Syst. 83 (3–4), 115–126. https://doi.org/10.1016/j.jmarsys.2010.05.008.

Carlson, R.E., 1977. A trophic state index for lakes1. Limnol. Oceanogr. 22 (2), 361–369. https://doi.org/10.4319/lo.1977.22.2.0361.

Cloutier, R.G., Sanchez, M., 2007. Trophic status evaluation for 154 lakes in quebec, Canada: monitoring and recommendations. Water Quality Research Journal 42 (4), 252–268. https://doi.org/10.2166/wqrj.2007.028.

Coffey, William L.P., 1986. Organic Matter in Seafoam (Cumberland Basin, N.B.). Honours Thesis. Mount Allison University, Sackville, New Brunswick, Canada.

Cohen, L., Moreno, A., Berna, J.L., 1993. Influence of anionic concentration and water hardness on foaming properties of a linear alkylbenzene sulfonate. JAOCS (J. Am. Oil Chem. Soc.) 70 (1), 75–78. https://doi.org/10.1007/BF02545371.

Craig, D., Ireland, R.J., Bärlocher, F., 1989. Seasonal variation in the organic composition of seafoam. J. Exp. Mar. Biol. Ecol. 130 (1), 71–80. https://doi.org/10.1016/0022-0981(89)90019-1.

Department of Consumer Affairs India, 2018. Household Detergent Powders. CONSUMER VOICE, pp. 8–16. AUGUST 2018.

Dhakwal, R.S., 1979. Nocardia amarae and activated sludge foaming. J. Water Pollut. Control Fed. 51, 144–150.

Eberstreich, S.J., Eberman, A.W., Armstrong, D.E., 1978. Enrichment of intermonolayers, heavy metals, and chlorinated hydrocarbons in wind-generated Lake foam. In: Bull. Environ. Contam. Toxicol, vol. 34. Chem. Soc. London. Special Publ. Issue 1.

Eberman, A.W., Armstrong, D.E., 1979. Enrichment of Zn, Cd, Pb, and Cu in the surface microlayer of lakes Michigan, Ontario, and Mendota. Limnol. Oceanogr. 24 (1), 133–144. https://doi.org/10.4319/lo.1979.24.1.0133.

EPA, 1986. General standards for discharge of environmental pollutants in. The Environment (Protection) Rules.

Franzetti, A., Caredda, P., la Colla, P., Pintus, M., Tamburini, E., Papacchini, M., Bestetti, G., 2009. Cultural factors affecting biosurfactant production by Gordonia sp. RS29. Int. Biodeterior. Biodegrad. 63 (7), 943–947. https://doi.org/10.1016/j.ibiod.2009.06.004.

Fryer, M., Gray, N.F., 2012. Foaming Scum Index (FSI) - a new tool for the assessment and characterisation of biological mediated activated sludge foams. J. Environ. Manag. 110, 8–19. https://doi.org/10.1016/j.jenvman.2012.05.009.

Hanif, N.M., Nurul, S., Adnan, N., Latif, M.T., Zakaria, Z., Othman, M.R., 2012. The comparison of surfactants in river water and its influence to the amount of surfactants in drinking water. World Appl. Sci. J. 17 (8), 970–975 https://doi.org/ISSN1818-4952.

Heard, J., Harvey, E., Johnson, B.B., Wells, J.D., Angove, M.J., 2008. The effect of filamentous bacteria on foam production and stability. Colloids Surf. B Biointerfaces 63 (1), 21–26. https://doi.org/10.1016/j.colsurfb.2007.10.011.

Hwang, Y., Tanaka, T., 1998. Control of Microthrix parvicella foaming in activated sludge. Water Res. 32 (5), 1678–1686. https://doi.org/10.1016/S0043-1354(97)00380-1.

Ivanković, T., Hrenović, J., 2010. Surfactants in the environment. Arh. Hig. Rad. Toksikol. 61 (1), 95–110. https://doi.org/10.2478/10004-1254-61-2010-1943.

Jamwal, P., 2017. Fate of nutrients in human dominated ecosystems: a case study of Jakkur Lake in Bengaluru. Resonance 22 (3), 279–290. https://doi.org/10.1007/s12045-017-0469-7.

Director of Census Operations, Kumar, A., 2011. CENSUS of INDIA 2011 Primary Census Abstract Data Highlights.

Kumar, M., Sharif, M., Ahmed, S., 2020. Impact of urbanization on the river Yamuna basin. Int. J. River Basin Manag. 18 (4), 461–475. https://doi.org/10.1080/15715124.2019.1613412.

Kundu, S., Vassanda Coumar, M., Rajendiran, S., Subba Rao, A., 2015. Phosphates from detergents and eutrophication of surface water ecosystem in India. Curr. Sci. 108 (7). https://www.currentscience.ac.in/Volumes/108/07/1320.pdf.

Li, G., Bai, X., Li, H., Lu, Z., Zhou, Y., Wang, Y., Cao, J., Huang, Z., 2019. Nutrients removal and biomass production from anaerobic digested effluent by microalgae: a review. Int. J. Agric. Biol. Eng. 12 (5), 8–13. https://doi.org/10.25165/ijabe.20191205.5030.

Liu, G., Wang, J., Campbell, K., 2018. Formation of filamentous microorganisms impedes oxygen transfer and decreases aeration efficiency for wastewater treatment. J. Clean. Prod. 189, 502–509. https://doi.org/10.1016/j.jclepro.2018.04.125.

Madoni, P., Davoli, D., Gibin, G., 2000. Survey of filamentous microorganisms from bulking and foaming activated- sludge plants in Italy. Water Res. 34 (6), 1767–1772. https://doi.org/10.1016/S0043-1354(99)00354-8.

