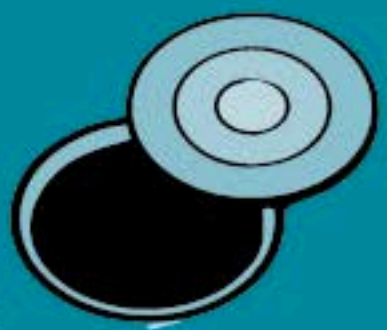

DETAILED PROJECT REPORT

CO-TREATMENT OF FAECAL SLUDGE AT BIJNOR SEWAGE TREATMENT PLANT

PREPARED BY

CSE Technical Support Unit (TSU)

For Bijnor Nagar Palika Parishad

Detailed Project Report

on

Co-treatment of Faecal Sludge at Bijnor Sewage Treatment Plant

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Abbreviations

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BA	Bijnor Area
BEA	Bijnor Extended Area
BOD	Biochemical Oxygen Demand
BIS	Bureau of Indian Standard
BNPP	Bijnor Nagar Palika Parishad
CAPEX	Capital Expenditure
CGWB	Central Ground Water Board
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health & Environmental Engineering Organization
CSE	Centre for Science and Environment
CSTF	City Sanitation Task Force
CUM	Cubic Meter
DPR	Detailed Project Report
DUDA	District Urban Development Authority
EWS	Economically Weaker Sections
FGD	Focused Group Discussion
FSS	Faecal Sludge & Septagae
FSM	Faecal Sludge Management
FSSM	Faecal Sludge and Septage Management
GoI	Government of India
GoUP	Government of Uttar Pradesh
KII	Key Informant Interview
lpcd	Litres per Capita per Day
MIS	Management Information System
MJS	Ministry of Jal Shakti (formerly MWRRD&GR)
MLD	Million Liters per Day
MoHUA	Ministry of Housing and Urban Affairs (Formerly known as MoUD)
MoUD	Ministry of Urban Development
MSL	Mean Sea Level
MWRRD &GR	Ministry of Water Resources, River Development and Ganga Rejuvenation
NFSSM	National Faecal Sludge and Septage Management
NIC	National Informatics Centre
NITI	National Institution for Transforming India (Formerly Known as Planning Commission)
NMCG	National Mission for Clean Ganga
NUSP	National Urban Sanitation Policy
OD	Open Defecation
OPEX	Operational Expenditure
OSS	Onsite Sanitation System
OU	Open Urination
PPE	Personal Protective Equipment
RSU	Reform Supporting Unit

SBCLTF	Swachh Bharat City Level Task Force
SBM	Swachh Bharat Mission
SDGs	Sustainable Development Goals
SFD	Shit Flow Diagram
SLB	Service Level Benchmarking
SLIP	Service Level Improvement Plan
SLRM	Solid Liquid Resource Management
sq.m	Square Meter
TSU	Technical Support Unit
UDD	Urban Development Department
ULBs	Urban Local Bodies
UP	Uttar Pradesh
UPPCB	Uttar Pradesh Pollution Control Board
UP-USP	Uttar Pradesh - State Urban Sanitation Policy

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Executive summary

• In Bijnor, 94% of population is dependent on onsite sanitation systems like septic tanks and pits, and this number is likely to decrease in the wake of sewer connections to all households in municipal boundary which may take 2-5 years

• City Sanitation Task Force (CSTF) of Bijnor decided to implement a pilot scale Co-treatment of Faecal Sludge and Septage at existing Sewage Treatment Plant (STP) of capacity 24 MLD and requested Centre for Science and Environment (CSE) to do prefeasibility study and prepare DPR

• After prefeasibility study and assessment of proposed sites, an area of 625 sq.m is selected for erecting the proposed co-treatment module. The site lies within the STP close to sludge sump unit

• This DPR is prepared for treating FSS at proposed Co-treatment facility of 20 Kilo Litres per Day (KLD) capacity. The city can follow a cluster approach and allow the plant to cater to the nearby villages located less than 8 km from the city

• Land required by the facility is proposed to be 225 square metre (Sq.m), of which the proposed built-up area is around 117 sq.m and rest of the land would be designated for horticulture

• Gravity based technology is proposed with following modules: screen chambers, a homogenisation tank; apart from this existing units of STP i.e for sludge treatment - sludge sump, sludge drying beds; and for leachate (liquid treatment) - filtrate sump and UASB reactor will be used

• The capital expenditure (CAPEX) of the facility for technical modules comes out to be 28.52 Lakhs including, road, wash area, landscaping, storm water drains etc., including contingencies

• The OPEX of the facility including manpower, electricity, consumables and repair should be part of regular operation of Sewage Treatment Plant

• The resource recovery can further be enhanced by co-composting the dried sludge with organic municipal solid waste

• BNPP would eventually have to move towards implementing city wide scheduled desludging and buy more trucks and implement more Co-composting facilities in different parts of the city to cater the increased demand

Key Features

Faecal Sludge Handling Capacity- **20 KLD**

CAPEX**- 28.52 lakhs**

OPEX**- Negligible** (to be part of regular operations of STP)

Area required for modules- **225 sq.m**

Time duration for implementation **– three months**

Technology used – **solid liquid separation** at drying beds followed by liquid treatment at UASB reactor

1 Introduction

More than 70% of urban population in India is dependent on onsite sanitation systems (OSS), which need regular desludging. Due to lack of any awareness, motivation, regulation, infrastructure and governance, faecal sludge and septage (FSS), desludged from OSS, is disposed of anywhere in open space, open drain or even in water bodies, causing severe problems of environmental pollution, ground water contamination and adverse impacts on the health of local communities. Hence, effective management of FSS from OSS like septic tanks and pit latrines has been well recognized by the concerned ministries of Government of India and different state governments.

1.1 About Bijnor

The city of Bijnor (at 29º 2'' to 29 º 58'' N and 78 º 0' to 78 º 57'' E), district headquarters of Bijnor district of Uttar Pradesh (UP) lies in the upper Indo-Gangetic plan (V) at 12 km west from River Ganga, 460 km from the state capital, Lucknow and 162 km from Delhi, the capital city of India. The city is well connected with other parts of the country via railways and roads.

The current municipal boundary of Bijnor Nagar Palika Parishad (BNPP) encompasses 25 wards and is spread to an area of 3.65 sq. km. The revised municipal boundary as per the expansion proposal submitted by the administration to the state urban development department shall encompass a total area of 11 sq. km (expanding the municipal boundaries to nearby 14 villages having a cumulative area of 7.4 sq. km) which would be three times the current area of administration under BNPP and will demand additional efforts and resources to extend the public services to the expansion area. The proposed area under the villages is addressed as BEA or Bijnor Expansion Area. Combined area under BNPP and BEA shall be addressed as Bijnor Area (BA) throughout this report.

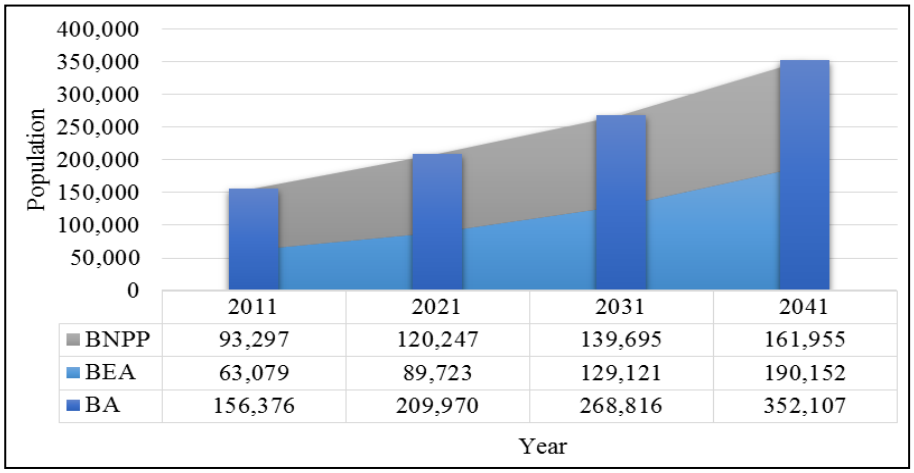


Figure 1: Population projection for Bijnor Area (Source: CSE, 2019)

The cumulative population of BEA (covering nearby 14 villages) is 63,079 with 11,853 HHs. Thus, the total population of BA would be 1,56,376 residing in 29,568 HHs with a population density of 14,255 people per sq. km (see figure 1: Population projection for Bijnor area).

