Deliverable 3.3

Assessment and Improvement Measures Selected CETPs and PETPs in Uttar Pradesh

SGR - GOPA Infra GmbH Team

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in consortium with

Consulting Services on Rehabilitation Measures on behalf of the National Mission on Clean Ganga

"Support to Ganga Rejuvenation"
Phase II
Uttarakhand and Uttar Pradesh

India

Indo-German Development Cooperation
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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Abbreviations

ACF	Activated Carbon Filter
AFR	Alternative Fuels and Raw Materials
AOX	Adsorbable Organic Halides
AQA	Analytical Quality Assurance
BOD	Biochemical Oxygen Demand
BOO	Build – Own - Operate
BOOT	Build – Own – Operate - Transfer
BREF	Best Available Techniques Reference
CETP	Common Effluent Treatment Plant
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CTE	Consent to Establish
CTO	Consent to Operate
DBOF	Design – Build – Finance - Operate
DO Sensor	Dissolved Oxygen Sensors
DPR	Detailed Project Report
DS of Sludge	Percentage of Dry Substance or Dry Matter in Sludge
EPA	Environment Protection Act
EQT	Equalisation Tank
ETP	Effluent Treatment Plant
EU	European Union
HPDA	Hapur Pilkhuwa Development Authority
IDM	Indirect Discharge Monitoring
IFAS	Integrated Film Activated Sludge
KLD	Kilo Liters Per Day
MBBR	Moving Bed Biofilm Reactor
MGF	Multi Grade Filter
MLSS	Mixed Liquor Suspended Solids
MS Steel Wall	Mild Steel Wall
NABL	National Accreditation Board for Testing and Calibration Laboratories
NGT	National Green Tribunal
NMCG	National Mission for Clean Ganga
O & M	Operation & Maintenance
OCEMS	Online Continuous Emission Monitoring Systems
PE	Polyethylene
PETP	Pre- Effluent Treatment Plant

RCC	Reinforced Cement Concrete.
RCEUS	Regional Centre for Urban and Environmental Studies-
RIA	Rooma Industries Association
SCADA	Supervisory Control and Data Acquisition
SGR	Support to Ganga Rejuvenation
SMCG	State Mission for Clean Ganga
SOP	Standard Operating Procedures
SPV	Special Purpose Vehicle
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen (sum of ammonia-nitrogen plus organically bound nitrogen)
TSS	Total Suspended Solids
TWIC	Tamilnadu Water Investment Co. Ltd.
UK	Uttarakhand
UP	Uttar Pradesh
UPPCB	Uttar Pradesh Pollution Control Board
UPSIDC	Uttar Pradesh State Industrial Development Corporation
ZLD	Zero Liquid Discharge

Background

Under the Indo-German Technical Cooperation, the Government of Germany has extended support to the Government of India through sharing of experiences on river rejuvenation. In this framework, the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH / German Corporation for International Cooperation (GIZ) implements the project "Support to Ganga Rejuvenation (SGR)", contributing to the initiative 'Namami Gange', the umbrella programme for all Ganga Rejuvenation activities of the Indian Government.

The first phase (2016-2018) of the project has been implemented till November 2018 at national level and in the state of UK. Now, the project has been further extended till 2020. In its extension phase starting from Dec 2018, key activities of the project will be implemented in the state of UP as well along with UK, in collaboration with the State Mission for Clean Ganga - Uttar Pradesh (SMCG UP).

The consulting company GOPA-Infra GmbH, in consortium with the consulting company Fichtner Water & Transportation GmbH (FWT), has been contracted by GIZ to implement part of the project in the states of UK and UP.

In the state of UP, the project is active since November 2018, by providing advisory services and exchange of knowledge to support improved management of industrial wastewater in the textile sector. These include supporting efficiency improvements of 5 textile CETPs/ETPs through suggestions for improved treatment process, technologies, O&M mechanism and capacity building of the operators / responsible actors. Another focus is advising relevant industries of the textile cluster concerning modern wastewater technologies and methods.

The 5 CETPs/ETPs and industrial cluster have been identified in close consultation with the NMCG and SMCG in UP. These are:

1. Bhadohi CETP, Bhadohi, UP
2. Rooma CETP, Kanpur, UP
3. Pilkhuwa CETP, Hapur, UP
4. Mathura CETP, Mathura, UP
5. Tronica City CETP, Loni, Ghaziabad &, UP

Assessment of the CETP in Badohi showed that the structure had never been used. Therefore, the project team decided in consultation with NMCG to assess the remaining 4 plants and 3 ETPs connected to Rooma, Hapur Pilkhuwa and Mathura depending on the status of ETP and willingness of industry.

This report focuses on assessment of selected CETPs and PETPs and improvement measures suggested as an outcome of site visits, technical assessment and interactions with CETP developers, industries associations, regulators, industries and other stakeholders.

Assessment and Improvement Measures CETPs and PETPs

1 Bhadohi CETP

1.1 Overview

Aspect	Observations / Suggestions
Administrative	
Planning	The industries' members have detached from CETP. In future, planning will require upfront agreement with members in co-ordination with UPPCB
Development	Partly developed and defunct
Finance	Never functional
Sustainability	Non sustainable model
Human Resources	Do not exist
Technical	
Appropriateness of Technology / Treatment Processes at CETP	
Operation	Non operational
Laboratory management	Not available
Preventive & Breakdown Management	Not available
Energy Efficiency	
Sludge / Hazardous Waste Management	Not available
Indirect Discharge Management	Not available
Member level wastewater monitoring	Do not exist
Managerial	
Appropriateness of Operators / staff	No staff
Skills of Staff	No staff other than guards
Co-ordination with external stakeholders	Do not exist
Legal issue management (NGT and Others)	Do not exist
Professional Management	Do not exist

Assessment of the CETP in Badohi showed that the structure had never been used. After construction by the Bhadohi Industrial Development Authority (BIDA), carpet industries in the industrial cluster never connected their effluents to the plant. The reason claimed by the industries was limited trust in the management capacity of the operator.

Therefore, the project team decided in consultation with NMCG not to assess this CETP further.

Figure 1: Present Status of Bhadohi CETP

2 CETP and PETP, Rooma, Kanpur

Rooma Textile Park has been set up on 173 acres of land on the highway Kanpur-Allahabad. Facilities like Training Centre, Fashion Design Centre, etc. for textile units in the area have been set up in the project. The industrial park has a CETP for treatment of common effluents by the industries. 18 units are currently planned, of which 13 have already been built. At time of visit, 8 units were found in operation.

All of the 8 active industrial units have a similar product palette and hence are having comparable production processes (production of cotton clothes from cotton yarn). Thus, the wastewater-relevant processes (bleaching and dying) are also similar amongst the active industrial units. Each of the 8 active units were operating a Primary Effluent Treatment Plant (PETP) for a pre-treatment process of the wastewater before the di charge to the Common Effluent Treatment Plant (CETP).

2.1 Pre - Effluent Treatment Plant (PETP)

An assessment of the PETP could be performed at the company Ganga KnitFab. According to operator's information the PETP was designed with a capacity of 150 m^3/d (0.15 MLD). The current hydraulic load was 50 m^3/d (at 50 % production capacity). Under condition of being informed correctly, the capacity of the PETP is sufficient for a 100 % production capacity as well.

The PETPs of the units are using a similar principle for the mechanical and chemical wastewater treatment as used at the CETP, but in different scales. Most of the PETPs are operated with batch processes that are handled manually. Some of the PETPs are having monitoring systems for pH and flow rates of the effluent to the CETP.

PETPs are monitored by RIA/Rooma Industrial Pollution Control Society as well as by the UPPCB by taking random samples for analysis, which cannot be considered as representative values. Limit values for main parameters at the PETP outlet are defined by the UPPCB as follows:

Table 1: Standards for effluent discharge from textile industry

S. No.	Industry	Parameter	Standard
1	2	3	4
"6	All Integrated textile units, units of Cotton / Woollen / Carpets / Polyester, Units having Printing / Dyeing / Bleaching process or manufacturing and Garment units.	**TREATED EFFLUENTS**	**Maximum concentration values in mg/l except for pH, colour and SAR**
		pH	6.5 to 8.5
		Suspended Solids	100
		Colour, P.C.U (Platinum Cobalt Units)	150
		Bio-Chemical Oxygen Demand [3days at 27°C] (BOD_3)	30
		Oil and Grease	10
		Chemical Oxygen Demand (COD)	250
		Total Chromium as (Cr)	2.0
		Sulphide (as S)	2.0
		Phenolic Compounds (as C_6H_5OH)	1.0
		Total Dissolved Solids, Inorganic (TDS)	2100**
		Sodium Absorption Ratio (SAR)	26**
		Ammonical Nitrogen (as N)	50

Source: DPR for upgradation of Existing CETP of 1.55 MLD Capacity to ZLD based CETP for Textile, Processing Units in Rooma Textile zone in Rooma, Kanpur - U.P (Volume-I)

2.1.1 Simplified Process Flow Diagram of PETP

A simplified process flow diagram of a PETP as it is used at Ganga KnitFab in the Rooma Textile Zone is shown in the following drawing.

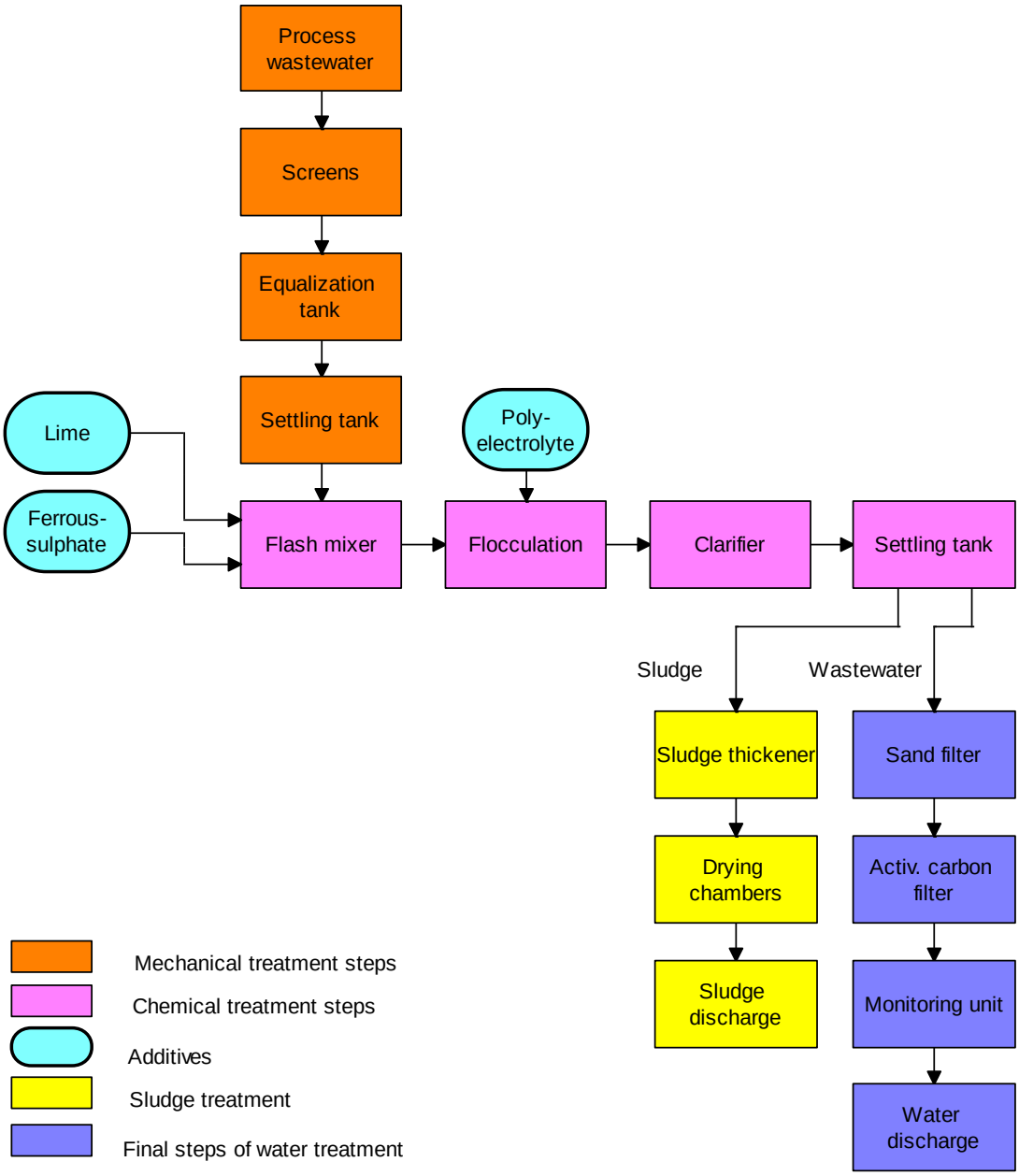


Figure 2: Simplified process flow diagram for PETP

As long the production processes are not changed (ionic or dispersion colours, additional chemical treatment processes of the cotton) it can be presumed the PETP is suitable for keeping the limit values, under condition of a correct operation.