Maharana, D.M., Chanakya, H.N., Ramachandra, T.V., 2011. Assessment of treatment capabilities of. Int. J. Environ. Technol. Manag. 14, 84–102.

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Pagilla, K.R., Sood, A., Kim, H., 2002. Gordonia (nocardia) amarae foaming due to biosurfactant production. Water Sci. Technol. 46 (1–2), 519–524. https://doi.org/10.2166/wst.2002.0628.

Petrovski, S., Dyson, Z.A., Quill, E.S., McIlroy, S.J., Tillett, D., Seviour, R.J., 2011a. An examination of the mechanisms for stable foam formation in activated sludge systems. Water Res. 45 (5), 2146–2154. https://doi.org/10.1016/j.watres.2010.12.026.

Petrovski, S., Dyson, Z.A., Quill, E.S., McIlroy, S.J., Tillett, D., Seviour, R.J., 2011b. An examination of the mechanisms for stable foam formation in activated sludge systems. Water Res. 45 (5), 2146–2154. https://doi.org/10.1016/j.watres.2010.12.026.

Ramachandra, T.V., Asulabha, K.S., Sincy, V., Bharath, H. Aithal, Sudarshan, P.B., Durga, M.M., 2015. Pathetic Status of Wetlands in Bangalore: Epitome of Inefficient and Uncoordinated Governance. https://doi.org/10.13140/RG.2.1.1092.7846.

Rubio, V., López-Sánchez, J.F., Pardo, P., Rauret, G., Muntau, H., Quevauviller, P., 1999. Selection and evaluation of sequential extraction procedures for the determination of phosphorus forms in lake sediment. J. Environ. Monit. 1, 51–56.

Ruzicka, K., Gabriel, O., Wegricht, U., Winkler, S., Zessner, M., 2009. Foam formation on an Austrian-Hungarian lowland river: reasons, methods and solutions. Water Sci. Technol. 60 (6), 1379–1384. https://doi.org/10.2166/wst.2009.204.

Schilling, K., Zessner, M., 2011. Foam in the aquatic environment. In: Water Research, vol. 45, pp. 4355–4366. https://doi.org/10.1016/j.watres.2011.05.004, 15.

Seviour, E.M., Williams, C.J., Seviour, J., R.J., Soddell, J.A., Lindrea, K.C., 1990. A survey of filamentous bacterial populations from foaming activated sludge plants in eastern states of Australia. Wat. Res. 24 (issue 4).

Shetye, S.S., Bandekar, M., Nandakumar, K., Kurian, S., Gauns, M., Jawak, S., Pratihary, A., Elangovan, S.S., Naik, B.R., Lakshmi, S., Aswathi, V.K., 2021. Sea foam-associated pathogenic bacteria along the west coast of India. Environ. Monit. Assess. 193 (1) https://doi.org/10.1007/s10661-020-08784-4.

Siddiqui, Z.H., Wattal, R.K., Batchu, H., Abbas, Z.K., 2020. Assessment of cytotoxic and genotoxic effects of Yamuna river water pollutants in an urban metropolis, Delhi (India). Water Sci. Technol. Water Supply 20 (7), 2682–2697. https://doi.org/10.2166/ws.2020.165.

Sridhar, M.K.C., Rami Reddy, C., 1984. Surface tension of polluted waters and treated wastewater. Environ. Pollut. Ser. B Chem. Phys. 7 (1), 49–69. https://doi.org/10.1016/0143-148X(84)90037-5.

Stefani, F., Salerno, F., Copetti, D., Rabuffetti, D., Guidetti, L., Torri, G., Naggi, A., Iacomini, M., Morabito, G., Guzzella, L., 2016. Endogenous origin of foams in lakes: a long-term analysis for Lake Maggiore (northern Italy). Hydrobiologia 767 (1), 249–265. https://doi.org/10.1007/s10750-015-2498-8.

Sun, S., Huang, S., Sun, X., Wen, W., 2009. Phosphorus fractions and its release in the sediments of Haihe River, China. J. Environ. Sci. 21 (3), 291–295. https://doi.org/10.1016/S1001-0742(08)62265-4.

Walstra, P., 1989. Principles of Foam Formation and Stability, pp. 1–15. https://doi.org/10.1007/978-1-4471-3807-5_1.

Wang, L., Wang, X., Jin, X., Xu, J., Zhang, H., Yu, J., Sun, Q., Gao, C., Wang, L., 2017. Analysis of algae growth mechanism and water bloom prediction under the effect of multi-affecting factor. Saudi J. Biol. Sci. 24 (3), 556–562. https://doi.org/10.1016/j.sjbs.2017.01.026.

Wegner, C., Hamburger, M., 2002. Occurrence of a stable foam in the upper Rhine river caused by plant derived surfactants. Environ. Sci. Technol. 36, 3250–3256.

Wilson, M.L., Robertson, L.D., Daly, M., Walton, S.A., 1995. Effects of visual cues on assessment of water quality. J. Environ. Psychol. 15 (1), 53–63. https://doi.org/10.1016/0272-4944(95)90014-4.

Das, R., Rao, L., Jai Prakash, B., Chanakya, H., 2019. Froths, fires and fights over sustainability of bellandur lake - a case for intensive environmental detectivism (ISSN: 2282–0027 - ISBN: 9,788,862,550,144). In: Proceedings of Sardinia (2019). CISA Publishers, 1,348,582. http://eprints.iisc.ac.in/id/eprint/71559.