Climate and hydrogeology

Bijnor is located in hot sub humid (dry) northern plain according to Indian Council of Agricultural Research's (ICAR) agro ecological sub regions, upper Gangetic plain zone (V) according to Planning

Commission's agro-climatic zones and Bhabar and Terai zone (UP-2) agro climatic zone[1]. Located at elevation of 225 metres/ 738 feet above mean sea level, Bijnor's topography is primarily plain. As shown in Figure 3, the overall slope in BNPP is towards Ganga at 0.2%. Bijnor receives an annual average rainfall of 999.4 mm, mainly from south west monsoon in JJAS (June, July, August, and September). Temperature in Bijnor ranges from 6°C to 46°C.

Ground water

Out of 11 ground water monitoring wells located in the district, one monitoring well station is located at Gandhi Park in Bijnor, where the ground water was available at 11.45 meter with 0.40 meters of pre and post monsoon fluctuation. CGWB report reveals that the aquifer geometry down to 450 meters depth. While the fence diagram reveals two major clay layers one occurring at a depth of 80-90 metres and other at 250 metres[2]. Thickness of first clay layer is 8-10 metres while the second clay layer is of 25 metres. Following, three tier aquifer system exists in the area. The formation encountered are sands of various grades clay and kankar.

Table 1: Aquifer group as per ground water level

Aquifer group	Depth range (meters)
First aquifer (Top)	00.00-110.00
Second aquifer (Middle)	120.00-250.00
Third aquifer (Bottom)	270.00-450.00

Source: Ground water year book, Central ground water board, District block Bijnor, 2015

1.2 Rationale for DPR preparation

The Environment (Protection) Act, 1986 and the Water (Prevention and Control of Pollution) Act, 1974 prohibits effluent, sewage and septage discharge. Section-24 of Water Act informs that no person shall discharge any sewage or trade effluents beyond the standards as prescribed by CPCB into any stream, river, and well or on land.

The NFSSM policy defines the roles and responsibilities of various government entities and other relevant stakeholders such as the private sector, civil society organizations and citizens for effective implementation of FSSM services throughout the country through enabling the synergies among relevant central government programs such as Swachh Bharat Mission (SBM), Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and the Smart Cities Mission to realize safe and sustainable sanitation for all at the earliest.

Uttar Pradesh Septage Management Policy was issued dated 30th October 2019. The policy targets that by year 2023 there is improvement in the quality of water and protection of public health. The policy has also identified 48 ULBs which have STPs and directs them to undertake septage treatment at the wastewater treatment facilities.

The NFSSM Bye-laws have been passed by the acting board members of the Bijnor municipality and soon will be notified. With these bye-laws, the Municipality aim to bring in strict regulations on all the major stakeholders, across the whole sanitation value chain, thus furthering city's efforts towards citywide sanitation. One of the low hanging fruits for cities with existing sewage treatment plant (STP) is the possibility of exploring co-treatment of faecal sludge with sewage at the STP itself. That is what is being explored at Bijnor through this DPR.

[1] District planning committee, 2007

[2] Ground water year book, Central ground water board, District block Bijnor, 2015

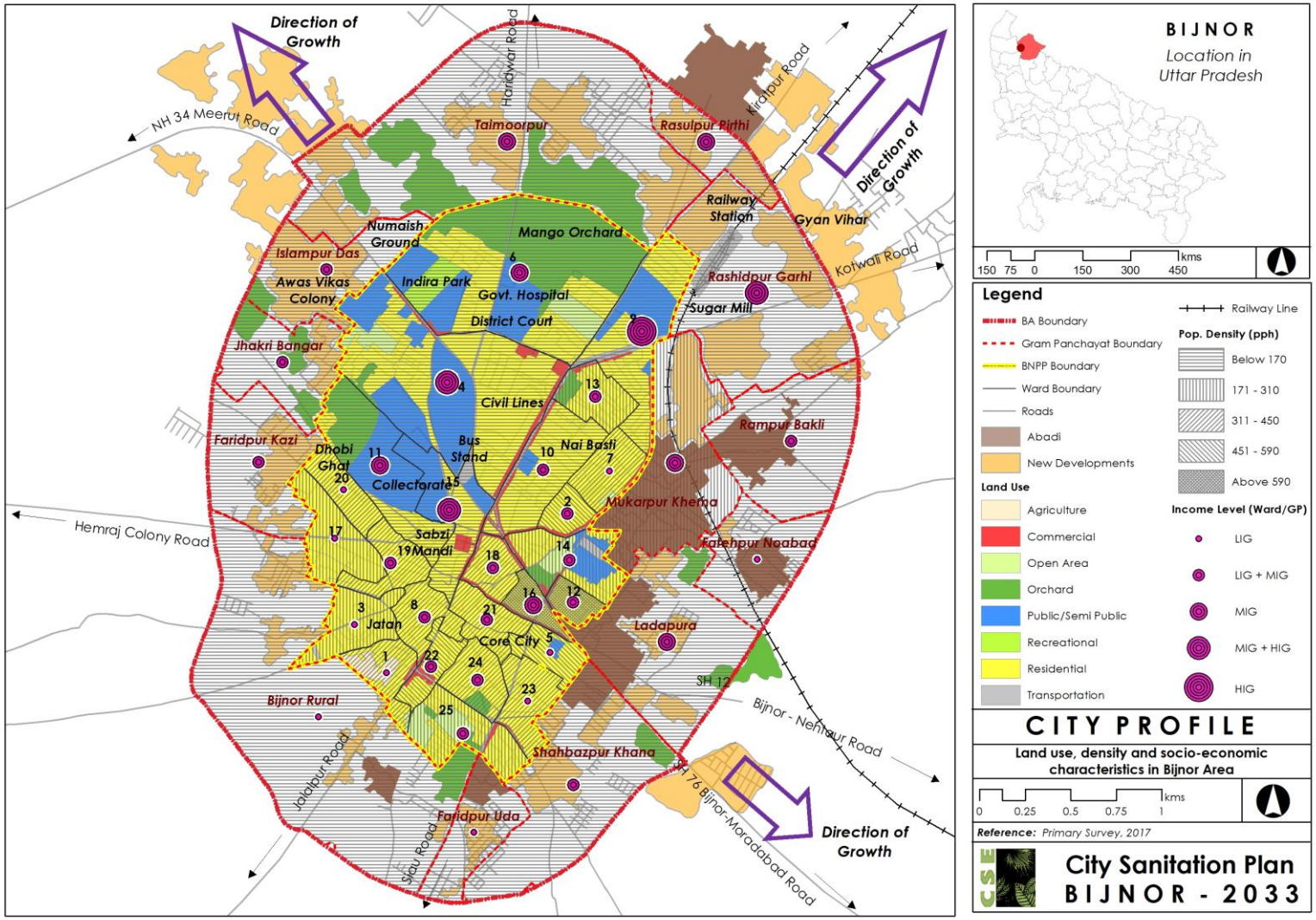


Figure 2: Regional setting of Bijnor (Source: CSE, 2019)