2.1.2 PETP Findings

The wastewater relevant processes with a significant pollutant load were the bleaching process (provided with hypochlorite) and dyeing processes with reactive colours. All other processes were mechanical processes partly combined with washing and spilling.
The assessment of the PETP of the Ganga KnitFab company was showing suitable arranged processes for treating the process wastewater according to the BREF. A separation of partial wastewater streams is not necessary, since the single parts of the wastewater treatment process are sufficiently designed for utilizing 100% operation capacity (according to the specification).

2.2 Common Effluent Treatment Plant CETP

The 1.55 MLD CETP was developed by UPSIDC. A study by the Central Pollution Control Board reveals that the CETP can treat only 0.7 MLD textile effluent. The 13 member units, of which currently only 8 active units, operate at 50% of production capacity connected/ permitted. All units have PETP; of these, only Ganga KnitFab could be visited.

The CETP current reported average effluent inflow is 0.6 MLD, with industries operating at 50 %. If industries were to operate at 100%, effluent production would be approximately 1.5 MLD. Since it was found that the actual treatment capacity of CETP is 0.7 MLD, the capacity of the CETP is not sufficient and hence must be increased before all the industrial units of the Rooma Textile Zone can be operated with their nominal production capacity.

2.2.1 CETP Treatment Steps

1. Mechanical treatment (removal of course solid components)
2. Chemical treatment (removal of suspended solid and precipitation of hardly soluble metal hydroxides e.g. chromium, nickel)
3. Biological pollutant degradation
4. Final purification steps (water filtration, monitoring units)

A simplified process flow diagram explains the working principle of the CETP in figure below.

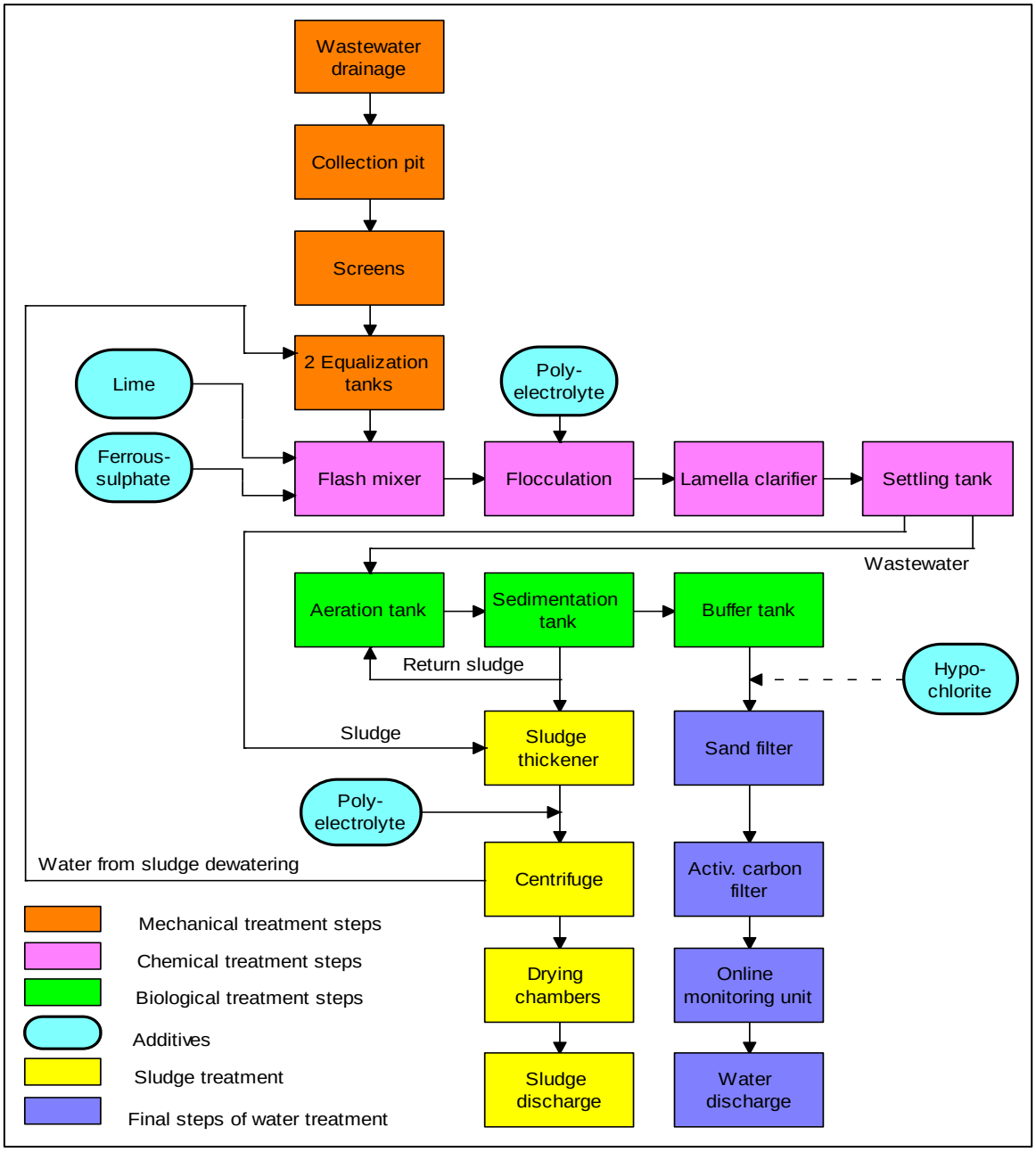


Figure 3: Simplified process flow diagram for CETP

2.3 Planned Expansion of the CETP

Preliminary proposal for the up-gradation of existing CETP to achieve full intended treatment capacity of 1.55 MLD as well as development of new CETP Module with ZLD having capacity of additional 1.55 MLD totalling to a total treatment capacity of 3.1 MLD (with 1.55 MLD CETP Module as ZLD) were developed by SPV and submitted to UPSIDC for further actions, including grant of funds. UPSIDC is supposed to develop the DPR and invite bid for

the aforementioned CETP Augmentation Project. Exact present status of project proposal and project development plan and schedule is required to be confirmed with UPSIDC.

GIZ - SGR team reviewed following two DPRs for the upgradation of Rooma CETP:

1. DPR # 1 for upgradation & expansion of CETP at Rooma as submitted to UPSIDC
2. DPR # 2 prepared by TWIC on upgradation of existing CETP to ZLD mode as submitted to SMCG for funding under NMCG.

Review of DPR # 1:

The capacity of the existing Rooma CETP is not sufficient to treat the wastewater generated by the 13 units in the industrial Textile Zone and hence an expansion of the CETP is urgently required. A project proposal for the upgrading of the existing CETP and the development of a new unit with the same nominal capacity (1.55 MLD) has already been developed in February 2019.

The contractor for this project is the FPI India Pvt. Ltd. In Noida, U.P. with head office in U.S.A. The planning documents have already submitted to UPSIDC for approval. The major change suggested is that the biological treatment to be installed should be an IFAS, more efficient of the current Activated Sludge.

According to the team's opinion the capacity of the upgraded and new CETPs must consider the hydraulic and pollutant loads as well as their expected peak loads for the whole catchment area (Textile Zone of Rooma).
An estimation of several parameters (flow, COD, pH, etc.) of inlet and outlet is missing and therefore it is not possible to determine whether the design considering a total hydraulic load of 3.1 MLD is sufficient for the whole catchment area. Additionally, consideration of the pollutant load was not mentioned in the project design.

The project proposal does not make any reference to inlet parameters or to the design calculations. This data is essential for calculating the necessary capacity and could be acquired either by performing an IDM at representative industrial effluents and a realistic upscaling of the total hydraulic and pollutant loads or through a full technical assessment.

Review of DPR # 2:

A technical review of the DPR (Volume I) has been carried out by Fichtner's international expert on the request of SMCG and the findings are summarized and attached as Annex 2. DPR (Volume II) on the bill of quantities or technical specification sheets are not to be commented, as these are specified by the calculated design.
This DPR focuses on upgrading the CETP to ZLD mode, the need/ requirements that necessitate the same could not be clarified by the CETP-operator & Rooma Industry Association.

2.4 National Green Tribunal (NGT) Actions

Rooma CETP falls under the purview of multiple cases of various courts including NGT, as Kanpur was once identified as most polluted cluster. CPCB monitors the matter related to

various directions and orders of Hon'ble NGT in this matter. CPCB have prepared a comprehensive Action cum Monitoring Plan for the State of UK and UP in compliance with the benchmark order of Hon'ble NGT named as **Ganga Matters** dated 02nd November 2015. CPCB regularly updates and submits compliance reports to Hon'ble NGT in various cases as well. Rooma CETP Operator (SPV) was also issued a Show Cause Notice by the NGT on 8th July 2019 for irregularities found regarding treatment capacity and quality of effluents. After hearing, the CETP was allowed to continue operate at reduced capacity.

2.4.1 Next Steps

Further interventions are required to bring UPSIDC and Industries Association together for assessment of the CETP and to suggest improvement measures to achieve compliance of Environmental Permits as well as directions of Order of Hon'ble NGT. These should include:

1. Technical and advisory assistance & handholding support to both stakeholders for development of DPRs;
2. Development of a CETP operational framework;
3. Upgradation of existing CETP; and
4. Development of new CETP treatment module in order to cater wastewater treatment need of the cluster. With industries operating at 100% production capacity another treatment module of 1.55 MLD is envisaged by association

2.5 Suggested Improvement Measures for CETP

Following improvement measures have been agreed with the operator as an outcome of assessment of data and details of Rooma CETP:

S. No.	Improvement Measure Suggested	Expected Impact	Status as on 02 – Dec - 2019
1	SOP for Lime milk preparation	Reduction in Chemicals consumption, Reduction in Sludge Generation	Implemented
2	SOP for FeSO4 solution preparation	Better treatment efficiency, removal of colour from wastewater, better consistency of Chemical Sludge	Implemented
3	SOP for PE solution preparation	Better treatment efficiency, better consistency of Chemical Sludge	Partially implemented
4	Provision of Slow speed Gate type Flocculator mechanism instead of high speed stirred	Better treatment efficiency, better consistency of Chemical Sludge	Under planning
5	Provision of Flocculation Channel or Flocculation Tank	Better Sludge Floc formation, improved settling and separation of Chemical Sludge	Under planning
6	Replacement of present blowers with high efficiency blowers for aeration Tank	Better BOD/COD removal efficiency & Energy Savings	Under considerations
7	Training for Manpower – Chemist & Operators	Improved Operation of CETP	Under Planning
8	Replacement of Leaking / Torn our diffusers	Better treatment efficiency, savings in energy consumption and operating cost	Under consideration
9	Jar Test on weekly basis for chemical treatment and fixing dosages	Better treatment efficiency, savings in chemical cost, reduced sludge generation	Under consideration

S. No.	Improvement Measure Suggested	Expected Impact	Status as on 02 – Dec - 2019
10	Cleaning of storm water drains inside CETP filled with Chemical Sludge	Proper handling of Hazardous waste	Implemented
11	Cleaning of open area filled with Hazardous waste	Proper handling of Hazardous waste	Under implementation
12	Cleaning of Lagoon filled with wastewater and use it as Buffer for high flow conditions	Reduced impact of soil	Under implementation, in consultation with UPSIDC
13	Replacement of BOD incubator	BOD analysis	Under implementation
14	Training for Operators and Chemists	Better plant operation	Under considerations
15	Dosing of Polyelectrolyte in Decanters	Better sludge dewatering	Under implementation
16	Installation of Sludge Drying Beds	Drying of Sludge	Implemented, under commissioning
17	Replacement of Wastewater feed pump for equalization	Better consistency of wastewater feed to CETP	Under implementation
18	Change / Top up / Replacement of media in MGF	Better treatment efficiency	Under implementation
19	Periodic analysis of activated carbon in ACF for Iodine Value	Preventive Analysis	Under Consideration
20	Change / Top up / Replacement of media in ACF	Better treatment efficiency, Colour Removal, Residual COD Removal, Excessive Oxidant / Disinfectant (NaOCL) Removal	Under Consideration
21	SOP for analysis of NaOCL (Sodium Hypo Chloride) and dosing procedures	Better treatment efficiency, Better disinfection efficiency, reduced cost of chemicals and operation	Under consideration
22	Information board at the main gate as per the order of Hon'ble Supreme Court of India	Legal Compliance	Under implementation
23	Daily random / regular sampling of wastewater from member industries after PETP treatment	Operation of CETP, Predictive analysis	Partly implemented, under progress
24	Provision of Sludge Storage Area – Impervious Ground, leachate collection and transfer system, closed from three sides	Impact on Soil	Under Construction
25	Member level wastewater analysis on daily basis	Predictability of wastewater characteristics & improved performance of CETP	Under Consideration
26	Online Flow meter data at CETP & Integration with CETP Operations	Wastewater quantity measuring at CETP, Avoid flooding at CETP	Under Consideration
27	Cleaning residual water from Open Channel near Laboratory building and using it as a buffer during emergency purposes for storage of wastewater	Impact on Soil, CETP operation during abnormal conditions	Under Consideration
28	Monitoring of IDM on regular basis	Avoidance of shock loads to CETP, improved treatment efficiency	Partly implemented

2.5.1 Suggested Timeline for Improvement Measures

The implementation of improvement measures can be assigned to the following time periods according to the improvement plan as agreed with the operator.