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Chief Engineer (P)
Bangalore Water Supply
and Sewerage Board
Bangalore 560 009

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## Annexure R-7

**DIARY NO. - 20422/2021**

**PREMAKALA PRABHAKARA REDDY VS. THE STATE OF KARNATAKA**

| **Case Details** | |
|---|---|
| Diary Number | **20422/2021** Filed on 31-08-2021 12:00 AM [ **SECTION: IV-A**] **PENDING** |
| Case Number | SLP(C) No. 016055 - / 2021 Registered on 05-10-2021 (Verified On 22-03-2022) |
| CNR Number | SCIN010204222021 |
| Present/Last Listed On | **03-11-2025 [HON'BLE THE CHIEF JUSTICEand HON'BLE MR. JUSTICE K. VINOD CHANDRAN]** |
| Status/Stage | Pending[] (Motion Hearing [AFTER NOTICE (FOR ADMISSION) - CIVIL CASES]) Not taken up/ Not Today-Ord dt:03-11-2025 |
| Tentatively case may be listed on (likely to be listed on) | 09-01-2026 (Computer generated) |
| Category | 3001-Land Acquisition and Requisition : Challenge to land acquisition, lapsing of acquisition, de-reservation, requisition and de-requisition of property and others |
| Petitioner(s) | 1 PREMAKALA PRABHAKARA REDDY<br>2 B.N. ADARSH |
| Respondent(s) | 1 THE STATE OF KARNATAKA<br>2 KARNATAKA INDUSTRIAL AREA DEVELOPMENT BOARD<br>3 THE SPECIAL LAND ACQUISITION OFFICER<br>4 BANGALORE WATER SUPPLY AND SEWERAGE BOARD |
| Petitioner Advocate(s) | DEVASA & CO. |
| Respondent Advocate(s) | ANURADHA MUTATKAR[caveat]<br>NISHANTH PATIL[R-2]<br>NISHANTH PATIL[R-3]<br>SANCHIT GARGA[R-1] |

# Annexure R-8

**COMPLIANCE FOR NGT MATTER O.A. No.111/2020 Re: Frothing and foaming in Thenpennai River.**

| Sl No. | Observation | Para wise compliance |
|---|---|---|
| 1. | The report dated 20.08.2025 of the Chief Secretary, State of Karnataka, regarding their action taken pursuant to the orderpassedinO.A.No.111of2020(SZ)dated28.06.2021isfiled. | Noted |
| 2. | The said action taken report details the action taken by the Karnataka State Pollution Control Board against the polluting industries, the Real Time Monitoring System and the results of the Real Time Monitoring The said action taken report details the action taken by the Karnataka State Pollution Control Board against the polluting industries, the Real Time Monitoring System and the results of the Real Time Monitoring System. | NA |
| 3 | The action taken by the Bengaluru Water Supply and Sewerage Board (BWSSB) regarding the sewage generated in the river catchment area is also mentioned. As per the same, the existing 16 STPs of the total installed capacity was 621.5 MLD and the treating capacity was 550 MLD. Presently, the BWSSB is having 26 STPs with a capacity of 958.5 MLD and is treating 830 MLD. | Noted |
| 4 | It is specifically stated that the total quantity of sewage generated in the Thenpennai River catchment area is 1329 MLD and they are proposed to construct 12 STPs of 225 MLD capacity both in Hebbala and K & C Valley. | Noted, the construction of 12 No. STP's of 225 MLD capacity is under progress. |
| 5 | The timeline indicates that 04 projects are scheduled for completion by the end of December 2025, 06 by the end of December 2026, and 01 by the end of December 2027 | Noted, and accordingly the works will be completed. |
| 6 | As an interim measure, they provided the UGD facilities to Byatarayanapura Bommanahalli & Mahadevapura Zones coming under 110 Villages to a total length of 800 Kms. Besides the interim measures, the long-term measures were undertaken by the BWSSB. It is stated that the core areas of CMC/TMC have a UGD network in a complete manner. Therefore, the sewage from these areas is conveyed out through the piped network. | Noted |
| 7 | The report further states that, until the STP's are completed and connected to the 30,000 households, the residents are currently relying on their individual soak pits for sewage disposal. However, the continued use of such | The soak pits/ septic tanks are not a long term measures, thus after completion and commissioning of STPs within a span of 6 months, these 30,000 households can be taken in to the UGD system. |

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Submitted by BWSSB on 23/9/2025

CEO-2, KSPCB

Chief Engineer (P)
Bangalore Water Supply
and Sewerage Board
Bangalore 560 009

Chief Engineer
(WWM-East)
BWSSB

Chief Engineer
(WWM-West)
BWSSB

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| | | |
|---|---|---|
| | soak pits without septic tanks requires examination, as they may pose a risk of groundwater contamination in the long run. | |
| 8 | Accordingly, the Chief Secretary, State of Karnataka, is directed to file a detailed report addressing the recurrence of the toxic foam discharge into the dam, indicating the immediate and strict interim measures being implemented until the long-term remedial measures are fully operational. | As BWSSB conveys and treats the domestic sewage through closed network system, it does not come in contact with the atmosphere leading to odor and septicity of sewage. Thus there is no any discharge resulting in toxic foam from domestic sewage.<br><br>However, as submitted earlier the construction of 25 MLD capacity STP at Varthur under JICA Phase III is very much essential, which is not yet started due to land dispute before Hon'ble High court of Karnataka. Until & unless Varthur STP does not commission the sewage generated in Mahadevapura zone cannot be treated in a complete manner, which is a major catchment of Dashinapinaki along with completion of works proposed under Long term measures. |
| 9 | The State of Tamil Nadu is also directed to monitor the directions already issued by the Joint Committee in O.A. No.111 of 2020(SZ) and join hands with the State of Karnataka in implementing the directions issued and file a report in this regard. | |

**Observation:** Since upcoming STP and the UGD network are said to be completed by December 2025, what interim measures are being taken by the State to ensure that sewage does not enter the river water

**Compliance:** As submitted, BWSSB has assured the completion 4 No. of STP's to be completed by December 2025. Accordingly, the works are under progress and presently the UGD network work is almost completed and the STP works is in progress

As there is no any other alternates until completion & commissioning of ongoing STP's by 2025, the 30,000 household connections cannot be taken into sewerage network of BWSSB.