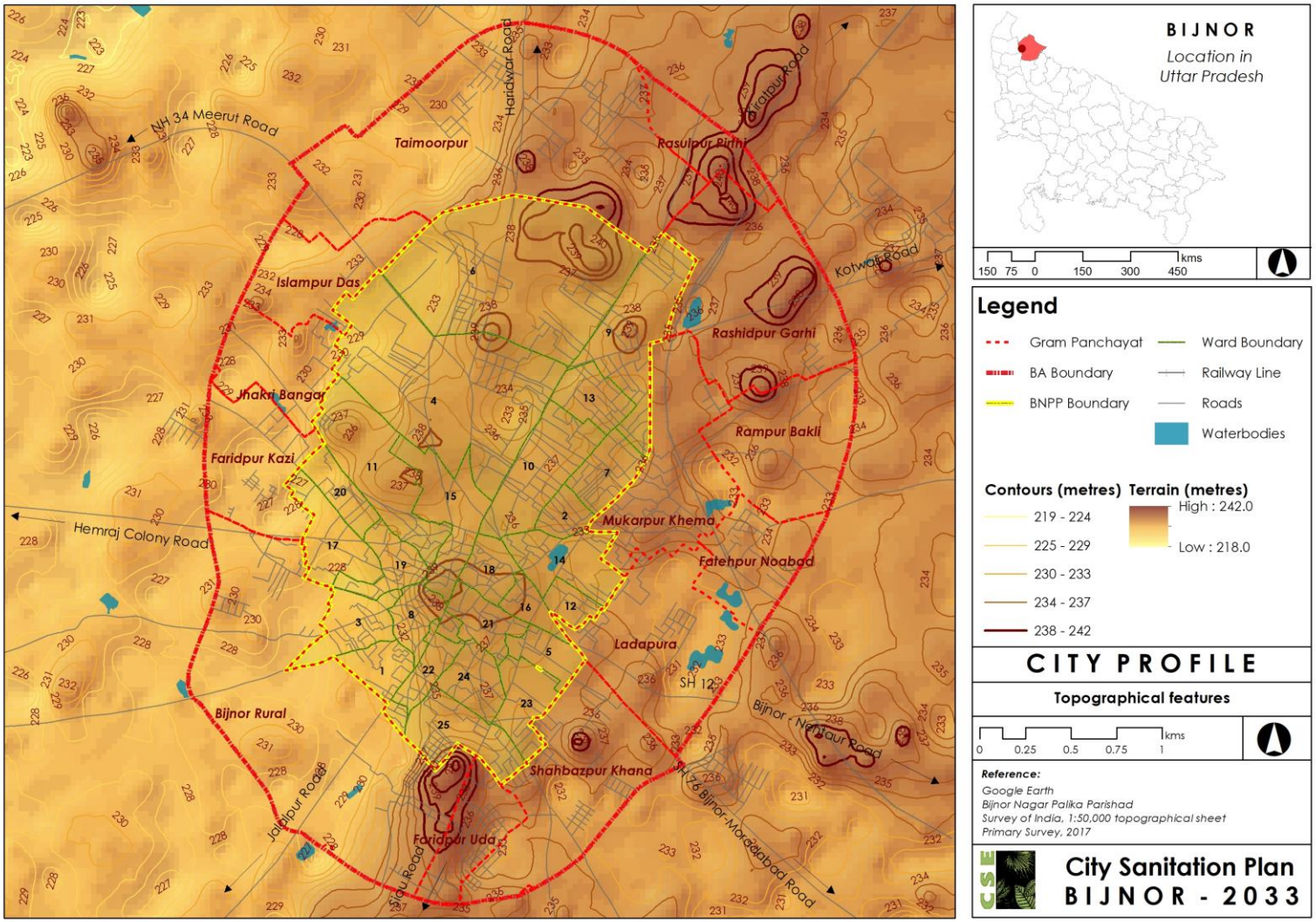


Figure 3: Topography of Bijnor (Source: Prepared by CSE, 2019)

Role of CSE in supporting FSSM in Bijnor is summarized below:

- MoHUA identified CSE to support a total of 23 towns (including Bijnor) so that they become flagship towns in FSSM (D.O. MD-SBM/AA/62/2016 dated 30th May 2016, Annexure 1)
- During the City Sanitation Task Force Meeting (CSTF) in Bijnor on 13th February 2019, the CSTF members approved the proposal of co-treatment and requested CSE to prepare a DPR for co-treatment (Minutes of the meeting held on 13th Feb, 2019, Annexure 2)
- During the CSE- State Mission for Clean Ganga meeting in Lucknow at SMCG office, technical advisor, SMCG assured full cooperation from UP Jal Nigam for feasibility study and preparation of DPR for co-treatment (Minutes of the meeting held on 15th May 2019, Annexure 3)
- UP Jal Nigam provided the 'No Objection Certificate' to CSE for inspecting the site and preparing DPR for co-treatment of faecal sludge at Bijnor STP on 29th November 2019 (1020/022-505/2019 dated 29th November 2019, Annexure 4)

Accordingly, CSE has done survey of the city, inspection of the STP and testing of faecal sludge from containment systems of different typology before preparing this DPR.

In this regard, Jal Nigam officials and ULB officials have attended national and international exposure visits to successfully implemented FSTP and SeTP and also had first-hand interaction with the technology provider, municipality and beneficiaries. The DPR is prepared against the above background and submitted to BNPP for their necessary action and perusal.

2 Existing Sanitation Scenario

According to excreta flow diagram, also known as Shit Flow Diagram, of Bijnor area, 97% population is dependent on onsite sanitation systems, 3% population is directly discharging wastewater to storm water drains. With the recent development of intercepting major drains in Bijnor, the percentage of excreta being managed has become 47%. But it can be clearly seen from the graphic, that there is a huge gap of safe management of excreta at containment, emptying and transportation stage. Overall, excreta of 53% population is not being managed.

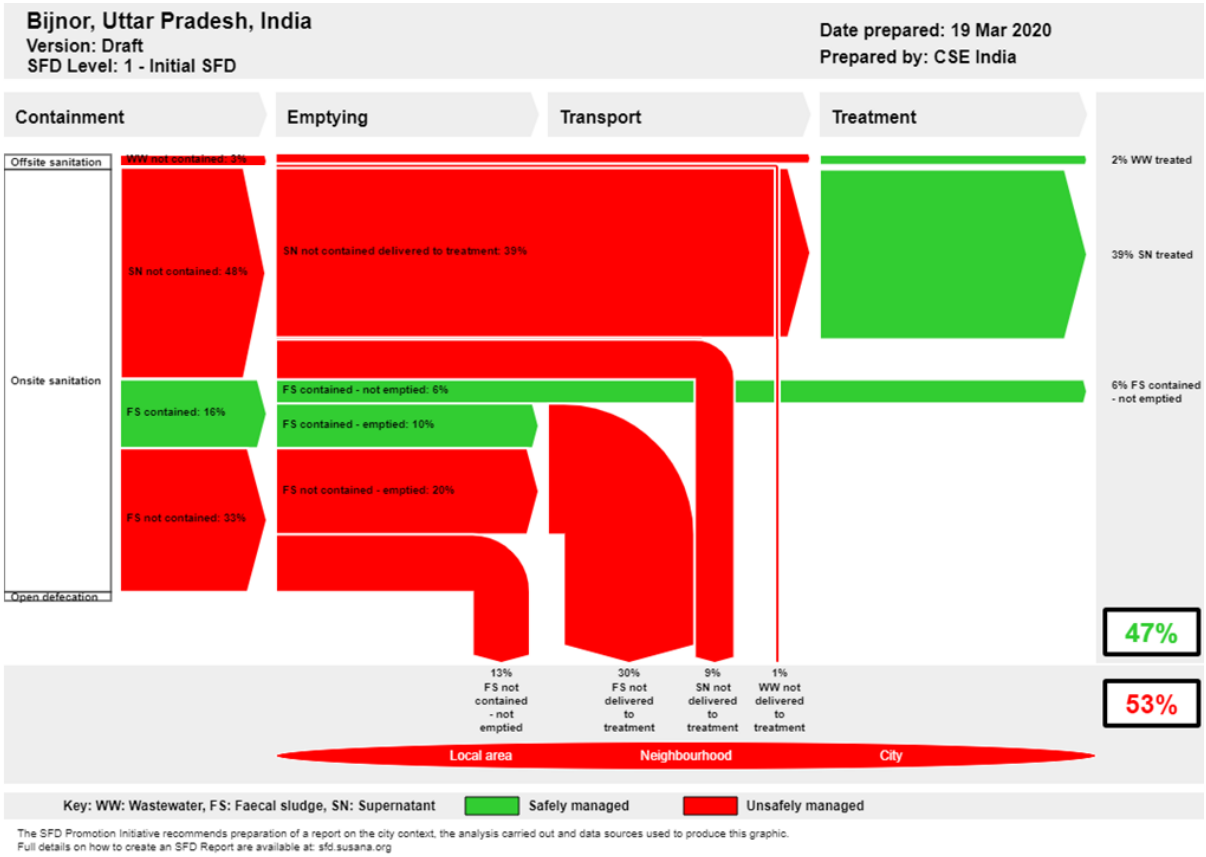


Figure 4: Shit flow diagram of Bijnor city (Source: Bijnor SFD lite report, CSE, 2020)