Immediate Actions

- Appointment of professional agency for O&M of CETP
- Immediate improvement measures, such as replacement of old equipment, as suggested in improvement measures
- Formation of SPV
- Tariff Mechanism for wastewater treatment
- Immediate Diversion of treated Sewage entering CETP
- Development of DPR for upgradation and capacity enhancement of CETP

Mid-Term Actions

- Upgradation of CETP through medium term measures as suggested
- Implementation of Indirect Discharge Management (IDM)
- Upgradation of Laboratory
- Training of operators
- Training of officials
- Integrated Sludge Management Plan
- Permanent stoppage of treated Sewage entering into CETP premises

Long-Term Actions

- Development of CETP including upgradation of existing infrastructure and enhanced treatment capacity

3 CETP and PETP, Pilkhuwa, Hapur

Hapur Pilkhuwa Development Authority was established as an independent authority from GDA by U.P. Administration during 1996-97. There are 25 textile units currently in the industrial park, all provided with PETP that discharge in a CETP.

Table 2: Brief Details of Pilkhuwa CETP

Units in total	25
Units currently in operation	22
Operator of CETP	Hapur Pilkhuwa Development Authority (HPDA)
Owner of CETP	Hapur Pilkhuwa Development Authority (HPDA)
Hydraulic Design of CETP	2.10 MLD

3.1 Pre – Effluent Treatment Plant (PETP)

The visited industrial unit in Pilkhuwa was the CTA Apparels. CTA Apparels is producing different textile products (cotton and synthetics) only for export. The average production capacity is about 8000 kg/d.

Wastewater relevant processes are mercerizing, bleaching, dyeing, printing, finishing and washing. The average water consumption was specified with 150 m^3/d. Since the CTA Apparels is only producing for export, the technique of production facilities and the PETP are meeting BREF standards.

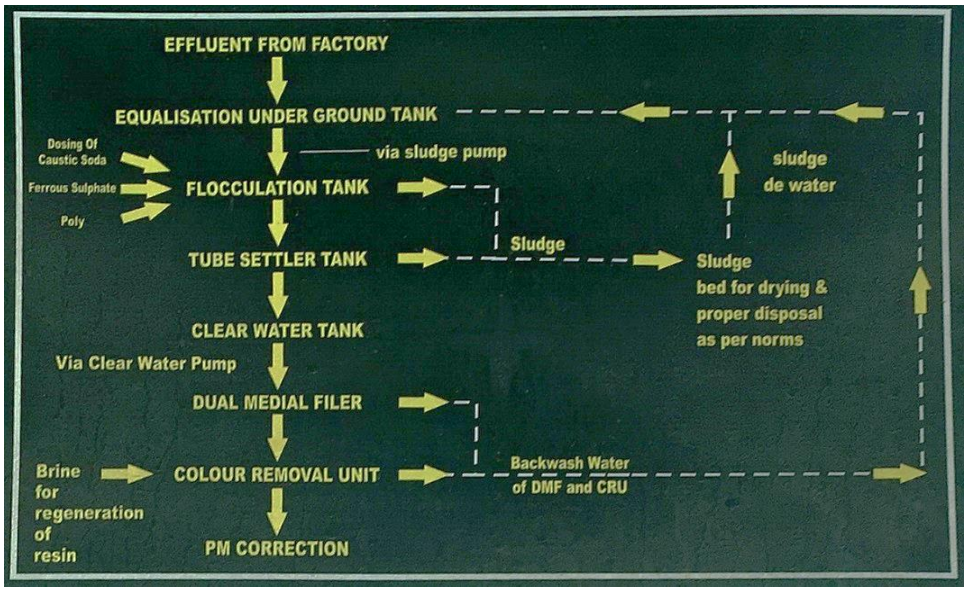
The technical principle (main treatment steps) of the PETP can be summarized as follows:

3.1.1 Process Steps

Following are the process steps:

1. Equalization tank providing 15 hours retention time
2. pH adjustment with sodium hydroxide
3. Adding ferrous sulfate

4. Flocculation with polyelectrolyte
5. Tube settlers for sludge separation and clear water tank
6. Dual media filter (sand filter with different grains) for the removal of suspended solids
7. Colour removal unit (ion exchange resin, brine for regeneration of resin).
8. Sludge treatment system (sludge bed, filter press, disposal according to legal regulations).



The wastewater treatment processes are controlled by self-monitoring measures calibrated on the required standards for discharge effluents reported in the table below.

Table 3: Standards for discharge of effluents

4 THE GAZETTE OF INDIA : EXTRAORDINARY [PART II—SEC. 3(i)]

STANDARDS FOR DISCHARGE OF EFFLUENTS FROM TEXTILE INDUSTRY

S. No.	Industry	Parameter	Standard (applicable for all modes of disposal*)
1	2	3	4
"6	All Integrated textile units, units of Cotton / Woollen / Carpets / Polyester, Units having Printing / Dyeing / Bleaching process or manufacturing and Garment units.	**TREATED EFFLUENTS**	Maximum concentration values in mg/l except for pH, colour, and SAR
		pH	6.5 to 8.5
		Suspended Solids	100
		Colour, P.C.U (Platinum Cobalt Units)	150
		Bio-Chemical Oxygen Demand [3days at 27°C] (BOD_3)	30
		Oil and Grease	10
		Chemical Oxygen Demand (COD)	250
		Total Chromium as (Cr)	2.0
		Sulphide (as S)	2.0
		Phenolic Compounds (as C_6H_5OH)	1.0
		Total Dissolved Solids , Inorganic (TDS)	2100**
		Sodium Absorption Ratio (SAR)	26**
		Ammonical Nitrogen (as N)	50

3.1.2 PETP Findings

The assessment of the PETP of the CTA Apparels Company revealed a plant fitted with modern and efficient processes and responding to the relevant treatment requirements for the industry.

However, since it was not possible to carry out flow measurements at the time of visit, this report cannot comment on capacity of PETP. As CTA Apparels has a large production unit operated at full capacity, it remains to be verified whether the volume of treated effluents is adequate to the production.

3.2 Common Effluent Treatment Plant- CETP

The 2.1 MLD CETP, developed & operated by HPDA, mostly caters to Textiles Industries. Only 20% area of cluster is developed and connected to CETP. From this area, 25 units are connected to the plant CETP but the expected to exceed designed capacity very soon, with industrial development on-going in cluster.

Currently the plant is being operated by a private contractor – M/s Amba Engineers. The current average effluent inflow is 1.8 MLD, often reaches maximum capacity, i.e. 2.1 MLD. No Tariff is in place for CETP members, HPDA bears O&M expenses.

3.2.1 Present Status of CETP & Wastewater Collection and Conveyance System

The CETP structures and equipment are in good shape due to regular maintenance. O & M of CETP is being outsourced through a professional agency – M/s Amba Engineers (contract valid till November-2019, ad hoc arrangements have been done as a short term solution for the year 2020, HPDA is yet to initiate tendering for O & M) having good knowledge on CETP processes and equipment. The wastewater from industries is collected in dedicated wastewater collection and conveyance system made from closed piping network. Operation and Maintenance of Drainage System is the responsibility of HPDA.

Imagery ©2019 CNES / Airbus, Maxar Technologies, Map data ©2019

Imagery ©2019 CNES / Airbus, Maxar Technologies, Map data ©2019

3.2.2 Pilkhuwa CETP: Present Treatment Process

The hydraulic design of the Pilkhuwa CETP is limited by the design on a flow rate of 2.1 MLD and is already operated at the maximum capacity.

The principle for the CETP is reflected by the different treatment stages, namely:

1. Mechanical treatment (removal of course solid components)
2. Physico-chemical treatment (removal of suspended solid and precipitation of hardly soluble metal hydroxides e.g. chromium, nickel)
3. Biological treatment through aerobic process
4. Final purification steps (water filtration, monitoring units)
5. Sludge dewatering units

A simplified process flow diagram explains the working principle of the CETP is provided in this section.

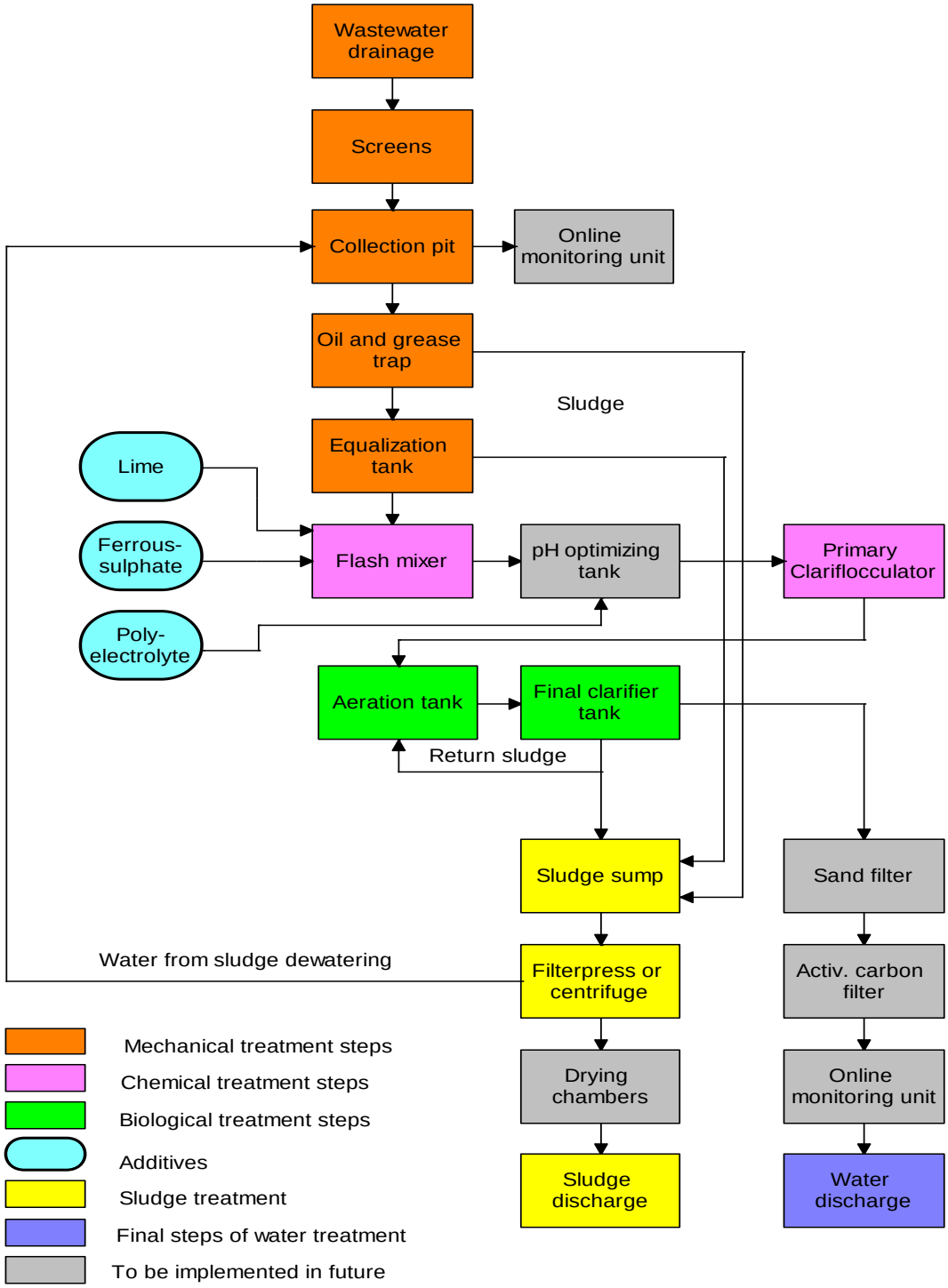


Figure 4: Simplified process flow diagram of Pilkhuwa CETP

3.2.3 CETP Deficits and Improvement Measures

The specific findings as an outcome of the assessment of the Pilkhuwa-CETP are described in the next sections. According to the different process steps, a brief description, identified deficits and proposed improvement measures are tabulated and provided herewith. The CETP was found in overall good state of functioning.