Hence, to avoid discharge of untreated sewage into storm water drains which may lead to contamination of water bodies, the existing system has to be retained.

CE(WWM-E)
BWSSB

CE(WWM-W)
BWSSB

CE(P)
BWSSB

TRUE COPY

Chief Engineer (P)
Bangalore Water Supply
and Sewerage Board
Bangalore 560 009

Chief Engineer
(WWM-East)
BWSSB

Chief Engineer
(WWM-West)
BWSSB

Phone:080-22945350 Email:ceewwmwest@bwssb.gov.in

**BENGALURU WATER SUPPLY AND SEWERAGE BOARD**
**Office of the Engineer In Chief**
**2nd Floor, Cauvery Bhavan, KG Road, Bangalore - 560009**

No.BWSSB/EIC/CE(WWM-WEST)/ DCE(WWM-E&W)/TA-2/880/2025-26 Dt: 13/10/25

To,
The Member Secretary,
Karnataka State Pollution Control Board,
Parisara Bhavan, 1st to 5th Floors,
No.49, Church Street
Bangalore – 560 001

Sir,

**Sub:** Furnishing latest status of action taken report in respect of Hon'ble National Green Tribunal in OA 111 of 2020 (SZ) - reg.

**Ref:** 1. Proceeding of the NGT case hearing held on 21.08.2025.
2. Mail from Mr. Darpan KM, Standing Council, State of Karnataka in the NGT Matter of OA No.111 of 2020 (SZ) dated: 22.08.2025.
3. Compliance report submitted by your end dtd. 23.09.2025
4. No.PCB/CEO-2/O.A 111/2024-25/2742 Dt : 03.10.2025.

~*~*~*~

With reference to above subject, it is hereby submitting the compliance to the Action Taken Report with respect to OA No. 111/2020 is enclosed with this letter.

Thanking you,

Yours faithfully,

**Engineer In Chief (I/C)**
BWSSB

Copy to Hon'ble Chairman for kind information.
Copy to CE(WWM-West) for information.
Copy to CE(WWM-East) for information.
Copy to CE(P) for information.

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**COMPLIANCE FOR NGT MATTER O.A. No.111/2020 Re: Frothing and foaming in Thenpennai River. (CE(P) Zone-09.10.2025**

| Sl No. | Observation | Compliance |
|---|---|---|
| 1. | Your reply is silent about the immediate and strict interim measures incorporated to treat the balance quantity of sewage in complete manner until construction of 25 MLD capacity STP at Varthur JICA Phase-III. | As already replied, the construction of STP at Varthur is proposed based on the topography of the contributing catchment area. The proposed STP site is bowl shaped and most suitable for construction of STP. Further, sewage flow from all the catchment gravitates to connect to STP.<br>Accordingly, the sewer network (laterals and sub-mains) are laid considering the proposed location of STP with construction of 15 MLD ISPS at Hagadur.<br>Hence, the construction of STP is the only solution to control the surface water pollution and entry of sewage into open drains. Apart from this there are no any other immediate and strict interim measures to treat the balance quantity of sewage. |
| 2. | Further, you have not submitted the work order and progress report w.r.t the upcoming STPs submitted as mentioned in the previous affidavit -12 STPs of 225 MLD capacity in both Hebbal and K & C Valley<br>• 4 STPs by end of December 2025<br>• 6 STPs by the end of December 2026<br>• 01 STP by the end of 2027 | Please refer the updated status of Annexure-A & C |

CE(WWM-E)
BWSSB

CE(WWM-W)
BWSSB

CE(P)
BWSSB

TRUE COPY

Chief Engineer (P)
Bangalore Water Supply
and Sewerage Board
Bangalore 560 009

Chief Engineer
(WWM-East)
BWSSB

Chief Engineer
(WWM-West)
BWSSB

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| List of Under Construction STPs (BWSSB) Annexure A | | | | | | |
|---|---|---|---|---|---|---|
| Sl. No. | STP location | Proposed capacity (MLD) | Amount in crore | Technology used | Proposed date of completion of work | Status of the project |
| 1 | Kaggadasapura | 5 | 26.38 | SBR | 31.12.2025 | Earlier location was downstream side of lake i.e., 2.5 Acre land due to local objection and as per direction of Hon'ble High Court STP location was shifted and land located only 1.18 Acre and near mouth of storm water drain as such monsoon period entire plant flooded and contractor unable to carryout the work during monsoon period. But now 70% work completed and balance 30% will be completed by December 2025 |
| 2 | Varthur | 25 | 95.25 | EA | - | After clearance of court case pending in Hon'ble Supreme Court and High Court, the construction work will be taken up |
| 3 | Bilishivale | 17 | 61.61 | SBR | 30.04.2026 | Under progress |
| 4 | Doddabetta hally | 7 | 36.30 | SBR | 31.12.2025 | The civil structures along with electro- mechanical installation of STPs at Jakkur-7MLD, Doddabettahally-7MLD & Yelahanka Kere- 6 MLD under JICA V stage will be completed by the end of December-2025 and STP will be commissioned in full manner by the mid of 2026. |
| 5 | Jakkur | 7 | 31.27 | SBR | 31.08.2025 | |
| 6 | Yelahanka | 6 | 38.29 | SBR | 31.12.2025 | |
| 7 | Jakkur-down stream | 10 | 29.33 | SBR | 31.12.2026 | Works are under progress and the same will be completed by the end of December 2026. |
| 8 | Byrahikanne | 13 | 49.68 | SBR | 31.12.2026 | |
| 9 | Anjanapura | 5 | 28.20 | SBR | 31.12.2026 | |
| 10 | Rachenahalli | 10 | 32.85 | SBR | 31.03.2026 | Works are under progress and the same will be completed by the end of March 2026 |
| 11 | Horamavu | 60 | 149.55 | IFAS | 31.12.2026 | Works are under progress and the same will be completed by the end of December 2026 |
| 12 | Hebbal | 60 | 139.40 | IFAS | 28.02.2027 | Works are under progress and the same will be completed by the end of February 2027 |
| Total | | 225.00 | 718.11 | | | |