2.1 Containment

All the HHs with toilets in BNPP are dependent on onsite sanitation systems. 31% of the HHs resort to septic tanks, 66% on fully lined tanks. Remaining, 3% HHs do not have any containment system connected to user interface and discharge the excreta directly from the toilet to the environment.[3] Primary surveys also revealed that the containment systems do not follow design prescribed by IS 2470: Code of Practice for Installation of Septic Tanks or Swachh Bharat Mission Guidelines and varies widely from one containment to another. Observed variations in the volume of containment systems are summarized in Table 2.

[3] SFD lite report for Bijnor, CSE, 2020

Table 2: Volume of containment systems prevalent

Type of user	Volume of containments		
	Minimum (cu.m)	**Average (cu.m)**	**Maximum (cu.m)**
Residential (BNPP)	1	6.5	34
Residential (BEA)	0.8	5.2	11.9
Institutional (BA)	0.8	16.8	54.4
CT/PT (BA)	5	12.9	42

(Source: draft CSP, 2019)

Key informants indicate that the design of the containment system is generally recommended by the masons (based on their experience) in the Bijnor area, which has caused the widespread adaptation of fully lined tanks in newly built/rebuilt or renovated containments. The cost of containment construction having such design is essentially cheaper than building a septic tank. There are two key design aberrations suggested by masons, firstly the locally designed fully lined tanks do not have the baffle wall(s) (suggested under the BIS codes). An elbow at the outlet of the containment system which is further connected to the drainage network as illustrated in figure 8; secondly the size of the containment system, though dependent on the space availability, is often built larger in size with respect to the number of people using the toilet facility.

Figure 5: Fully Lined Tank containment system

(Source: CSE, 2019)

Figure 6: Pit type containment system

(Source: CSE, 2019)

Figure 7: Containment type- Septic tank

(Source: CSE, 2019)

Figure 8: Fully lined tank under construction and effluent overflowing through elbow (Source: draft CSP, 2019)

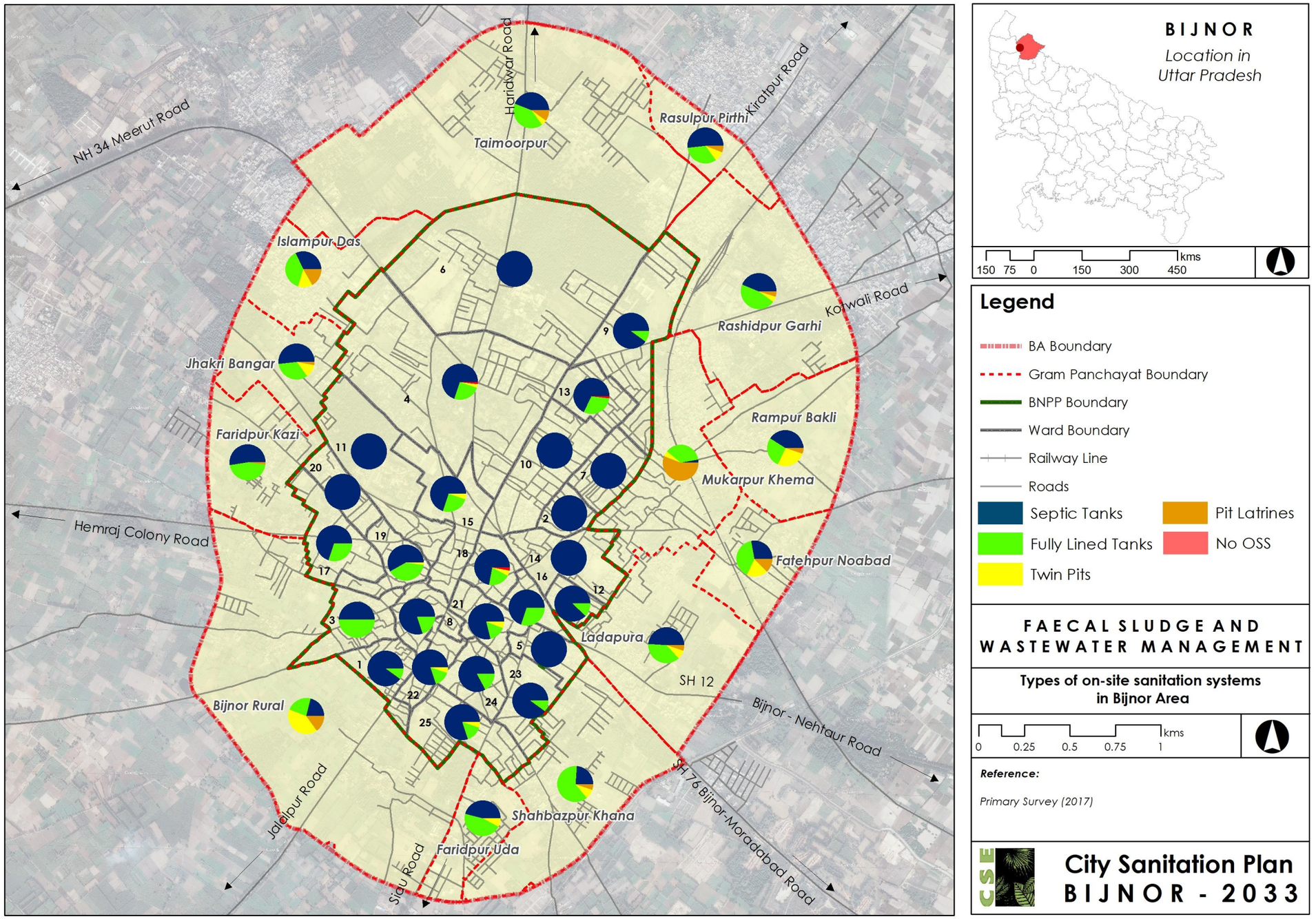


Figure 9: Types of onsite sanitation systems in Bijnor area (Source: draft CSP, 2017)

2.2 Emptying and transportation

Depending on when the containment systems get full, households in Bijnor area get their systems emptied. As mentioned earlier, these systems are of variable size, therefore desludging frequency varies accordingly. The administrative agencies, namely BNPP and Village Panchayats do not own any vacuum tanker and hence do not offer desludging services. Thus, households in the Bijnor area are dependent on private emptiers.

Field based study indicates that there are eight private emptiers operating in Bijnor area and each of them own 1-2 tractor mounted tankers as illustrated in Figure 10. These emptying vehicles used in Bijnor are assembled in Karnal or Sangla. The emptiers put forth issues with regard to problems faced during emptying service provision in areas with narrow lanes. The Focus Group Discussions (FGDs) with private emptiers revealed that they have to often decline service in areas with narrow lanes, where even the use of extension pipes deems futile. During FGDs, few emptiers revealed that they themselves are farmers and started the emptying business (using their farm tractors) to source faecal sludge only to use it as manure in their farmlands.