3.3 Major Observations and Issues Identified for Improvement in CETP

3.3.1 Indirect Discharge Management (IDM)

During visits of experts, it was observed that one pipeline carrying treated sewage from Hapur Municipal Area is passing from the north side periphery of CETP. The pipeline ends near the east corner of CETP where the treated wastewater is usually discharged in natural drainage system. However, near the boundary wall of CETP, another disposal point is provided which ends up inside the CETP. Industries, sometimes, willingly or unwillingly (due to choking of drains) dispose their wastewater in the storm water drains. Such wastewater when disposed, ends up in natural drainage system instead of CETP.

It was suggested by the GOPA-Infra experts during a site visit that treated sewage from Hapur Municipal Authorities be stopped entering CETP premises on immediate basis. HPDA official took therefore immediate actions to stop the sewage entering in CETP premises.

It was also suggested by the expert to initiate routine & detailed monitoring of industrial wastewater disposal in storm water drains. As a result, HPDA officials established a team and started routine monitoring plan to monitor such activities.

3.3.2 Present Capacity of CETP vis-à-vis near Future Requirements

The CETP is presently having the capacity of treating 2.1 MLD wastewater generated from Pilkhuwa Textiles Cluster. Presently, approximately 20-22 industries have started their operations and production which contributes to 1.8 MLD wastewater flow on an average basis to CETP. As per Pilkhuwa Cluster masterplan, some 200 industrial plots have been created for installation of industries. As of December-2019, 8 -10 new industries were at various stages of construction.

These facts lead to the planning of capacity enhancement of the CETP. Furthermore, as all the industries rely on groundwater extraction for their water needs, it is also suggested that maximum possible treated wastewater is recycled back to industries and that wastewater disposal norms for the balance treated wastewater are complied with. The partial recycling of treated wastewater can reduce ground water extraction substantially.

It is suggested that the present CETP should be enhanced to treat total of 7.0 MLD wastewater looking to the medium-term wastewater treatment demand of the cluster. Further improvement measures are provided in following sections.

3.3.3 Detailed Project Report (DPR)

SGR GOPA team has prepared the present report on improvement measures, including suggestion for development of DPR. HPDA will prepare DPR through their consultants. As HPDA are short of funds, will need financial assistance from NMCG for the implementation of the project proposed.

3.4 National Green Tribunal (NGT) Actions

The CETP was issues a Show Cause notice by the NGT on 19. September 2019 for non-compliance with effluent quality norms and storage of untreated effluents in a tank. Subsequent to taking the required measures for compliance, the units were allowed to resume manufacturing operations on 27 September 2019.

3.4.1 Next Steps

1. HPDA to prepare DPR and submit to SMCG/NMCG.
2. SGR GOPA team to provide advisory and handholding support for suggested improvement measures.

3.5 Suggested Improvement Measures

Following improvement measures have been submitted to the operator for implementation in phases as an outcome of assessment of data and details of Pilkhuwa CETP:

S. No.	Part, Process	Description	Identified Issues/Deficits	Improvement Measures	
1	Wastewater Drainage	Separated sewer systems for storm water and industrial water	Indirect Discharges	Detailed and routine monitoring program, wastewater analysis of natural drains in industrial cluster	
2	Screens	The screens are removing course solid materials from the wastewater	Screens must be frequently inspected and cleaned manually. The screens get flooded in case of peak flows	Installation of a screen system with automatic cleaning (screenings removal) The solid matters separated by the screen is removed with level-controlled rakes and disposed in a residue collecting basket	
3	Collection Pit	The collection pit is used as a pumping pit of the incoming wastewater	Feed pumps are manually operated according to the observed current flow rate	Installation of level-operated feed pumps and fill-level alarm. The power of pumps must be sufficient for hydraulic peak loads	
4	Oil and Grease Traps	Separation of oil and grease	Needs repairs	Upgradation of O&G Trap	
5	Equalization Tanks (EQT)	Mixing and buffering of incoming wastewater to avoid peaks for the hydraulic and pollutant loads	Homogenization of wastewater	It is recommended to install a mechanical mixer instead of a blower system (preferred by operator)	
				Blower system	Mechanical mixer
				Low homogenization degree	High homogenization degree
				Significant sedimentation of solids	Negligible sedimentation of solids
				Reduction of mixing performance due to ageing processes in diffusors and hence increasing energy consumption	Constant and reliable mixing performance over long periods of time
				High investment and operating costs (periodical exchange of diffusors, high energy costs)	Significantly lower investment and operating costs

S. No.	Part, Process	Description	Identified Issues/Deficits	Improvement Measures
6	Effluent Feed Pumps	Conveying wastewater from the EQT to further treatment steps	Current pumps are working but they are old and require regular maintenance. So at least one new pump should be added to avoid sudden work stopping. A level control system needs to be installed for an automatic operation of the feed pumps	New pumps needed along with auto start-stop control unit One pump should be installed for redundancy
7	Flash Mixer	The flash mixer is the first step of a chemical wastewater treatment by adding iron (or aluminium) salts to the wastewater at an alkaline pH value. The metal hydroxides are forming flocks with an electrical charge that can adsorb suspended 13particles from the wastewater	The current polyelectrolyte mixing system has rusted and needs to be replaced with a new one According to the operator's information, laboratory tests have been carried out for an optimization of the flocculation in order to use a maximum pollutant removal with a minimum of operational costs The currently operation of the flash mixer and flocculation is providing a sufficient flocculation	The flocculation should be always performed in the optimum pH range (according to laboratory tests) Hence, the dosing of flocculating agents should be controlled with a pH sensor to ensure the correct pH for the optimum flocculation results. The current Flash mixer is working but it would be better to have separate mixing of flocculating agents by providing a pH optimization tank prior to the flash mixer. This will lead to even better flocculation The mixer should be equipped with a paddle to achieve a better homogenization A new pH optimization tank and a new mixing system for polyelectrolyte is already planned
8	Flocculation	The forming of big hydroxide clusters for an efficient removal of suspended solids can be achieved by adding of polyelectrolytes		
9	Preparation of Flocculating Agents	The solutions of flocculating agents are prepared from solid basic materials (lime, ferrous sulphate, polyelectrolyte	The existing equipment is working	Since a new pH optimization tank is recommended it can be assumed that the piping of the chemical tanks must be modified as well. The piping sizes of the chemical preparation tank needs to be increased and more pressurized water is needed for an efficient preparation of the chemical solutions
10	Primary Clarifier	Separation of flocks (suspended solids) from the water	Existing sludge has operational issues	The existing sludge scraper needs to be replaced even the current treatment process meets the required limit values
11	Air Blower	Air blowers, together with diffuser units are providing the required oxygen in the	The existing aeration facility has three blowers based on twin lobe technology	It is recommended to get one new blower and to maintain/repair the existing two blowers that are currently working. In order to control the power of the blowers according to the oxygen demand of the aeration tank, a VFD needs to be provided.

S. No.	Part, Process	Description	Identified Issues/Deficits	Improvement Measures
		aeration tank for biodegradation and nitrification		A VFD is required for an automatic control of the blowers provided by an oxygen sensor (DO Sensor)
12	Aeration Tank	Biological carbon degradation and nitrification of organically bound nitrogen and ammonia	The existing aeration tank is having sufficient volume capacity for 2.1 MLD	However, it is recommended to improve the design by installing a baffle in order to avoid short cut flows to the outlet. Depending on the future pollutant load an upgrade of the aeration capacity by implementing advance technologies such as MBBR or IFAS In case the C:N:P ratio in the aeration tank is out of range (100:5-10:1), an additional feed of the loss-making component is required for a proper biological wastewater treatment
13	Secondary Clarifier	Separation of activated sludge	The bottom scraper is rusted. It is working now but it will not work for long time due to increasing corrosions The sludge recirculation pumps are working but are old	The installation of a new bottom scraper should be conducted in due time An additional new sludge recirculation pump is recommended. An additional installation of a sludge thickener after the secondary clarifier could be an added advantage for an improved sludge dewatering process (centrifuge or screw press)
14	Sludge Dewatering	Dewatering of sludge	Requires major upgradation	It is recommended to carry out sludge dewatering with a sludge thickener in combination with a centrifuge or screw press to get better solid content in dewatered Sludge
15	Filter Feed Tank and Feed Pumps	Buffer tank for sand and activated carbon filter for a reliable operation of the filter units	Not installed	A buffer tank is recommended for even feeding of the filter systems Two new filter feed pumps are suggested (1 working+1 standby)
16	Sand Filter	Reducing suspended solids after the chemical-biological wastewater treatment	Not installed	Two sand filters with a backflush option are suggested (1 working+1 standby)
17	Activated Carbon Filter	Removal of non-biodegradable components	Not installed	Two activated carbon filters are suggested (1 working+1 standby)
18	Disinfection Unit	To disinfect treated wastewater	Not installed	A disinfection unit is required if the treated wastewater is planned to be recycled back to industries
19	Flow Monitoring	Monitoring of flow rate	The existing flowmeter for the inlet is working	An additional flowmeter at the final outlet from the new recommended carbon filter should be installed for a better controlling of the filter units

S. No.	Part, Process	Description	Identified Issues/Deficits	Improvement Measures
				The flowmeter at the outlet can be connected on a planned online monitoring system
20	Online Monitoring System	Monitoring of flow rate and pollutant parameters as specified by regulatory authorities	Currently only one flowmeter for the inlet	All monitored parameters must be comprehensible by calibration protocols and validated by a different analytical standard method (e.g. comparison of the value by photometric or titrimetric laboratory analysis) The calibration procedure is usually given by the manufacturer's manual. However, the COD can be easily controlled by applying a calibration solution that can be purchased ready to use from different suppliers or can be easily prepared in the laboratory
21	Drying Beds	The sludge from the chamber filter press is dried in provisional sludge drying beds	A Comprehensive sludge management plan is required	By utilizing drying beds, a gradual progression of the sludge dewatering must be considered. Means, depending on the lifetime in the drying bed, the upper layers will have much less water than the lower layers near to the bottom of the drying bed Particularly under consideration of the CETP-expansion a solar sludge drying, could be an alternative for the drying beds. Very efficiently could be a simple solar dryer with a combined sludge turning and transportation system. The reduction of the sludge volume by higher dewatering degrees safes significantly costs for the sludge disposal **For a holistic sludge management after a CETP-upgradation, the following measures can be summarized as follows:** 1. Optimization of flocculation by laboratory test and characterization of the sludge from the chemical treatment (% of dry substance). 2. Characterization (% of dry substance) of the biological sludge. 3. Sludge amounts and sludge characteristics of both of the sludge qualities (chemical sludge from flocculation, sludge from aeration tank) can be figured out for the evaluation
22	Sludge Disposal	Currently no plans. At the moment the sludge is kept in a sludge storage hall		

S. No.	Part, Process	Description	Identified Issues/Deficits	Improvement Measures
				of a solar dewatering (are savings of a higher drying degree economically, enough space available for the required percentage of dry substance). This evaluation can be used to decide whether both of the sludge qualities can be treated together or separately. 4. Detailed sludge characterization and chemical analysis for the evaluation of disposal alternatives (such as AFR in Cement factories). 5. The volume of the sludge thickener must fit to the design of the CETP (flow rate, duration time, dry matter for dewatering). 6. For finding alternative sludge disposals (e.g. rotary kilns of cement industries) suitable sludge analysis (calorific value, dry substance content, ash residue, toxicity) are mandatory. For a thermal sludge utilization, the water content should be low, the caloric value should be high (low percentage of inorganic compounds) and the mass concentration of inorganic and organic halogen compounds (Cl, Br) must be low in order to avoid high toxic flue gas emissions during the incineration process (formation of polychlorinated dibenzodioxins and -furans).
23	Laboratory	A laboratory is mandatory for the operational self-monitoring of a CETP	Currently measured parameters: pH, TSS, COD, BOD_3	Relevant parameters for an operation of a CETP are COD, BOD, TKN, P-PO_4 together with TDS, TSS, MLSS and pH as well as the DS of sludge before and after dewatering that should be measured daily from representative samples For a proper technical control of the CETP it is a must that all records (including calibration records) of the online-monitoring station are available at the CETP as well. Ideally the laboratory at CETP is suggested to get NABL accreditation It also required that a computer is available for the preparation of required documentations (log-book for daily analysis and maintenance works, energy consumption, and other operational data) The evaluation of records from the online-monitoring unit (av-