CE(WWM-East)
BWSSB

CE(WWM-West)
BWSSB

CE(P)
BWSSB

TRUE COPY

Chief Engineer (P)
Bangalore Water Supply and Sewerage Board
Bangalore 560 009

Chief Engineer
(WWM-East)
BWSSB

Chief Engineer
(WWM-West)
BWSSB

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**Annexure R-2**

| List of proposed STPs (BWSSB) Annexure C | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sl. No.** | **STP location** | **Proposed capacity (MLD)** | **Amount in crore** | **Technology used** | **Date of commencement** | **Date of completion** | **Status of the project** |
| 1 | Kogilu | 15 | 39.97 | Sequential Batch Reactor (SBR) | 25-08-2025 | 24-02-2028 | The work orders for the construction of 6 STPs along with UGD network of various capacities totalling to 98 MLD proposed under World Bank fundered Karnataka Water Security Resiliance Programme is issued and copies of the same is enclosed for reference. As recently, the work orders are issued the contractors are engaged in mobilization of men and materials and soil investigation/geo-technical |
| 2 | Channasandra | 20 | 48.18 | Sequential Batch Reactor (SBR) | 25-08-2025 | 24-02-2028 | |
| 3 | Sowlkere | 28 | 59.02 | Sequential Batch Reactor (SBR) | 29-08-2025 | 28-02-2028 | |
| 4 | Chikkabegur | 15 | 39.97 | Sequential Batch Reactor (SBR) | 29-08-2025 | 28-02-2028 | |
| 5 | Hulimavu | 15 | 39.97 | Sequential Batch Reactor (SBR) | 25-08-2025 | 24-02-2028 | |
| 6 | Ibblur | 5 | 15 | Sequential Batch Reactor (SBR) | 25-08-2025 | 24-02-2028 | |
| **Total** | | **98.00** | **227.11** | | | | |

CE(P)
BWSSB

CHAIRMAN
BWSSB

e-mail :cep@bwssb.gov.in

Telephone: 080-22945108

**BANGALORE WATER SUPPLY AND SEWERAGE BOARD**
**Office of the Chief Engineer (Project)**
Cauvery Bhavan III Floor, Bangalore 560009

No. BWSSB/CE (P) /ACE(P)-1/ 987 /2025-26 Dt: 22/08/2025.

**NOTICE TO PROCEED WITH THE WORK**

To,
M/s. Enviro Infra Engineers Limited
201, Second Floor, RG Metro Arcade,
Rohini Sector 11, Delhi-110085
Delhi (India).

Sir,

Sub: Design, Engineering, Construction and Commissioning of Wastewater Treatment Plants with Tertiary Treatment Facility and Intermediate Sewage Pumping Station along with Operation & Maintenance thereof for Ten years for Byatarayanapura Zone (DBO mode) in 110 village areas (Phase II) under Karnataka Water Security and Disaster Resilience Program (KWSDRP) – (Contract package No. BWSSB CE-P/KWSDRP/WBS-II-A).

Ref:
1. IFT No. BWSSB/CE(P)/ACE(P)-1/ACE(P)-1/110/2025-26,Dtd: 24.04.2025
2. Indent No. BWSSB/2025-26/WT/WORK_INDENT2252
3. Approval of Board in its meeting held on 15.07.2025
4. LOA No.BWSSB/CE(P)/ACE(P)-1/ACE(P)-1/814/2025-26 Dtd: 23.07.2025.
5. BG No: 027GT02252130011 Date: 01.08.2025- Rs. 2,70,00,000/-.
6. Agreement No.:22/2025-26 Date: 22.08.2025.

*******

Pursuant to furnishing the requisite security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement in respect of "Design, Engineering, Construction and Commissioning of Wastewater Treatment Plants with Tertiary Treatment Facility and Intermediate Sewage Pumping Station along with Operation & Maintenance thereof for Ten years for Byatarayanapura Zone (DBO mode) in 110 village areas (Phase II) under Karnataka Water Security and Disaster Resilience Program (KWSDRP) – (Contract package no. BWSSB CE-P/KWSDRP/WBS-II-A)", you are hereby informed to proceed with the execution of the said work in accordance with the Contract Documents and as per the directions of EE (P)-2.