Figure 10: Emptying vehicles used in Bijnor area (Source: Bijnor SFD lite report, 2020)

It was observed during the field investigation that 2-3 emptying personnel (1 driver + 1-2 helpers) are deployed for conducting an emptying process. None of these personnel use Personal Protective Equipment (PPE) throughout the emptying process. Manual emptiers existing in Bijnor area cannot be de jure quantified. Manual Scavenging Act, 2013, criminalise the act of engaging or employment of manual scavenger therefore it is strongly shunned by the administrative agencies. However, the practice of manual cleaning, de facto, exists and is practiced predominantly in areas having inaccessible narrow roads which cannot be served by the mechanical emptiers, the HHs located on roads with width less than 3m are not accessible by these tankers. During primary survey, it was also recorded that many proponents in Bijnor area prefer manual cleaning of containment systems as the systems look "completely white washed" and "brand new" post emptying. This can be attributed to lack of awareness and warrants rigorous campaigns aiming at behavior change. Table 4 presents a detailed status of both mechanical and manual methods practiced in Bijnor area.

Table 3: Type of emptying in Bijnor area

Parameters	Mechanical	Manual
No. of operators in the city	8 (2 in BNPP & 6 from Chandpur)	100-150 (approximate)
No. of people required for a trip	2-3 people (One driver and 1-2 helpers)	6-8 people
Prevalent Containment types	Septic tanks (older ones) and fully lined tanks (newer ones)	Septic tanks (older ones) and fully lined tanks (newer ones)
Collection frequency	2-3 trips/day	2 trips/week
Use of PPE	Used by registered operators	Gloves
Type of vehicle used	Tractor mounted tanker	Cycle driven cart
Size of tanker (litre)	3000-5000	N/A
Time taken to empty	1-2 hours (depending on volume and density of sludge)	5-10 hours (depending on volume and density of sludge)
Maximum distance per trip	25 kms in and around BNPP	5 kms in and around BNPP
Average distance travelled per trip	3-5 km (BEA)	2-5 km (Bijnor area)
	8-12 km (BNPP)	
Charge taken for emptying (INR)	1500-2000	2500 -3000 (equally split between number of people)
Challenges faced by operator	Need to travel longer distance for disposal	Objection from residents regarding disposal
	Inaccessibility due to narrow lanes	The faecal sludge at times is very coarse due longer time period between two successive emptying
	Objection from residents during day time	During monsoon, the faecal sludge has to be covered with polyethene yet it spreads while transportation
	Not able to empty the whole tank due to coarseness of the faecal sludge	Dermal infection
		Mechanical preferred owing to low costs
Preferred time of working	Any time during the day	Night time
Method of advertisement of service	Business card, newspaper ads, wall painting, contact no. on tankers	Word of mouth or people can reach them at Valmiki Chauraha

Source: CSE, 2020

Figure 11: Setting up for an emptying process (Source: CSE, 2017)

Figure 12: Disposal of FSS in low lying area in outskirts of BNPP (Source: CSE, 2017)

2.3 Treatment and Disposal of FSS

Currently, there is no provision for treatment of faecal sludge and septage (FSS) generated in BA. Thus, FSS is eventually disposed of either at agricultural fields or open grounds in the outskirts of the city. The mechanical emptiers dispose the faecal sludge in their own farm lands or provide the same to other farmers on request. In situations when the collected sludge has no demand, the FSS is stacked on farm land or disposed in low lying areas away from habitation. Manual emptiers report disposal of FSS in open drains.

3 Design considerations

3.1 Quantification of wastewater in Bijnor area

In Table 4 wastewater generation estimated by two agencies- UP Jal Nigam and Bijnor Nagar palika Parishad is listed.

Table 4: Wastewater generation as per different sources of data

Source of data	Parameters	2010	2011	2017	2025	2040
DPR prepared for STP	Population	95205			189170	283350
	Total wastewater generation (MLD)	11.82			23.51	35.19
	Wastewater generation per capita (LPCD)	124.15			124.28	124.193
BNPP[4]	Population		93297	102731		
	Total wastewater generation (MLD)		15.459	17.005		
	Wastewater generation per capita (LPCD)		165.53	165.53		

The primary survey by CSE, though, reveals that the volume of wastewater generated from the 87% properties connected to BNPP's piped water supply is 12.94 MLD. The remaining 13% properties which are dependent on water from hand pumps, bore wells etc. generate about 1.31 MLD wastewater. Water lost/wasted during distribution accounts to about 3.6 MLD. Thus, total of 16.85 MLD wastewater is generated in BNPP.[5]

3.2 Estimation of faecal sludge and septage generation

On an average the private vacuum trucks do 2 trips per day in BNPP limits and 1 trip per day from the expansion area. The volume of septic tank ranges from 3000 liters to 5000 liters. Based on household survey we can assume average volume of the tanks being desludged to be 4000 liters, therefore the current demand of the Bijnor area can easily be met by a treatment facility of 12-14 KLD capacity. Sooner or later the households in the BNPP limits will get connected to sewerage network but till then the emptied sludge can be safely managed at the STP. The neighboring villages depend completely on OSS; hence the provision of scheduled desludging would have to be implemented in phases in expansion area. Gradually FSS generation will decrease from the BNPP area. Simultaneously, the FSS being collected from BEA area will be allowed to discharge at STP.

In 2031, there will be 24362 households in the expansion area and if 70% of households have accessible OSS and also comply with scheduled desludging programme, there will be 17,053 tanks to be emptied once in 5 years (based on the desludging frequency suggested in the UP state septage management policy). Which means around 3400 tanks per year or 11 tanks per day in other words total treatment capacity of 44 KLD would be required then.

[4] BNPP, 2017. *Updated performance report against service level benchmarks submitted to 14th Finance Commission of India,* Bijnor: Bijnor Nagar Palika Parishad.
[5] CSE, 2018. *Primary survey data analysis,* Delhi: Centre for Science and Environment.

Table 5: Wastewater and Faecal Sludge generation

Source of data	Parameters	2010	2011	2017	2021	2025	2031
DPR prepared for Sewerage Scheme	Population	95205	N.A			189170	
	Total wastewater generation (MLD)	11.82				23.51	
BA (draft CSP)	Population		93297	102731	209,970		268,816
	Total wastewater generation (MLD)		15.459	17.005			
	*Faecal Sludge and Septage generation (KLD)**			*8-12*			

Hence, it is proposed that the capacity of this pilot co-treatment facility should be kept 20 KLD. The proposed plant would make sure that all the emptied sludge brought on demand from both BNPP limits and expansion area gets treated also there will be spare capacity to take care of demand in near future and also help in piloting scheduled desludging in some wards of the city. To implement scheduled desludging throughout the city another plant of 24 KLD capacity should be proposed on the opposite location of the STP so that the distance travelled by each tanker can be reduced.

Table 6: Estimation of faecal sludge and septage generation

Year	BNPP	BEA	BA	BNPP (No. of HH)	Faecal sludge emptied (KLD)	BEA (No. of HH)	Faecal sludge emptied (KLD)
2011	93297	63079	156376	17603	NA	11902	NA
2021	120247	89273	209970	22688	8-12	16844	4-6
2031	139695	129121	268816	26358	0	24362	44