S. No.	Part, Process	Description	Identified Issues/Deficits	Improvement Measures
				erage values) should be combined with the result of daily analysis in the log-book Significant improvements are recommended for efficiently and reliable analyses of required basic parameters. Suggested are for example the equipment for manometric measurement of BOD (without chemicals) and the utilization of photometric standard methods for other parameters like COD or anions The implementation of a simple sampling and analysis based on Standard Operational Procedures (SOPs) is mandatory for achieving reliable results with a constant precision **SOPs should be prepared for:** 1. Sampling procedure for a combined sample obtained by 5 qualified single samples and 1.5 hours sample intervals. 2. Analysis procedures for all parameters analysed in the CETP laboratory according to an accepted standard method (preferable photometric methods) including the respective calibration procedures. 3. Evaluation and documentation of analytical results signed by the responsible person. 4. Calibrations/adjustments for all parameters of the Online-Monitoring-System, including the evaluation of obtained values. Intensive training measures for sampling, AQA and calibration of monitoring systems are urgently required.
24	SCADA System	An appropriate SCADA system is recommended for controlling all relevant parts of the CETP	Optional	The implementation of an appropriate SCADA system is recommended. The SCADA system can be implemented stepwise by setting priorities (e.g. aeration system, feed pumps, centrifuge) and can be expanded step by step. However, a stepwise implementation must consider sufficient free ports and a suitable control unit for further connections
25	Capacity Increase	In the longer term, the capacity of the CETP is not sufficient to treat the	The existing 2.1 MLD capacity sometimes becomes less to treat the incoming wastewaters from	The capacity should be increased to 7 MLD considering future expansions On request, the operator of the CETP was explaining in details

S. No.	Part, Process	Description	Identified Issues/Deficits	Improvement Measures
		wastewaters of the expanding textile cluster. Therefore, an increase in CETP capacity must be planned and implemented in due time	the industrial cluster. Furthermore looking forward to near future wastewater treatment demand, CETP Hydraulic Treatment capacity of 2.1 MLD will be far below the wastewater generation from the cluster	how the future expansion of the CETP will be designed. Thus, it could be summarized that the expansion of the CETP is intended to be designed according to BREF (comparable with standards of the German Association for Water, Wastewater and Waste, DWG) under consideration of the incoming hydraulic and pollutant loads (IDM) and with certain degree of recycle / reuse of treated wastewater within industries to reduce groundwater extraction and dependence thereupon.
26	Indirect Discharge Management	Uncontrolled and unauthorized treated sewage disposal into CETP, industrial wastewater discharge in storm water drains	Treatment and disposal liability of Sewage under EPA and Water Act	Detailed and routine monitoring and IDM program by HPDA

3.5.1 Suggested Timeline for Improvement Measures

The implementation of improvement measures can be assigned to the following time periods according to the improvement plan as agreed with the operator.

Immediate Actions

- Improvement of laboratory
- Installation of Online-Monitoring-System (inlet and outlet).
- Optimization of flocculation by installation of a pH control tank.
- Installation of level-operated feed pumps and fill-level alarm in collection pit.
- Training measures for maintenance/calibration of CETP equipment's and monitoring equipment.
- Preparation of DPR for Capacity Enhancement & Recycle treated wastewater.

Mid-Term Actions

- Set-up of Indirect Discharge Monitoring system.
- Optimization of sludge dewatering with centrifuge / screw press along with Polyelectrolyte dosing system.
- Installation of carbon and sand filter systems along with dis-infection system.
- Remaining preventive and breakdown maintenance measures.

Long-Term Actions

- Integrated sludge management Plan.
- Utilization of data base.
- Implementation of an appropriate SCADA system (optional).

4 CETP and PETP, Mathura

Mathura is a textile cluster for small cottage industry, which today produces mainly synthetic sarees. There are 18 operating units of the initial 32 installed. There is a CETP that collects effluents from the individual units.

Table 4: Brief Details of Mathura CETP

Units in total:	18 (formerly 32)
Units currently in operation:	18
Operator of CETP	Industrial association (Through SPV)
Owner of CETP	Industrial association (SPV)
Hydraulic design of CETP	6.25 MLD (proposed)

4.1 Pre – Effluent Treatment Plant (PETP)

The visited industrial unit in Mathura was Mathura Trading Co. Mathura Trading Co. is a small factory operated by family members and only producing synthetic garments for the local market. The average production capacity is about 2500 kg/d. Wastewater relevant processes are washing, drying, bleaching, printing (cleaning of tools and equipment). The average water consumption was specified with 40 m^3/d.

The applied production processes are simple, since only one product type (printed synthetic garments) is produced for the local market.

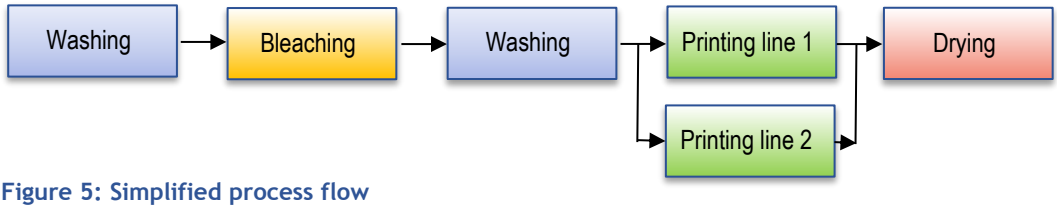


Figure 5: Simplified process flow

Mathura Trading Co. is utilizing old process technologies (mainly manual work) and old production machineries. The techniques of production facilities and the PETP are not meeting BREF standards.

The PETP is limited by 2 grease traps for treating the wastewater from washing the printing equipment. The treated water is partly reused for cleaning the printing equipment.

Figure 6: Grease Traps

The grease traps were not working efficiently. Significant amount of oil on the surface and oil emulsion could be seen in the wastewater drain.

Wastewaters from other production facilities are discharged without any treatment. The installation of an efficient grease trap and an equalization tank (approx. 4 – 5 hours retention time) is recommended as an initial step for a simple PETP.

4.2 Common Treatment Effluent Plant- CETP

The 6.25 MLD CETP was commissioned in 1996. 18 small/ micro textile units are connected, that produce predominantly low-cost synthetic Saree – dyeing & printing.
The current effluent inflow is approx. 2.25 MLD but suffers from poor operations. The plant needs complete overhaul. It is considered for support under NMCG

4.2.1 Present Status of CETP

The CETP structures have become very old facing frequent maintenance issues. The complete CETP structures and electromechanical items requires major overhaul / replacements. The Technology used is very old. The CETP, though operational as on date, faces sustained problem of compliance with the regulatory norms due to aforementioned reasons.

The CETP is planned to be upgraded with the help of funding support from NMCG. The Tendering process is in progress and expected to be concluded by end of 2019 or first quarter of 2020. The new contractor will be responsible for upgradation of the present CETP as well as operation and maintenance for the terms agreed by CETP Owners, which shall be reconfirmed in the award of contract.

4.2.2 Detailed Project Report (DPR)

The DPR was prepared and presently tendering process is going on which is expected to be completed by December-2019 / January-2020. The GOPA-infra team was invited by the NMCG to comment on the DPR and to participate in the first round of tendering. Comments during these sessions were later incorporated in a second round of tendering procedure. In particular, the observation advanced by the team that the tender should be done with *open technology* was incorporated in the final tender documents. At time of writing, the second round of tendering process was completed, award of contract was awaited.

4.2.3 Next Steps

The present CETP will be handed over to the successful bidder of CETP tendering process for up-gradation and operation and maintenance. The revamping of Board of Directors of SPV is under process and the new President will take the charge of SPV and will oversee up-gradation process. As mentioned above, GOPA SGR team is actively involved with the tendering process and provided technical support to NMCG during tender committee and other meetings on Mathura CETP matters. Once the successful bidder takes the charge of CETP and the new office bearers of SPV assumes the office, dialogues can be initiated on techno-advisory support and handholding support by GOPA SGR team.

4.3 Suggested Improvement Measures

Following improvement measures are suggested for implementation in phases as an outcome of assessment of data and details of Mathura CETP:

S.no	Part, Process	Description	Identified Issues/Deficits	Improvement Measures	
1	Wastewater Drainage Management	Separated sewer systems for storm water and industrial water	No separate Industrial wastewater drains and storm water drains are provided	Separate wastewater collection and conveyance system for trade influents from industries and storm water drains are suggested	
2	Screens	The screens are removing course solid materials from the wastewater	Poor maintenance of screens, multiple screening of wastewater	Installation of a multiple screen system (coarse & fine) with automatic cleaning to be provided The solid matters separated by the screen is removed with level-controlled rakes, and disposed in a residue collecting basket. Regular maintenance is required	
3	Wastewater Collection Pit	The collection pit is used as a pumping pit of the incoming wastewater	Feed pumps are manually operated according to the observed current flow rate. One of three pumps is out of order and needs full repair	Installation of level-operated feed pumps and fill-level alarm. The power of pumps must be sufficient for hydraulic peak loads. Auto-start stop pumping controller to be provided. Maximum pumping capacity to be provided considering peak loads and retention capacity of collection pit	
4	Oil and Grease Traps	Separation of oil and grease	Needs major repairs	Change of MS steel wall to RCC wall baffle for better life and a skimmer for oil/grease removal is suggested	
5	Equalization Tanks (EQT)	Mixing and buffering of incoming wastewater to avoid peaks for the hydraulic and pollutant loads.	The volume of the existing equalization tank is designed considering present wastewater load. Adequate additional Equalization capacity to be provided considering upgradation of proposed waste water treatment capacity The old blower system for mixing is scheduled to be replaced with more efficient and energy saving mixing system	It is recommended to install a mechanical mixer (submerged Banana type / equivalent) instead of a blower system	
				Blower System	Mechanical Mixer
				Low homogenization degree	High homogenization degree
				Significant sedimentation of solids	Negligible sedimentation of solids
				Reduction of mixing performance due to ageing processes in diffusors and hence increasing energy consumption	Constant and reliable mixing performance over long periods of time
				High investment and operating costs (periodical exchange of diffusors, high energy costs)	Significantly lower investment and operating costs
6	Effluent Feed Pumps	Wastewater transfer from the EQT to further	Current pumps are working but	At least one new pump should be added to avoid sudden stoppage	

S.no	Part, Process	Description	Identified Issues/Deficits	Improvement Measures
		treatment steps	they are very old and require regular maintenance.	of wastewater transfer. A level control system needs to be installed for an automatic operation of the feed pumps
7	Flash Mixer	The flash mixer is the first step of a chemical wastewater treatment by adding iron (or aluminium) salts to the wastewater at an alkaline pH value. The metal hydroxides are forming flocks with an electrical charge that can adsorb suspended particles from the wastewater	The current polyelectrolyte mixing system has rusted and needs to be replaced with a new one. According to the operator's information, laboratory tests have been carried out for an optimization of the flocculation in order to use a maximum pollutant removal with a minimum of operational costs. The current operation of the flash mixer and flocculation is providing a sufficient flocculation.	The flocculation should be always performed in the optimum pH range (according to laboratory tests) Hence, the dosing of flocculating agents should be controlled with a pH sensor to ensure the correct pH for the optimum flocculation results. The current Flash mixer is working but it would be better to have separate mixing of flocculating agents by providing a pH optimization tank prior to the flash mixer. This will lead to even better flocculation. Separate reagent preparation systems with auto dosing systems to be provided to ensure optimum use of chemical and minimum sludge generation. The mixer should be equipped with an inverted paddles to achieve a better homogenization A new pH optimization tank and a new mixing system for polyelectrolyte is already planned
8	Flocculation	The forming of big hydroxide clusters for an efficient removal of suspended solids can be achieved by adding of polyelectrolytes		
9	Preparation of Flocculating Agents	The solutions of flocculating agents are prepared from solid basic materials (lime, ferrous sulphate, polyelectrolyte	The existing equipment is working	Since a new pH optimization tank is recommended it can be assumed that the piping of the chemical tanks must be modified as well. The piping sizes of the chemical preparation tank needs to be increased and more pressurized water is needed for an efficient preparation of the chemical solutions. Sufficient mixing time to be provided e.g. for lime milk 30-45 mins in warm water and for other reagents – 10-15 mins with continuous stirring
10	Primary Clarifier	Separation of flocks (suspended solids) from the water	Existing sludge scraper is rusted and often stops working	The existing sludge scraper needs to be replaced
11	Air Blower	Air blowers, together with diffuser units are providing the required oxygen in the aeration tank for carbon digestion and nitrification	The existing aeration facility has three blowers. Two of them are working and one is out of operation	It is recommended to get one new blower and to maintain/repair the existing two blowers that are currently working. In order to control the power of the blowers according to the oxygen demand of the aeration tank, a VFD needs to be provided and to be interlocked with DO sensors in the aeration tank