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The details of work are as follows:

| | | |
|---|---|---|
| 1 | Sanctioned Estimate cost | Rs. 92.05 Crores (vide CER No.02/2025-26 date:24.04.2025) |
| 2 | Amount put to Tender excluding GST | Rs.71,69,63,260/- |
| 3 | Evaluated cost excluding GST | Rs.67,81,00,000/- (Rupees Sixty-Seven Crore Eighty One Lakh only)<br>Capital Cost- Rs.53,81,00,000/-<br>Opex Cost- Rs.14,00,00,000/- for 10 years<br>GST will be paid in accordance with contract conditions as per actual. |
| 4 | Percentage at which work is to be executed | 5.42 %below the amount put to tender |
| 5 | Contract duration | 30 months (including monsoon) |
| 6 | Date of Commencement | 25.08.2025 |
| 7 | Date of Completion | 24.02.2028 |
| 8 | O & M period (Work A) | 10 years from the Taking-Over certificate. |
| 9 | Head of Account | "CE-KWSDRP-SWPL for the year 2025-26" |

You are hereby requested to start the work immediately and complete the same by fulfilling the tender specifications, satisfactorily and hand over to the Board in a complete manner within the stipulated period.

As per the contract conditions stipulated under Contract Data, you are hereby informed to submit the performance security deposit amount equivalent to 5% of total O &M Price for 10 years starting from the date of completion of the works (date of issue of the Taking-Over Certificate) before commencement of O & M period. Further, additional security for unbalanced O & M tender in accordance with Clause 25.5 of ITT and Clause 44 of the Conditions of Contract amounting to Rs. 6,75,85,152/- need to be furnished.

You are requested to contact EE (P)-2 Division, BWSSB, Bangalore for further needful.

Thanking you

Yours faithfully

**Chief Engineer (Project)**
**BWSSB**

1. Copy submitted to Hon'ble Chairman for kind information.
2. Copy submitted to EIC for kind information.
3. Copy to EE(P)-2 Division along with Approved BOQ, Bid Documents, Original BG along with confirmation & Agreement copy for information and necessary action.
4. Copy to M/s. TCE LTD-NJSEI-JV for information and necessary action.

210

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e-mail: ce-p@bwssb.gov.in

Telephone: 080-22945108

**BANGALORE WATER SUPPLY AND SEWERAGE BOARD**
**Office of the Chief Engineer (Project)**
Cauvery Bhavan III Floor, Bangalore 560009

No. BWSSB/CE (P) /ACE(P)-2/ 975 /2025-26 Dt: 21/08/2025.

**NOTICE TO PROCEED WITH THE WORK**

To,
M/s. VA TECH WABAG Limited
"WABAG House", No. 17, 200 Feet Thoraipakkam,
Pallavaram Main Road, Sunnambu,
Kolathur, Chennai-600117.

Sir,

Sub: Design, Engineering, Construction and Commissioning of Wastewater Treatment Plants with Tertiary Treatment Facility, Biogas Generation & Solar Sludge Drying Bed and Intermediate Sewage Pumping Station along with Operation & Maintenance Thereof for Ten years [Works - A] and Procurement and Construction of Rising Main, Main Sewers and laterals including Machine holes and Lift Sewage Pumping Stations [Works – B] Hybrid Mode for Bommanahalli Zones in 110 village areas (Phase II) under Karnataka Water Security and Disaster Resilience Program (KWSDRP) - (Contract Package No. BWSSB CE-P/KWSDRP/WBS-III).

Ref: 1. IFT No. BWSSB/CE(P)/ACE(P)-1,2/TA/141/2025-26,Dtd: 29.04.2025
2. Indent No. BWSSB/2025-26/WT/WORK_INDENT2255
3. Approval of Board in its meeting held on 15.07.2025
4. LOA No. BWSSB/CE(P)/ACE(P)-2/828/2025-26 Dtd: 25.07.2025.
5. BG No: 1810IGPER021825 Date: 28.07.2025, Rs. 16,57,00,000/-.
6. Agreement No.: 21 Date : 21/08/2025

*******

Pursuant to furnishing the requisite security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement in respect of "Design, Engineering, Construction and Commissioning of Wastewater Treatment Plants with Tertiary Treatment Facility, Biogas Generation & Solar Sludge Drying Bed and Intermediate Sewage Pumping Station along with Operation & Maintenance Thereof for Ten years [Works - A] and Procurement and Construction of Rising Main, Main Sewers and laterals including Machine holes and Lift Sewage Pumping Stations [Works – B] Hybrid Mode for Bommanahalli Zones in 110 village areas (Phase II) under Karnataka Water Security and Disaster Resilience Program (KWSDRP) (Contract Package No. BWSSB CE-P/KWSDRP/WBS-III)", you are hereby informed to proceed with the execution of the said work in accordance with the Contract Documents and as per the directions of EE (P)-1.

The details of work are as follows:

| | | |
|---|---|---|
| 1 | Sanctioned Estimate cost | Rs.470.20 Crores (vide CER No.04/2025-26 date: 24.04.2025) |
| 2 | Amount put to Tender excluding GST | Rs. 362,42,17,771/- Crores |
| 3 | Evaluated cost excluding GST | Rs.380,39,60,300/-(Rupees Three Hundred Eighty Crore Thirty-Nine Lakh Sixty Thousand and Three Hundred only)<br>Capital Cost- Rs.331,39,60,300/-<br>~~Opex Cost- Rs.49,00,00,000/- for 10 years (For Work A only).~~<br>GST will be paid in accordance with contract conditions as per actual. |
| 4 | Percentage at which work is to be executed | 4.95% above the amount put to tender |
| 5 | Contract duration | 30 months (including monsoon) |
| 6 | Date of Commencement | 25.08.2025 |
| 7 | Date of Completion | 24.02.2028 |
| 8 | O & M period (Work A) | 10 years from the Taking-Over certificate. |
| 9 | Head of Account | "CE-KWSDRP-SWPL for the year 2025-26" |

You are hereby requested to start the work immediately and complete the same by fulfilling the tender specifications, satisfactorily and hand over to the Board in a complete manner within the stipulated period.