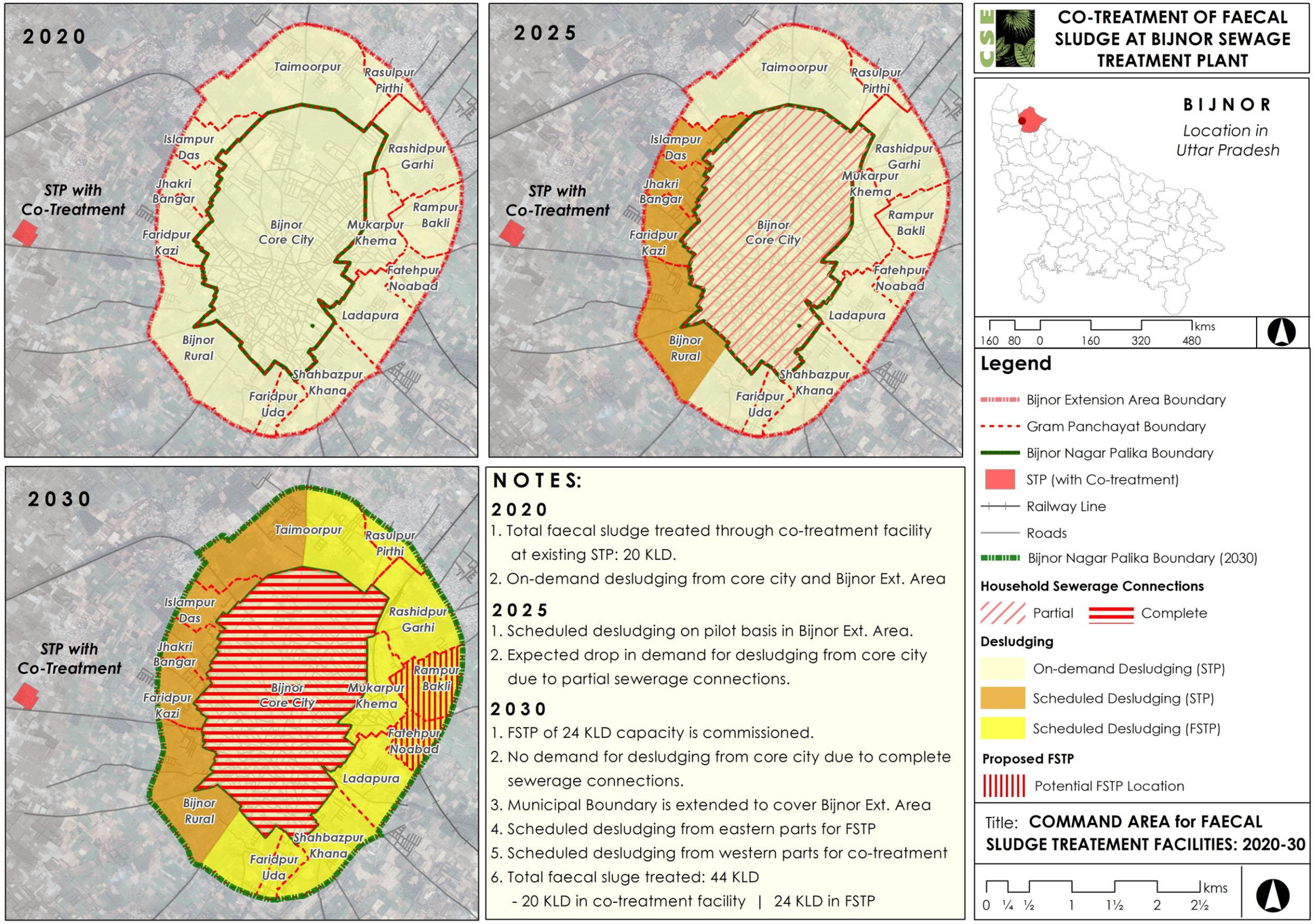


Figure 13: Command area for faecal sludge treatment facilities: 2020-30

3.3 FSS testing and characteristics of sludge

Although, we get a fair idea of chemical and biological characterization of FSS from already published texts, research papers worldwide, CSE decided it would be prudent and wise to initiate a first-of-its-kind India-specific study wherein FSS samples from Bijnor area shall be collected and analysed. CSE collected samples in Bijnor during January and February 2019 respectively, following the strict process and protocols. The samples were collected at the discharging point of the de-sludging vehicle. The information related to the source of the FSS was also recorded. The results from the tests conducted by CSE on the samples collected from Bijnor is shown in the tables below.

Figure 14: FSS sample collection from Bijnor (Source: CSE Laboratory, 2019)

Table 7: FSS characteristics in Bijnor area

SL no.	Sample location	TSS	COD	BOD	TKN	COD/BOD
1	HCT -B	50328	32600	4280	851	7.62
2	RCR_B	25360	20550	1380	862	14.89
3	HMK-B	118648	120100	5430	3080	22.12
4	HWV-B	31398	35900	4630	10133	7.75
5	JLP-B	34388	26900	2420	806	11.12
6	KCS-B	1278	1040	870	126	1.20
7	HFU-B	42264	45550	1640	1428	27.77
8	CTR-B	2638	6200	630	210	9.84
9	DHR-B	9766	16200	1258	571	12.88
10	DMR-B	79622	71950	3850	2329	18.69
11	AVI-B	41424	49300	3010	1584	16.38
12	**COM-B (Composite Sample)**	**27594**	**37900**	**2690**	**1282**	**14.09**
Average		38725.67	38682.5	2674	1938.5	13.70
For design consideration		**40000**	**45000**	**3500**	**1500**	**12.86**

***<2: readily biodegradable effluent;**
2 <COD / BOD <4: moderately biodegradable effluent;
COD / BOD> 4: hardly biodegradable effluent.

COD / BOD*

COD to BOD ratio is the measure of FSS susceptibility to biodegradation: the higher the ratio, the more refractory matter it contains. The COD to BOD ratio of faecal sludge of all the samples except one - KCS-B has >4 value which implies that it is largely non-biodegradable. It consists mostly inert material. In case of Bijnor, the COD to BOD ratio is consistently over 10 which means substantial stabilization has already been undertaken in the FSS, and it is not really biodegradable. A compatibility study was done to check whether it is possible to discharge the raw faecal sludge at influent or not. See Annexure 7 to find the results.

3.4 Design period

According to DPR - Bijnor Sewerage Scheme, the Sewage Treatment Plant design period is considered for 30 years. The proposed modules can easily cater to FSS collected in BNPP and expansion area for similar period. As quantity of faecal sludge considered for co-treatment is calculated based on the actual demand for faecal sludge being emptied within municipal boundary and in coming years from Bijnor extended area. By 2030 it is forecasted that the demand from sewered areas will decline to zero and to implement scheduled desludging in the expanded city the municipality would need another FSTP of 24 KLD in opposite direction, which will reduce the distance covered per trip by emptying vehicles significantly.

STP design parameters

As per the data provided by UPJN officials, the STP is designed for the following inlet and outlet parameters, as depicted in Table 8.

Table 8: Design Parameters of Outlet Characteristics of STP

Raw Sewage Characteristics	Inlet concentration	Outlet concentration
Average flow	24 MLD	
pH	6.5 to 8.5	6.5 to 8.5
BOD (5 days @ 20^{o}C)	250	<20 mg/l
Avg. suspended solids	500	<30 mg/l
Chemical Oxygen Demand	450	<250
Faecal Coliform count	1.0 x 10^{7} MPN/100ml	1000 MPN/100ml

4 Proposed Co-treatment modules

Currently, effluent from STP is discharged at a BOD concentration that is less than 10 mg/l. And the proposed co-treatment is using available modules of STP to treat faecal sludge and septage, without affecting the efficiency of the STP. However, the ultimate design for cotreatment at STP shall consider the new discharge norm of discharging effluent at <10 mg/l.

4.1 Receiving chamber followed by bar screen and fine screen

Since the faecal sludge and septage shall be discharged from a vacuum tanker, a receiving chamber with an inlet is required for offloading the faecal sludge to the collection tank. The receiving chamber should have adequate hydraulic properties to carry the slurry / liquid sludge without deposition and the screen should be able to separate the floating solids from the sludge.

Design facility:

The inlet (mouth) of the receiving chamber shall be spill proof. The diameter of the mouth shall be 5-6 inches. The chamber shall have depth of 1 m and length 3 m. A slope of 5% (1:20) (in degrees 2.86) shall be provided towards the bar screen.

Emptying time of one truck of 5000 litres capacity = 5 minutes

Discharge = 1000 lpm = 0.008 ~ 0.016 m^3/s

A). Bar Screen:

A course bar screen made of stainless steel of 316 grade with 20 mm spacing shall be provided at an angle of 135º to the direction of flow or 45º to the vertical. The screen shall be placed in chamber after 2m from the inlet. The particular screen be removable and should be placed through casing on the inner wall.