S.no	Part, Process	Description	Identified Issues/Deficits	Improvement Measures
12	Aeration Tank	Biological carbon degradation and nitrification of organically bound nitrogen and ammonia	The existing Aeration tank is having sufficient volume capacity for present wastewater load	However, it is recommended to improve the design by installing a baffle in order to avoid short cut flows to the outlet. Depending on the future pollutant load an upgrade of the aeration capacity based on advanced technologies such as MBBR or IFAS should be explored It is recommended to measure the mass concentration of nitrogen components (TKN, NH_4-N) and PO_4-P as well since the nitrification in the aeration tank is consuming more oxygen as an adequate carbon digestion and for being able to control the C:N:P ratio in the aeration tank. In case the C:N:P ratio in the aeration tank is out of range (100:5-10:1), an additional feed of the loss-making component is required for a proper biological wastewater treatment
13	Secondary Clarifier	Separation of activated sludge	The bottom scraper is rusted. It is working now but it will not work for long time due to increasing corrosions The sludge recirculation pumps are working but are old and often breaks down	The installation of a new bottom scraper should be conducted in due time An additional new sludge recirculation pump is recommended. An additional installation of a sludge thickener after the secondary clarifier could be an added advantage for an improved sludge dewatering process (centrifuge or belt press)
14	Chamber Filter Press	Dewatering of sludge	Currently are two chamber filter presses available	It is recommended to carry out sludge dewatering with a sludge thickener in combination with a centrifuge or Screw press for the dewatering of higher sludge volumes within a moderate time period Such equipment's provide higher dry matter of the sludge and have proven track record saving a lot of time (and operating cost also in the case of screw press) compared with a chamber filter press
15	Filter Feed Tank and Feed Pumps	Buffer tank for sand and activated carbon filter for a reliable operation of the filter units.	Not installed	A buffer tank is recommended for even feeding of the filter systems Two new filter feed pumps are planned (1 working+1 standby)
16	Sand Filter	Reducing suspended solids after the chemical-	Not installed	Two sand filters with a backflush option are planned (1 working+1 standby)

S.no	Part, Process	Description	Identified Issues/Deficits	Improvement Measures
		biological wastewater treatment.		
17	Activated Carbon Filter	Removal of non-biodegradable components.	Not installed	Two activated carbon filters system are planned (1 working+1 standby)
18	Flow Monitoring	Monitoring of flow rate	The existing flowmeter for the inlet is working	An additional flowmeter at the final outlet from the new recommended carbon filter should be installed for a better controlling of the filter units The flowmeter at the outlet can be connected on a planned online monitoring system
19	Online Monitoring System	Monitoring of flow rate and pollutant parameters as specified by regulatory authorities	Currently only one flowmeter for the inlet	All monitored parameters must be comprehensible by calibration protocols and validated by a different analytical standard method (e.g. comparison of the value by photometric or titrimetric laboratory analysis) The calibration procedure is usually given by the manufacturer's manual. However, the COD can be easily controlled by applying a calibration solution that can be purchased ready to use from different suppliers or can be easily prepared in the laboratory
20	Sludge Drying Beds	The sludge from the chamber filter press is dewatered in a provisional drying bed	A Comprehensive sludge management plan is required	By utilizing drying beds, a gradual progression of the sludge dewatering must be considered. Means, depending on the lifetime in the drying bed, the upper layers will have much less water than the lower layers near to the bottom of the drying bed. Particularly under consideration of the CETP-expansion a solar sludge drying, could be an alternative for the drying beds. Very efficiently could be a simple solar dryer with a combined sludge turning and transportation system. The reduction of the sludge volume by higher dewatering degrees safes significantly costs for the sludge disposal. **For a holistic sludge management after a CETP-upgradation, the following measures can be summarized as follows:** 1. Optimization of flocculation by laboratory test and characterization of the sludge from the chemical treatment (% of dry substance). 2. Characterization (% of dry substance) of the biological sludge.
21	Sludge Disposal	Currently no plans. At the moment the sludge is kept in a hall		

S.no	Part, Process	Description	Identified Issues/Deficits	Improvement Measures
				3. Sludge amounts and sludge characteristics of both of the sludge qualities (chemical sludge from flocculation, sludge from aeration tank) can be figured out for the evaluation of a solar dewatering (are savings of a higher drying degree economically, enough space available for the required percentage of dry substance). This evaluation can be used to decide whether both of the sludge qualities can be treated together or separately. 4. Detailed sludge characterization and chemical analysis for the evaluation of disposal alternatives (such as AFR in Cement factories) 5. The volume of the sludge thickener must fit to the design of the CETP (flow rate, duration time, dry matter for dewatering). 6. For finding alternative sludge disposals (e.g. rotary kilns of cement industries) suitable sludge analysis (calorific value, dry substance content, ash residue, toxicity) are mandatory. For a thermal sludge utilization, the water content should be low, the caloric value should be high (low percentage of inorganic compounds) and the mass concentration of inorganic and organic halogen compounds (Cl, Br) must be low in order to avoid high toxic flue gas emissions during the incineration process (formation of polychlorinated dibenzodioxins and -furans).
22	Laboratory	A laboratory is mandatory for the operational self-monitoring of a CETP	Currently measured parameters: pH, TSS, COD, BOD_3	Relevant parameters for an operation of a CETP are COD, BOD, TKN, P-PO_4 together with TDS, TSS, MLSS and pH as well as the DS of sludge before and after dewatering that should be measured daily from representative samples For a proper technical control of the CETP it is a must that all records (including calibration records) of the online-monitoring station are available at the CETP as well. Ideally the laboratory at CETP is suggested to get NABL accreditation It also required that a computer is available for the preparation of required documentations (log-book for daily analysis and maintenance works, energy consumption, and other operational data)

S.no	Part, Process	Description	Identified Issues/Deficits	Improvement Measures
				The evaluation of records from the online-monitoring unit (average values) should be combined with the result of daily analysis in the log-book Significant improvements are recommended for efficiently and reliable analyses of required basic parameters. Suggested are for example the equipment for manometric measurement of BOD (without chemicals) and the utilization of photometric standard methods for other parameters like COD or anions. The implementation of a simple sampling and analysis based on SOPs is mandatory for achieving reliable results with a constant precision. **SOPs should be prepared for:** 1. Sampling procedure for a combined sample obtained by 5 qualified single samples and 1.5 hours sample intervals 2. Analysis procedures for all parameters analysed in the CETP laboratory according to an accepted standard method (preferable photometric methods) including the respective calibration procedures. 3. Evaluation and documentation of analytical results signed by the responsible person. 4. Calibrations/adjustments for all parameters of the Online-Monitoring-System, including the evaluation of obtained values. Intensive training measures for sampling, AQA and calibration of monitoring systems are urgently required.
23	SCADA System (Optional)	An appropriate SCADA system is recommended for controlling all relevant parts of the CETP	Optional	The implementation of an appropriate SCADA system is recommended. The SCADA system can be implemented stepwise by setting priorities (e.g. aeration system, feed pumps, centrifuge) and can be expanded step by step. However, a stepwise implementation must consider sufficient free ports and a suitable control unit for further connections
24	Training to Operators and Chemist for Daily Operations	CETP staff's knowledge and expertise	The present staff members do not have exhaustive knowledge for day-to-day operations of CETP, Laboratory analysis and trouble shooting	A detailed training program is required to be prepared and implemented

4.3.1 Suggested Timeline for Improvement Measures

The implementation of improvement measures can be assigned to the following time periods according to the improvement plan as agreed with the operator:

Immediate Actions

- Improvement of laboratory
- Installation of Online-Monitoring-System (inlet and outlet).
- Optimization of flocculation by installation of a pH control tank.
- Installation of level-operated feed pumps and fill-level alarm in collection pit.
- Training measures for maintenance/calibration of CETP equipment's and monitoring equipment.

Mid-Term Actions

- Set-up of Indirect Discharge Monitoring system.
- Optimization of sludge dewatering with centrifuge / screw press along with Polyelectrolyte dosing system.
- Installation of redundant carbon and sand filter systems.
- Remaining preventive and breakdown maintenance measures.

Long-Term Actions

- Integrated sludge management Plan.
- Utilization of data base.
- Implementation of an appropriate SCADA system (optional).

5 CETP, Tronica City, Loni, Ghaziabad

Table 5: Brief Details of Tronica City – Loni CETP

Units in total:	30 (Approximately)
Units currently in operation:	With ZLD – 2 Nos With CETP Disposal - Not Known
Operator of CETP	UPSIDC (Uttar Pradesh State Industrial Development Corporation)
Owner of CETP	UPSIDC
Hydraulic design of CETP	New CETP - 6.0 MLD
	Old CETP – 4.0 MLD

An old 4 MLD CETP was developed & operated by UPSIDC and was later handed over to industry association for operation. A RCEUS study reveals that the old CETP can only treat 2 MLD textile effluent. Therefore, a new 6 MLD CETP, has been constructed and commissioned by UPSIDC. However, the Industries Association is reluctant to take handover of the CETP due to technical incompatibility that the CETP is undersized and needs to be assessed. As per Master Plan, UPSIDC is to develop an additional 22 MLD CETP.

All Wet Textile Operations in the industrial park are closed since 20th April 2019 as per CPCB directions and there after allowed to operate partially with certain restrictions.

5.1 Present Status of CETP & Interventions by Hon'ble National Green Tribunal of India (NGT)

Order of the National Green Tribunal in the matter of Rashid Ali Warsi Vs UPSIDC Ltd. & others dated 08/08/2019 regarding discharge of untreated effluents by textile units using hazardous chemicals in Loni area, Ghaziabad, UP.

The Tribunal on finding that the CETP set up by the UPSIDC was not functioning properly had directed its management to hand over it to SPV, Tronica City Association. But, the conveyance system was not rectified. BOD and O&G exceeded the prescribed standards. On account of chocking of drainage system, effluents were overflowing into the drain resulting in water logging. Hazardous waste was being stored unscientifically and damage

was being caused to the Jawali irrigation canal meeting Hindon River, which is a tributary of Yamuna.

The Tribunal, then had directed remedial measures to be taken up by the concerned authorities, overseen by a committee headed by Justice S.U. Khan, former Judge of Allahabad High Court. The report furnished by the Oversight/Monitoring Committee mentioned the **non-cooperative attitude of the concerned officers of the UPSIDC and the UPPCB**. The result was that the hazardous waste continued to be stored unscientifically in closed bags and there was non-compliance of the orders of NGT. BOD exceeded the prescribed parameters. Conveyance system was not properly maintained which was required to be done by CETP Association/UPSIDC.

The NGT vide order dated April 4, 2019 had asked the Chief Secretary, UP to look into the report and furnish an action taken report. The report of August 6, 2019 mentions that remedial measures have been taken and responsibility of erring officers of the UPPCB and the UPSIDC fixed who will now be proceeded against by the concerned departments. Further, 28 units which were operating at 50% capacity have been closed as the CETP did not have the capacity to sustain the pollution caused by the said units. A new CETP of 6 MLD capacity has now been constructed and conditional (CTO) has been given. There is proposal to revoke the closure in due course after improvement of the situation. The system has been operationalized and third-party verification is in process. OCEMS has been installed. The new CETP is under stabilization.

Keeping in consideration the report, NGT directs that further action be taken in accordance with law after ensuring that the CETP is fully functional and stabilized and no pollution caused.