As per the contract conditions stipulated under Contract Data (Work A), you are hereby informed to submit the performance security deposit amount equivalent to 5% of total O &M Price for 10 years starting from the date of completion of the works (date of issue of the Taking-Over Certificate) before commencement of O & M period. Further, additional security for unbalanced O & M tender in accordance with Clause 25.5 of ITT and Clause 44 of the Conditions of Contract amounting to Rs. 28,23,61,000/- need to be furnished.

You are requested to contact EE (P)-3 Division, BWSSB, Bangalore for further needful.

Thanking you

Yours faithfully

Chief Engineer (Project)
BWSSB

1. Copy submitted to Hon'ble Chairman for kind information.
2. Copy submitted to EIC for kind information.
3. Copy to EE(P)-3 Division along with Approved BOQ, Bid Documents, Original BG along with confirmation & Agreement copy for information and necessary action.
4. Copy to the TCF (P) ... for information and necessary action.

ENGINEER (PRO) BWSSB

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e-mail :cep@bwssb.gov.in

Telephone: 080-22945108

**BANGALORE WATER SUPPLY AND SEWERAGE BOARD**
**Office of the Chief Engineer (Project)**
Cauvery Bhavan III Floor, Bangalore 560009

No. BWSSB/CE (P) /ACE(P)-2/ 1603 /2025-26 Dt: 28 /08/2025.

**NOTICE TO PROCEED WITH THE WORK**

To,
M/s. Eco-Protection Engineers Pvt. Ltd- M/s. TECTON
Engineering & Construction (India) Pvt. Ltd. (JV)
No. 943, 54th Street, TVS Colony
Anna Nagar West Ext.
Chennai-600101

Sir,

Sub: Design, Engineering construction and commissioning of wastewater Treatment Plants with Tertiary Treatment Facility and Intermediate Sewage Pumping Station along with Operation & Maintenance thereof for ten years (Works-A) and procurement and construction of Rising Main, main sewers and laterals including machine holes and lift sewage pumping stations(Works-B) hybrid mode for Bommanahalli zone in 110 village areas(Phase-II) under Karnataka Water Security and Disaster Resilience Program(KWSDRP)-(Contract package No. BWSSB CE-P/KWSDRP/WBS-IV).

Ref: 1. IFT No. BWSSB/CE(P)/ACE(P)-1,2/TA/141/2025-26 Dtd.29.04.2025
2. Indent No. BWSSB/2025-26/WT/WORK_INDENT2256
3. Approval of Board in its meeting held on 15.07.2025
4.LOA No. BWSSB/CE(P)/ACE(P)-2/832/2025-26 Date: 28.07.2025.
5. BG No: 0734725BG0B00154 Date: 05.08.2025- Rs. 8,26,00,000/-.
6. Agreement No.: 26/2025-26 Date:28.08.2025.

*******

Pursuant to furnishing the requisite security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement in respect of "Design, Engineering construction and commissioning of wastewater Treatment Plants with Tertiary Treatment Facility and Intermediate Sewage Pumping Station along with Operation & Maintenance thereof for ten years (Works-A) and procurement and construction of Rising Main, main sewers and laterals including machine holes and lift sewage pumping stations(Works-B) hybrid mode for Bommanahalli zone in 110 village areas(Phase-II) under Karnataka Water Security and Disaster Resilience Program(KWSDRP)-(Contract package No. BWSSB CE-P/KWSDRP/WBS-IV)", you are hereby informed to proceed with the execution of the said work in accordance with the Contract Documents and as per the directions of EE (P)-3.

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The details of work are as follows:

| | | |
|---|---|---|
| 1 | Sanctioned Estimate cost | Rs.232.05 Crores (vide CER No.06/2025-26 date:24.04.2025) |
| 2 | Amount put to Tender excluding GST | Rs.179,12,46,564/- |
| 3 | Evaluated cost excluding GST | Rs.185,14,59,790/- (Rupees One Hundred Eighty Five Crore Fourteen Lakh Fifty Nine Thousand Seven Hundred and Ninety only)<br>Capital Cost - Rs. 165,14,59,790/-<br>Opex Cost - Rs.20,00,00,000/- for 10 years (For Work A only).<br>GST will be paid in accordance with contract conditions as per actual. |
| 4 | Percentage at which work is to be executed | 3.36 % above the amount put tender |
| 5 | Contract duration | 30 months (including monsoon) |
| 6 | Date of Commencement | 29.08.2025 |
| 7 | Date of Completion | 28.02.2028 |
| 8 | O & M period (Work A) | 10 years from the Taking-Over certificate. |
| 9 | Head of Account | "CE-KWSDRP-SWPL for the year 2025-26" |

You are hereby requested to start the work immediately and complete the same by fulfilling the tender specifications, satisfactorily and hand over to the Board in a complete manner within the stipulated period.

As per the contract conditions stipulated under Contract Data (Work A), you are hereby informed to submit the performance security deposit amount equivalent to 5% of total O & M Price for 10 years starting from the date of completion of the works (date of issue of the Taking-Over Certificate) before commencement of O & M period. Further, additional security for unbalanced O & M tender in accordance with Clause 25.5 of ITT and Clause 44 of the Conditions of Contract amounting to Rs. 24,96,80,000/- need to be furnished.

You are requested to contact EE (P)-3 Division, BWSSB, Bangalore for further needful.

Thanking you

Yours faithfully

**Chief Engineer (Project)**
**BWSSB**

1. Copy submitted to Hon'ble Chairman for kind information.
2. Copy submitted to EIC for kind information.
3. Copy to EE (P)-3 Division along with Approved BOQ, Bid Documents, Original BG along with confirmation & Agreement copy for information and necessary action.
4. Copy to M/s. TCE LTD-NJSEI-JV for information and necessary action.action.