Dimension of the bar screen

Height= 1m

Spacing between bars = 20 mm

Width of the circular bars = 15 mm

No. of bars required (n):

Area available = Height*width of spacing*(n+1)

(1000mm * 300 mm)/ (1000mm * 20mm) = n+1

N+1 (no. of spacing) = 15

N (no. of bars required) = 14

B). Fine screens are typically used to remove material that may create operation and maintenance problems in downstream processes, particularly in systems that lack primary treatment. Typical opening sizes for fine screens are 1.5 to 6 mm (0.06 to 0.25 in). For this case, a fine screen of opening 6 mm in size is considered to be installed after coarse screen. This shall be hanged with the hinges supported by wall of the outlet. This shall be removable. Followed by this an outlet of 6 inches diameter shall be placed at the bottom of the tank to convey faecal sludge to the next unit which will be a homogenization tank.

No. of inlets required in parallel: 2

Additional requirements for O&M

Sprayer:

A tap with sprayer shall be installed next to the receiving chamber to wash the hose pipe of the tanker, inlet of the chamber and screens. For this, water supply has to be ensured either by drawing water from the outlet of the STP/final pond or from overhead tank whichever is feasible.

4.2 Homogenization cum stabilization tank

Estimated faecal sludge collection would be 20 KLD for the designed period. A tank of 60 KL capacity is proposed. The tanks to be installed shall be made up of Reinforced Concrete Cement (RCC). Faecal sludge emptied by vacuum tankers from various establishments have different characteristics, so these tanks will store the faecal sludge and septage for 24 – 72 hours and a homogenized faecal sludge shall be passed to next unit.

Requirements for Co-treatment process (Specifications):

RCC tank volume= 60 KL

Shape: Rectangular

Height = 2 m

Length = 8 m

Width = 3.75

Slope: 2 %

Phase – 1: 10 KLD sludge loaded per day for 6 days

The solid concentration of FSS to be discharged on sludge drying bed is 40 kg/cum. Moreover, the SDB is designed for the solid concentration of 65kg/cum. Thus, TS concentration of FSS for treatment at SDB is complying with the design of SDB.

The capacity of the homogenization tank is designed based on the hydraulic and loading capacity of the sludge drying beds.

4.3 Sludge drying beds

Sludge drying beds are one of the simplest and oldest techniques for sludge dewatering. They are impermeable beds filled with different layers of gravel and sand. Draining pipes are in incorporated in the bottom of the beds. Sludge is applied in layers on the top of the beds. Drying is achieved by evaporation and gravity percolation. The effluent (percolate) that is collected in the drainage pipes shall be treated in aerated lagoons.

This particular unit is already available as designed for STP. Specifications are as follows:

Total no. of drying beds provided = 18 nos.

Size of beds = 20.0m X 18.29m X 0.20m (depth of sludge application)

Total capacity of the sludge drying beds to handle sludge is 73.16 cum

Requirements for co-treatment process

The size of the beds is quite large as it is designed for handling sludge from UASB reactor. However, discharging the volume of Faecal Sludge to one bed will be under utilization of the bed. Hence, it is recommended that faecal Sludge shall be stored for 60 KL and then pumped to drying bed.

Available hydraulic loading depth (HBD): 0.20 m

Available solid loading rate: 5707kg/day * 365 days/ total area

Hence, the SLR= 316 TS Kg/m^{2}·year

Concentration of solids loading on the designed sludge drying bed = 65 kg TS/cum

Calculation for co-treatment feasibility

10 KLD sludge is stored in 60 KL capacity homogenization tank

Retention time = 6 days

Once in a 6 days stored sludge will be pumped

1 week (except 1 day) = Total 60 KL shall be pumped to one bed

Drying cycle: 13 days for one bed

Scrapping of dried sludge = 1 day i.e. on 14^{th} day

No. beds required: 3

Bed required on standby: 1

Total beds required: 4

Hydraulic loading depth for 60 KL of FSS: 0.16 m which is in the range of 0.15m to 0.20 m of designed HLD of the SDB

Concentration of FSS solids loading on the bed= 40 kgTS/cum<65 KgTS/cum; hence can be discharged onto bed.

4.4 Sludge sump

Faecal sludge stored in the homogenization tank shall pass to the next unit which is sludge sump. This unit is already there as part of STP unit in a working condition.

Specification is as follows:

Size of the sludge sump: 3.8m Dia X 5.0m SWD + 0.5m FB

Capacity of each pump provided: 25 cum/hr @15m head

As the faecal sludge has already undergone anaerobic digestion in the containment systems (onsite sanitation system) hence, limited further digestion is expected, yet the faecal sludge will get some time for digestion in the homogenization tank. The concentration of solids (TS) is 40 kg/cum.

Requirements for Co-treatment

Phase – I (0-2 years): At the initial stage, it is estimated that 8-12 KLD will be delivered to the homogenization tank for 6 days which shall be pumped to the sludge drying bed that will take around 2 hrs 40 minutes for a pump to discharge the stored sludge from homogenization tank.

Phase – II (3 years to 15 years): At the scheduled stage, it is estimated that 20 KLD will be retained in the tank for 3 days and then pumped to the sludge drying bed. All four beds will be operational at this stage.

4.5 Filtrate sump

In case of sewage sludge, the leachate from the sludge drying bed is designed to be treated in the aerated lagoons unit of the STP. The filtrate or leachate produced from the sludge drying beds have high nutrient composition. Similarly, the leachate from the sludge drying beds which is produced from FSS, is still not fit to discharge in the environment. Hence, the filtrate should undergo oxidation treatment in the Aerated lagoons. The compliance check for the treatment of FSS filtrate is calculated, see Annexure 7.

5 Operation and maintenance

It is essential to regularly operate and maintain the Co-treatment modules for their smooth functioning and improved life span. It is necessary that all officials / engineers and staff of STP have a copy of the O&M activities and that they familiarize themselves with the standard operating procedures. The operator must be familiar with the operating procedures before he starts to operating the co- treatment facility. It is a must that the operator undergoes a training program dedicated to O&M of STP and handling Co-treatment facility from the service provider.

5.1 Truck arrival and faecal sludge decanting

The truck arrives at the STP and follows the road leading towards the screening chamber – Decanting Station. It shall be the responsibility of the respective vacuum tanker operator to connect truck's outlet with the screening chamber through hose pipe and discharge the faecal sludge into the screening chamber. Spillage of FSS at the decanting station should be avoided. A STP operator should monitor the decanting process and can fine the operator if spillage occurs due to negligence. The FSS can be received on any day in working hours except any one day of the week which must be a weekday. "Form 3" of Bijnor FSSM bye-laws: Record of collection, transport & disposal of FSS should be duly filled and signed by the STP operator before allowing tanker to enter the STP.

5.2 Screening chamber

The screening chamber should be cleaned at the end of the day each day. The solid waste and the grit deposited and screened at the unit should be removed manually and disposed with trash collected by other screens of the STP. The operator should wear protective equipment such as gloves and make sure not to come in contact with the faecal sludge with bare hands.

5.3 Tap with sprayer

A water tap with a sprayer as an additional equipment should be installed near to inlet of screen chamber. This shall be used for cleaning in case of spillage by tankers and to clear the blockage in screen chamber. For safety reasons, this tap can be used in case of accidental spillage. In case of spillage during decanting operation, based on the intensity of the spillage the staff responsible for supervision should get the affected area washed using clean water from the sprayer and sprinkle lime on it.

5.4 Homogenisation tank

Homogenization tank does not require any external operation as the flow works by gravity and it largely serve as a holding tank. The tank should not retain FSS for more than 6 days. Cowl should be provided on the top of the vent to prevent entry of flies and any insect into the tank.

5.5 Sludge sump

As the sludge sump is designed for pumping sludge from UASB reactor. Therefore, it can easily pump the faecal sludge to the Sludge Drying beds. The installed pump capacity is 5 HP which can handle solid concentration of 65 Kg TS/cum of sewage sludge. The incoming solid concentration of faecal sludge would be around 40 Kg TS/Cum hence the installed pump can cater the FSS.