NGT Court Orders: Original Application No. 317/2015(M.A. Nos. 831/2015, 1059/2017, 53/2018 & 1000/2018). **Salient features of final directions:**

1. 28 units which were earlier found achieving norms may be allowed to operate to the extent of 50% capacity till the CETP capacity is appropriately increased. We further clarify and direct that all the industries Member of CETP, should comply with PETP standards as prescribed by UPPCB through consent orders.
2. Conveyance system be operationalized within one month from date of order, in view of stand of the UPSIDC itself.
3. The hazardous waste lying in the premises of the CETP be scientifically transported and disposed of as per Hazardous and Other Wastes (Management & Trans boundary Movement) Rules, 2016, within one month from the date of order under the supervision of the UPPCB.
4. All the recommendations in the report be complied with (7 Recommendations).
5. For damage to the environment including for storing the hazardous waste illegally, CETP and UPSIDC will deposit a sum of Rs. One crore with the CPCB in the proportion of 50% each, within one month day.
6. If any unit is found to be ZLD, it will be open to the UPPCB to permit the capacity to be enhanced.

5.2 Detailed Project Report (DPR)

The DPR / Tender proposal was prepared by UPSIDC.

5.3 Further Interventions & Way Forward

Due to the controversial situation, to the decisive and on-going intervention of the NGT and to the reluctance of the Industries' Association to take over operations of the newly constructed CETP, the team has decided to postpone the in-depth assessment of the CETP and the development to fan improvement plan.

In order to suggest appropriate improvement measures, the team suggests that the following needs to be investigated / assessed:

1. Agreements between UPSIDC and Industries Associations and Industries
2. Organize a joint stakeholders meeting to understand conflicts / issues
3. Survey wastewater collection, conveyance and disposal system
4. Rapid / Detailed technical analysis of newly constructed 6.0 MLD CETP
5. Rapid Assessment of DPR (if prepared by CETP developer)

Issues and Recommendations

6 Issues of Textile Cluster in Uttar Pradesh

The table below presents an overview of the findings in the four operational textile CETPs in UP. The findings are organized according to administrative, technical and operational aspects. The comparison allows to identify common issues and to propose (in the following sub-chapter 6.1) recommendations for the relevant authorities on how to support the cluster meeting its regulatory standards and address operational issues

	Observations / Suggestions			
	Rooma, Kanpur	Pilkhuwa, Hapur	Mathura CETP	Tronica City, Ghaziabad
Administrative Aspects				
Planning	Very poor, required to be up-graded	Moderate; the CETP treatment process was planned adequately which is performing well. However, the CETP capacity filled up 100% and HPDA still in the phase of developing DPR, better this should have happened 2 years back	Under the new contract facilitated by NMCG	Issues in planning. Matter noted at NGT. The industries members are on disagreement with owners (UPSIDC) over several issues. Require upfront agreement with members in coordination with UPPCB
Development (DPR)	2 DPR existing. Quality not satisfactory, require to be upgraded.	DPR has been prepared. HPDA presently do not have funds for major up-gradation of CETP as well as capacity enhancement.	Satisfactory, under the supervision of NMCG DPR have been developed, tender in process	Issues with development and capacity
Finance	Very poor, required to be up-graded; association have not provisioned any funds for expansion, contingencies etc. Struggling to get assistance from UPSIDC for the CETP development. Presently, they are just meeting the operational expenses	HPDA presently do not have funds for major up-gradation of CETP as well as capacity enhancement. A long-term sustainable finance model is required	Satisfactory, under the support of NMCG for upgradation	Issues with Finance Recovery of funds
Sustainability (Are tariff systems in place?)	Sustainable in short term, medium to long to long term sustainability is questionable. No tariff system in place	Sustainable in present state, requires planning for long term sustainable model. No tariff system in place	Sustainable in short term, medium to long to long term sustainability is questionable. No tariff system in place	Non sustainable model in present state. Yet to derive tariff system in consultation with UPSIDC
Human Resources	Very poor, required to be up-graded; more qualified manpower required	Presently managed and operated by HPDA through their dedicated officers	Planned to be up-graded under the up-gradation project, re-	Requires major up-gradation; more qualified manpower required

	Observations / Suggestions			
	Rooma, Kanpur	Pilkhuwa, Hapur	Mathura CETP	Tronica City, Ghaziabad
			quire post up-gradation investigations	
Technical Aspects				
Appropriateness of Technology / Treatment Processes at CETP	Requires holistic approach starting with detailed wastewater analysis, wastewater inventory, clusters' wastewater generation capacity analysis & justification for capacity, medium to long term enhancement forecast, treatability studies and pilot trials	Satisfactory in present status, adoption of holistic approach for long term planning is suggested	Detailed wastewater analysis, justification for capacity and medium to long term enhancement forecast, treatability studies and pilot trials might have added value to the proposed up-gradation project	Requires further assessment
Operation	Not satisfactory in present state	Satisfactory in present state, through professional and experienced contractors (Contract ending November-2019)	Not satisfactory in present state, requires post up-gradation investigations	Requires further assessment
Laboratory Management	Not satisfactory in present state	Satisfactory in present state, through professional and experienced contractors (Contract ending November-2019). Laboratory requires up-gradation	Not satisfactory in present state, requires post up-gradation investigations	Requires further assessment
Preventive & Breakdown Management	Not satisfactory in present state	Satisfactory in present state, through professional and experienced contractors (Contract ending November-2019)	Not satisfactory in present state, requires post up-gradation investigations	Requires further assessment
Energy Efficiency	Very Poor, Not satisfactory in present state	Moderate, can be enhanced through various measures	Very Poor, Not satisfactory in present state, requires post up-gradation investigations	Requires further assessment
Sludge / Hazardous Waste Management	Poor, being upgraded in phased manner	Satisfactory in present state, through professional and experienced contractors (Contract ending November-2019)	Very Poor, Not satisfactory in present state, requires post up-gradation investigations	Requires major up-gradation
Indirect Discharge Management	Very Poor, Not satisfactory in present state	Poor, Not satisfactory in present state. HPDA has initiated actions to stop IDM	Very Poor, Not satisfactory in present state, requires post up-gradation investigations	Requires further consolidated efforts

	Observations / Suggestions			
	Rooma, Kanpur	Pilkhuwa, Hapur	Mathura CETP	Tronica City, Ghaziabad
Members Level Wastewater Monitoring	Does not exist,	Does not exist, Required to be included in CETP management (Outside prevue of CETP Operation agency)	Does not exist, Not satisfactory in present state, requires post up-gradation investigations	Requires further assessment
Managerial Aspects				
Appropriateness of Operators / Staff	Poor, Not satisfactory in present state	Satisfactory in present state, through professional and experienced contractors (Contract ending November-2019)	Very Poor, Not satisfactory in present state, require post up-gradation investigations	Requires further assessment
Skills of Staff	Very Poor, Not satisfactory in present state	Satisfactory in present state, through professional and experienced contractors (Contract ending November-2019)	Very Poor, Not satisfactory in present state, require post up-gradation investigations	Requires further assessment
Co-ordination with External Stakeholders	Very poor, lead to frequent closures of CETP forcing Industries to shut down and industrial production at reduced capacities	Satisfactory in present state, through HPDA officials	Satisfactory as of now, under the supervision of NMCG	Very poor
Legal issue Management (NGT and Others)	Very poor, lead to frequent closures of CETP forcing Industries to shut down and industrial production at reduced capacities	Satisfactory in present state, through HPDA officials	Satisfactory as of now, under the supervision of NMCG	Improper handling
Professional Management	Not satisfactory, requires major up-gradation	SPV does not exist. HPDA is in process to form SPV for Management of Assets and Operation and Management of CETP	Very Poor, Not satisfactory in present state, require post up-gradation investigations	Requires further assessment

7 Recommendations for a Strategy for SMCG/NMCG to Support Textile CETPs in Uttar Pradesh

In consideration of the issues presented in the table above and of the findings of visits and interviews with main stakeholders, it is recommended that the SMCG/NMCG develops the following operational framework to support textile cluster and its CETPs:

1. **Regulatory Framework**
   - Develop a special policy / guidelines at NMCG for CETPs under Ganga River Basin under Ganga Act 2017 in consultation with MoEFCC
   - Develop a framework to bring all CETPs under Ganga River Basin on unified platform in consultation with MoEFCC

2. **Enforcement Mechanism**
   - Create joint steering committee at Central Level with MoEFCC & CPCB having mandate under EPA 1986 and NMCG under Ganga Act 2017
   - Create joint steering committee at States level with SPCBs having mandate under EPA 1986 and SMCG under Ganga Act 2017
   - Capacity building of NMCG and SMCG officials for enforcement
   - Develop Enforcement Mechanisms

3. **CETP Pre-Development Mechanism**
   - CETPs to be developed after tri-party agreements i.e. Industries Association, Developers and Industries and creation of SPVs
   - No CTE / CTO to Industries to be granted without consent / membership of CETPs
   - Detailed tariff structure to be developed prior to development of CETPs
   - Indirect Monitoring system to be developed
   - Monitoring Mechanism to be defined prior to development of CETPs
   - Long Term sustainability plan to be developed prior to development of CETPs with special focus on Financial Sustainability

4. **CETP Development Mechanism**
   - Development of CETPs through SPVs
   - SPV to have professional directors with experience in field
   - Not more than 2 Industry members to be allowed on board of Directors
   - Board should have at-least 2 paid Technical Members with experience in field
   - NMCG to designate their representative as ex-officio board member
   - NMCG to have “Right to Take Over” in case of major non compliances, especially for the CETPs which receives grants from NMCG
   - District Magistrate can chair the Board (Ref. NGT directives issuing notices to CS of States for non-compliances)
   - BOD can form various committees such as – Operations Committee, Audit Committee, Finance Committee, Tariff Committee, Legal Compliances Committee etc. depending on the scope / nature of CETP

5. Operations Mechanism

- Operations through experienced contractors
- BOO / BOOT / DBOF can be thought of as options, with strategic partners
- Operators must be qualified and certified
- Regular training to be must for all levels of operators
- CETPs to develop plan for providing technical guidance to member industries in reducing waste pollution and wastewater generation
- CETPs to develop plan for working as Incubation Centres / Centres of Excellence / Training Centres for member industries
- CETPs to operate "Cleaner Production Centres" providing systematic technical information to member industries aiming to reduce water pollution and wastewater generation for member industries who wish to expand, modernize and change production profile
- Mechanisms for close monitoring – including performance guarantee to be levied from the SPV to recover the public funds invested in the initiative in case the SPV fails to sustain the CETP

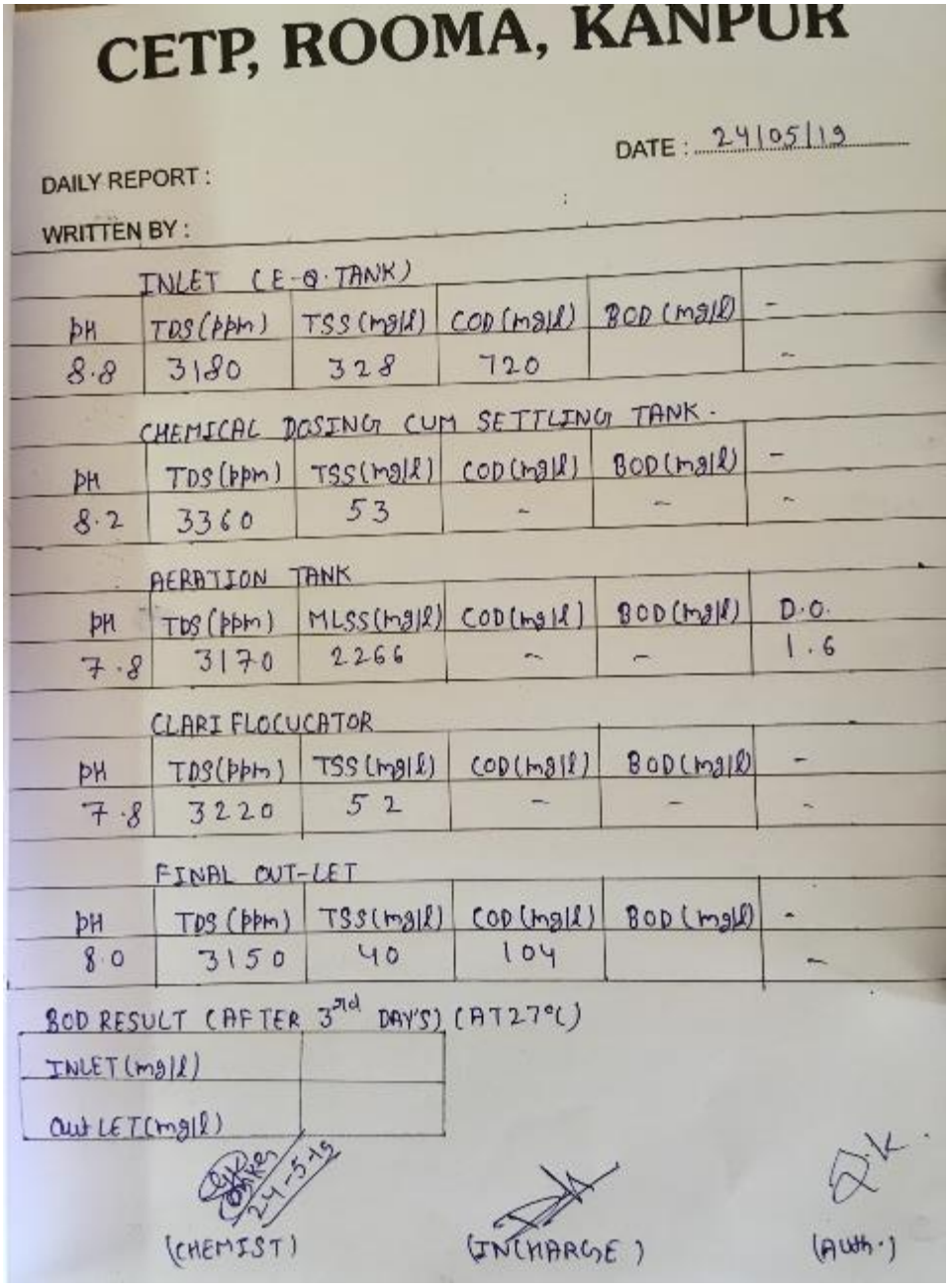
6. Powers that should be granted to SPVs of CETPs