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e-mail :cep@bwssb.gov.in

Telephone: 080-22945108

**BANGALORE WATER SUPPLY AND SEWERAGE BOARD**
**Office of the Chief Engineer (Project)**
Cauvery Bhavan III Floor, Bangalore 560009

No. BWSSB/CE (P) /ACE(P)-2/ 988 /2025-26 Dt: 22/08/2025.

**NOTICE TO PROCEED WITH THE WORK**

To,
M/s. Enviro Infra Engineers Limited
201, Second Floor, RG Metro Arcade,
Rohini Sector 11, Delhi-110085
Delhi (India).

Sir,

Sub: Design, Engineering construction and commissioning of wastewater Treatment Plants with Tertiary Treatment Facility, Solar Panels along with Operation & Maintenance thereof for ten years (Works-A) and procurement and construction of Rising Main, main sewers and laterals including machine holes and lift sewage pumping stations (Works-B) hybrid mode for Mahadevapura zone in 110 village areas(Phase-II) under Karnataka Water Security and Disaster Resilience Program(KWSDRP)-(Contract package No. BWSSB CE-P/KWSDRP/WBS-V).

Ref:
1. IFT No. BWSSB/CE(P)/ACE(P)-1/ACE(Cst-DCW)/110/2025-26, Dtd: 24.04.2025
2. Indent No. BWSSB/2025-26/WT/WORK_INDENT2251
3. Approval of Board in its meeting held on 15.07.2025
4. LOA No.BWSSB/CE(P)/ACE(P)-2/815/2025-26 Date: 23.07.2025.
5. BG No: 027GT02252130009 Date: 01.08.2025- Rs. 5,49,00,000/-.
6. Agreement No.: 23/2025-26 Date: 22.08.2025.

*******

Pursuant to furnishing the requisite security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement in respect of "Design, Engineering construction and commissioning of wastewater Treatment Plants with Tertiary Treatment Facility, Solar Panels along with Operation & Maintenance thereof for ten years (Works-A) and procurement and construction of Rising Main, main sewers and laterals including machine holes and lift sewage pumping stations (Works-B) hybrid mode for Mahadevapura zone in 110 village areas(Phase-II) under Karnataka Water Security and Disaster Resilience Program(KWSDRP)-(Contract package No. BWSSB CE-P/KWSDRP/WBS-V)", you are hereby informed to proceed with the execution of the said work in accordance with the Contract Documents and as per the directions of EE (P)-4.

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The details of work are as follows:

| | | |
|---|---|---|
| 1 | Sanctioned Estimate cost | Rs.167.47 Crores (vide CER No.06/2025-26 date:24.04.2025) |
| 2 | Amount put to Tender excluding GST | Rs.127,74,01,964/- |
| 3 | Evaluated cost excluding GST | Rs.119,70,19,006/-(Rupees One Hundred Nineteen Crores Seventy Lakh Nineteen Thousand Six only)<br>Capital Cost- Rs.109,70,19,006/-<br>Opex Cost- Rs.10,00,00,000/- for 10 years (For Work A only).<br>GST will be paid in accordance with contract conditions as per actual. |
| 4 | Percentage at which work is to be executed | 6.29% below the amount put to tender |
| 5 | Contract duration | 30 months (including monsoon) |
| 6 | Date of Commencement | 25.08.2025 |
| 7 | Date of Completion | 24.02.2028 |
| 8 | O & M period (Work A) | 10 years from the Taking-Over certificate. |
| 9 | Head of Account | "CE-KWSDRP-SWPL for the year 2025-26" |

You are hereby requested to start the work immediately and complete the same by fulfilling the tender specifications, satisfactorily and hand over to the Board in a complete manner within the stipulated period.

As per the contract conditions stipulated under Contract Data (Work A), you are hereby informed to submit the performance security deposit amount equivalent to 5% of total O &M Price for 10 years starting from the date of completion of the works (date of issue of the Taking-Over Certificate) before commencement of O & M period. Further, additional security for unbalanced O & M tender in accordance with Clause 25.5 of ITT and Clause 44 of the Conditions of Contract amounting to Rs. 13,02,68,000/- need to be furnished.

You are requested to contact EE (P)-4 Division, BWSSB, Bangalore for further needful.

Thanking you

Yours faithfully

Chief Engineer (Project)
BWSSB

1. Copy submitted to Hon'ble Chairman for kind information.
2. Copy submitted to EIC for kind information.
3. Copy to EE (P)-4 Division along with Approved BOQ, Bid Documents, Original BG along with confirmation & Agreement copy for information and necessary action.
4. Copy to M/s. TCE LTD-NJSEI-JV for information and necessary action.

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**Compliance for para No. 8 of O.A No. 14/2025 and 111/2020 w.r.t the hearing on 21.08.2025.**

| Para No.8-Observation | Compliance |
|---|---|
| Accordingly, the Chief Secretary, State of Karnataka, is directed to file a detailed report addressing the recurrence of the toxic foam discharge into the dam, indicating the immediate and strict interim measures being implemented until the long-term remedial measures are fully operational. | Studies carried out by the IISc on the incidence of foaming due to sewage ingress into Bellandur Lake revealed that the main cause of foaming is predominantly due to the presence of under composed domestic detergents along with some naturally growing non-pathogenic bacteria.<br><br>In the presence of adequate oxygen, these detergents will rapidly get decompose by naturally occurring resident bacterial populations and, therefore, may not be construed to be caused by toxic substances. |

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Submitted by BWSSB on 3/11/2025

CEO-2, KSPCB