- To close/ take punitive action on violating industries – particularly the ones who release effluent quantity more than allocated/ sanctioned.
- To identify/ report about industries diverting effluent to storm water drains
- Buy back Agreement with industries in case treated water need to be reused.
- Control and Monitoring over water supplied/ abstracted by industries
- Monitoring of groundwater quality and change in water table to track any unauthorized discharge to the aquifer and finger printing the culprits
- O&M costs to cover also sinking fund creation as part of sustainability initiative.

Annexes

Annex 1

Logbook Entry of Rooma-CETP



CETP, ROOMA, KANPUR

DATE : 24/05/19

DAILY REPORT :

WRITTEN BY :

INLET (E-Q TANK)

pH	TDS (ppm)	TSS (mg/l)	COD (mg/l)	BOD (mg/l)	-
8.8	3180	328	720		-

CHEMICAL DOSING CUM SETTLING TANK.

pH	TDS (ppm)	TSS (mg/l)	COD (mg/l)	BOD (mg/l)	-
8.2	3360	53	-	-	-

AERATION TANK

pH	TDS (ppm)	MLSS (mg/l)	COD (mg/l)	BOD (mg/l)	D.O.
7.8	3170	2266	-	-	1.6

CLARI FLOCUCATOR

pH	TDS (ppm)	TSS (mg/l)	COD (mg/l)	BOD (mg/l)	-
7.8	3220	52	-	-	-

FINAL OUT-LET

pH	TDS (ppm)	TSS (mg/l)	COD (mg/l)	BOD (mg/l)	-
8.0	3150	40	104		-

BOD RESULT (AFTER 3rd DAY'S) (AT 27°C)

INLET (mg/l)	
OUT LET (mg/l)	

24-5-19

(CHEMIST) (INCHARGE) (Auth.)

Annex 2

Rooma CETP - Technical Review Findings of DPR # 2 (Volume I) Prepared by TWIC

The technical review of the DPR Volume I is presented in tabular form herein after.

Page	Issue	Comment
22	Number of Textile Processing Units: 30	According to information of RIA there are 13 units in total and 8 of them active.
	Effluent Standards to be achieved: ZLD	Neither the specification documents of the planning company nor the CETP-operator were considering ZLD measures. The answer on request of the expert was that the ZLD is a political issue to be clarified in the future. Thus, the issue on ZLD is not considered in the assessment. However, the ZLD is not considered as a Best Available Technique and not used for industrial or municipal wastewater treatment plants in EU/Germany. In rare cases the ZLD is used internally in industrial sites as a measure for water recycling. The legal limit values for waste water in the EU/Germany are considered sufficient for the protection of the receiving waters. ZLD measures are causing a significant carbon/CO_2-footprint due to the high energy consumption. This fact must be considered as well by the evaluation of pros and cons of the ZLD implementation.
62	List of Textile Units: 13 of 30 units under operation	According to information of RIA 13 units in total, 8 in operation.
63	Door-to-door survey provided by TWIC at industrial units	It was not possible to comprehend how the individual wastewater volumes of each unit were determined (measurements, calculation based on processing capacity or other methods). The total capacity as per door to door survey, was figured out with 209.5 KLD for the whole industrial cluster of the Rooma Textile Zone. However, the display of the online-monitoring unit at the CETP was showing a value of 550 KLD. According to information of the CETP-operator the wastewater flowrate shows values around 500 and 900 KLD. It was not possible to evaluate, whether the flowrate of the monitoring unit was correct calibrated. Nevertheless, these data are of fundamental importance for the correct design of the CETP. Hence, it should be clarified whether the design is based on realistic calculations.

Page	Issue	Comment
73	Results of effluent samples from industrial units	Due to the batch processes the water quality is changing significantly (treatment processes, spilling processes) within short time periods. Hence, it is important to take qualified combined samples over the whole time period of all relevant batch processes (dyeing, bleaching). Analytical results from grab samples or single random samples are not representative at all and should not be taken in consideration for designing a CETP. The analytical test reports are not indicating composite samples, even they are figured out in the table of test results. Analytical values of fundamental importance for a CETP design should be always evaluated thoroughly.
176	Biological treatment of CETP	According to the documentation of FPI India Pvt. Ltd. it is intended to change the existing aeration tank to an IFAS tank (Integrated Fixed Film Activated Sludge). In order to get a sustainable improvement by the IFAS system (which is significantly more expensive as a common aeration system), it must be considered that the growth of bio-film on the textile fibres is controlled properly in order to avoid bio-film clogging or inefficient thick bio-film layers. An automatic blower control by installing oxygen sensors in the IFAS tank is recommended in order to save energy and costs.
178	Color removal by chlorination	In order to reduce recalcitrant COD or colours the chlorination of wastewater after the biological treatment is mentioned. In principle it can be stated that such processes are very costly when applied in a CETP, due to the high wastewater volume. It would be much more efficient to reduce colours at the place where they come from, means in partial wastewater streams of dyeing processes in industrial units. However, chlorination is not a proper method to reduce organic matters, because of the formation of critical chlorinated by-products (e.g. AOX) that are significantly hazardous for health. If decolourization is required, the process should be focused on other more efficient methods like Fenton reactions (hydrogen peroxide in combination with iron salts) or ozone.
220	Sludge disposal	Before defining a solution of the sludge disposal, a characterization by suitable analysis is mandatory. Beside the content of water and the ratio of organic and inorganic matters, comprehensive chemical analysis must be carried out under consideration of toxic components. Halogenated

Page	Issue	Comment
		compounds are of great importance for a thermal disposal, because of the emission of highly toxic compounds like polyhalogenated dibenzodioxins and -furans. This is particular the case when chlorination is used for the removal of colours and COD. The sludge management is not considering dewatering methods e.g. centrifuge in combination with solar dryers. Independent from the utilization or disposal of the remaining sludge it is always recommended to achieve a high percentage of dry matter for reducing cost of disposal or for being accepted for a thermal utilization (in case of suitable analysis results).

Annex 3

Photo Documentation – Rooma CETP Kanpur

Collection Pit

Equalization Tank

Flash Mixer

Aeration Tank

Online Monitoring Unit

Laboratory

Storm Water Drains (Before)

Storm Water Drains (After)

Lime milk & FeSO4 preparation Tanks

Sludge Drying Beds (Construction under progress)

A View of aeration Tank with Leakages from Air Diffusers

Segregated Lime & FeSO4 Dosing in Physico-Chemical Treatment Section of CETP

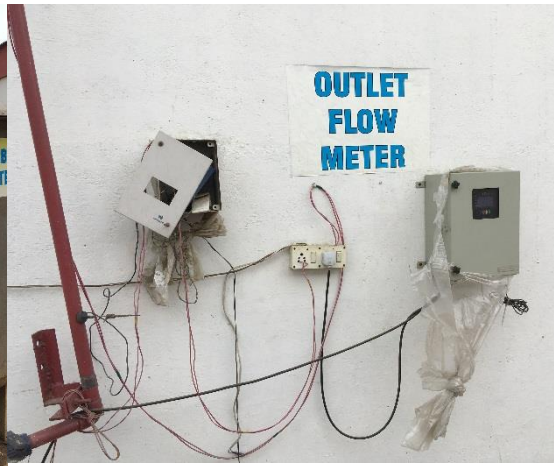
Photo Documentation – Rooma PETP Kanpur

The photos were taken at the Ganga KnitFab factory, Rooma, Kanpur

Equalization Tanks (sedimentation)

Reaction and Settling Tank

Sand Filter and Carbon Filter



Monitoring Unit

Flowmeter in Monitoring Unit

End Products

Annex 5

Photo Documentation – Pilkhuwa CETP, Hapur

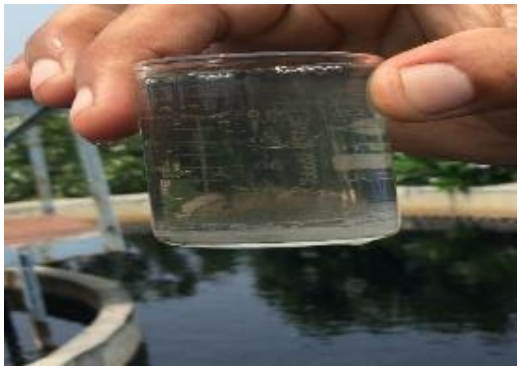
Current Primary Flocculation

Floc Formation

Aeration Tank

Blowers for Aeration Tank

Final Sedimentation Tank



Treated Water from Outlet

Wastewater at various stages of CETP

Sludge Dewatering using Filter-Press

Photo Documentation – CTA Apparels PETP, Pilkhuwa, Hapur

Chemicals for Flocculation

Flocculation Tank

Flocculator and Tube Settler

Filter Units for Color Removal and Suspended Solids

Annex 7

Photo Documentation –Mathura CETP

Screen Inlet

Inlet Equalization Tank

Chemical Storage for Flocculation

Flocculation

Final Sedimentation Tank (Secondary Clarifier)

Outlet of CETP

Equalization Tank

Flocculation Channel & Clarifier

Sludge Drying Beds

Annex 8

Photo Documentation –Mathura Trading Co. PETP, Mathura

Drying of Garments

Preparation before Printing

Printing

Printed Garments

Annex 9

Photo Documentation – Tronica City CETP, Loni, Ghaziabad

Layout of Tronica City Industrial Area - UPSIDC

Wastewater outside CETP

Wastewater in Industrial Estate

Sludge Drying Beds at CETP

Annex 10

Status of CETPs/ETPs Visited and Way Forward

CETP /ETP	Assessment Report	Improvement Measures Plan	Status of Implementation improvement measures	DPR	NGT	Way Forward
Pilkhuwa CETP	✓	✓	Follow up during 2020	Will be developed by Consultants of CETP Owners (HPDA)	Industries operating	Preparation of DPR by HPDA, submission to SMCG/NMCG for grant of funds
Pilkhuwa ETPs (2)	To be assessed in 2020	To be suggested in 2020	Follow up during 2020	-----	----	Industries to be assessed in 2020. Improvement measures to be suggested in 2020. Handholding support to be provided in 2020.
Mathura CETP	✓	Not relevant at the moment because DPR/tendering still in progress		Suggestion by SGR team to include open technology in revised tender was accepted and implemented.	----	New Contactors for CETP Contact and New Office Bearers of Industries Association to be contacted in 2020
Tronica City CETP	✓	Not developed because industries were closed recently by UPPCB based on NGT Order. Now partially reopened		New 6 MLD CETP already commissioned. UPPCB to check	Yes (2018)	UPSIDC to be contacted for further actions thereupon
Rooma CETP, Kanpur	✓	✓	✓	2 DPRs developed by SPV submitted to UPSIDC	Yes. Today industries operate at 50%. CPCB has carried out sampling in Nov. 19, awaiting results	UPSIDC to be contacted for further actions thereupon
Bhadohi CETP	✓	------	------	------	-----	(All Industries disconnected from CETP and operating their own ETPs)
Kanpur-Jajmau	✓	Not in scope of work			Yes (details)	

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