5.6 Electricity

The cost of running the electrical equipment, generator sets and their accessories have already been included in the previous DPR of Bijnor Sewerage Scheme under UIDSSMT programme. As the reactor is hardly producing any sludge the sludge sump and the drying beds are not getting utilised to their full capacity, therefore, the electricity required and related cost to run the pumps (once in a week) installed at sludge sump and filtrate sumps (once in a fortnight) have not been included in this

DPR. Once the STP starts running at full capacity this extra cost to manage faecal sludge can be relooked at.

6 Re-use of by-products from FSS treatment

Reuse and revenue generation potential of the sludge generated from the Co-treatment should also be taken into consideration. Dried sludge is not stabilized, but additional composting (e.g. co-composting) will allow to recycle nutrients and organic matter into agriculture. The dried sludge generated from FSS is very high in nutrient content and has good potential for use in agriculture. The project should explore the possibility of co-composting of sludge generated from FSS treatment with organic municipal solid waste, which further helps to improve the nutritional value of compost and reduce the pathogen content. In order to ensure there is a good market for manure generated from co-treatment, there is a need to sensitize the end users about the benefits of organic compost and incentives are needed from the authority to promote its use. There are examples from Bangladesh (for example, Sakhipur Plant) where the treated sludge from FSTP is co-composted with organic municipal solid waste. The manure here has gathered popularity among local farmers. The dried sludge should be stored in store yard and should be transferred to co-composting plant to prepare soil conditioner.

Even if we calculate on a conservative side with a load of 60 KL per week at the rate of 40 Kg/cum of TS. The plant will generate roughly 125 tons of TS in a year. Considering 10 % moisture in the dried sludge this becomes around 140 tons of dried sludge. Assuming 10% loss in handling it comes around 126 tons of dried sludge. This sludge can be sold to farmers as it is and can also be co-composted with municipal solid waste, which will not only enhance the quality of soil conditioner but also increase the quantity of final product. If sold at 3 Rs/kg revenue of 3.78 lakhs can be generated per year.

7 Annexures

Annexure 1: Letter by Joint Secretary and Mission Director

PRAVEEN PRAKASH, IAS
Joint Secretary & Mission Director (SBM)
GOVERNMENT OF INDIA
MINISTRY OF URBAN DEVELOPMENT

प्रवीण प्रकाश, भा.प्र.से.
संयुक्त सचिव एवं मिशन निदेशक (एस.बी.एम.)
भारत सरकार
शहरी विकास मंत्रालय

D.O No. MD-SBM/AA/62/2016 **30th May, 2016**

Sub: Support to Towns for achieving ODF status and for effective Fecal Sludge Management (FSM) - Reg.

Respected Sir,

As you are aware, one of the key objectives of Swachh Bharat Mission (Urban) is to help all 4041 cities/towns achieve 100% Open Defecation Free (ODF) status by 2nd October 2019.

2. As we move towards 100% coverage of toilets, we need to look ahead at managing the large volume of fecal sludge from the growing number of septic tanks and single pit latrines. Proper fecal sludge management (FSM) that maximizes safety and sustainability is essential and we need to develop a model that will cater to the country's future needs. Fecal sludge comprises partially stabilized excreta and slurry from improved single pit latrines, septic tanks, as well as latrines based on other improved and unimproved technologies. Unless managed appropriately, this fecal sludge poses a huge risk to public health and the environment.

3. At present about 64 million Indian households must be supported with safe FSM services. Safe disposal of fecal sludge means ensuring safety while handling/emptying the sludge from septic tanks/pits and the proper transport and disposal of the removed sludge. The demand and supply services for FSM need to be assessed, along with the associated safety issues. Local bodies, both rural and urban, state governments, and the central government have a stake in ensuring that the fecal sludge is disposed of properly, in a manner that does not cause any health or environmental hazards.

4. In this regard, MoUD has decided to extend extensive handholding support to 29 cities/towns so that they can become flagship towns for Fecal Sludge Management in India. For the same, two agencies, **Centre for Science & Environment (CSE, a leading non-profit working on environmental issues in India)** and the **National Institute for Urban Affairs (NIUA, a Government of India entity)**, working on urban transformation efforts) will provide active handholding to the below selected cities:

Sl. No	State	Towns/Cities	Assigned Agency
1	Andhra Pradesh	Proddatur, Dist. Kadapa	NIUA
2	Andhra Pradesh	Gudur, Dist Nellore	NIUA
3	Andhra Pradesh	Srikakulam, Dist Srikakulam	CSE
4	Uttarakhand	Rishikesh, Dist Dehradun	CSE
5	Uttar Pradesh	Unnao, Dist Unnao	NIUA
6	Uttar Pradesh	Ghazipur, Dist Ghazipur	NIUA
7	Uttar Pradesh	Chunar, Dist Mirzapur	CSE
8	Uttar Pradesh	Ramnagar, Dist Varanasi	CSE
9	Uttar Pradesh	Ganga Ghat, Dist Unnao	CSE
10	Uttar Pradesh	Bijnore, Dist Bijnore	CSE
11	Uttar Pradesh	Agra, Dist Agra	
12	Bihar	Bhagalpur, Dist Bhagalpur	NIUA
13	Bihar	Hajipur, Dist Vaishali	NIUA

Office: 140-C, Nirman Bhawan, New Delhi-110011 ♦ Mob: 9013133636, Phone: 011-23062309, Fax: 23062477
praveenprakashud@gmail.com, praveen.prakash71@nic.in

Sl. No	State	Towns/Cities	Assigned Agency
14	Bihar	Muzaffarpur, Dist Muzaffarpur	CSE
15	Bihar	Katihar, Dist Katihar	CSE
16	Bihar	Buxar, Dist Buxar	CSE
17	Bihar	Bodh Gaya, Dist Gaya	CSE
18	West Bengal	Bansberia, Dist Hugli	CSE
19	West Bengal	Bongaon, Dist North 24 Parganas	CSE
20	West Bengal	Darjeeling, Dist Darjeeling	CSE
21	Tamil Nadu	Tiruchirapalli	CSE
22	Madhya Pradesh	Gwalior	CSE
23	Madhya Pradesh	Dewas	CSE
24	Mizoram	Aizawl	CSE
25	Rajasthan	Bikaner	CSE
26	Odisha	Cuttack	CSE
27	Karnataka	Tumkur	CSE
28	Delhi	Delhi	CSE
29	Maharashtra	Solapur	CSE

The key contact person for the respective agencies are:

a) **Centre for Science and Environment (CSE)**
Shri Suresh Rohilla
Programme Director, Water Management
Email: srohilla@cseindia.org
Mobile: 9910317804

b) **National Institute of Urban Affairs (NIUA)**
Ms Paramita Datta Dey
Senior Research Officer
Phone: +91-11-24617517, 24643284 (ext: 207)
Email: pdey@niua.org

5. The scope of work of CSE and NIUA would be to help the towns/cities in capacity building for FSM apart form support to identify the technology and need for FSM in their area, support in selection of consultant for preparation of DPR, and Transaction Advisory Support for selection of private partner to operate the FSM facility. They may also support the city in other FSM related aspects such as behaviour change, regulatory changes etc.

6. I request you to kindly issue instructions to the concerned officers/ municipal commissioners to get in touch with CSE/NIUA at the earliest, and to work closely with them in order to fully leverage their significant expertise in this area. They may reach out to me in case any clarifications are required.

In anticipation of your kind support.

With regards,

Yours sincerely,

(Praveen Prakash)

To,

Chief Secretaries of concerned states

Annexure 2: Minutes of the CSTF meeting Bijnor

कार्यालय नगर पालिका परिषद, बिजनौर

संख्या 1864 न0पा0परि0बि0/2018–19 दिनांक : 28–03–2019

स्वच्छ गंगा मिशन योजनान्तर्गत सिटी सेनिटेशन प्लान (सी0एस0पी0) तैयार किये जाने हेतु आज दिनांक 13–03–2019 को पूर्वान्ह् 11:00 बजे टास्क–फोर्स की बैठक श्रीमती रूखसाना माननीया अध्यक्ष, नगर पालिका परिषद्, बिजनौर/टास्क फोर्स तथा दुर्गेश्वर त्रिपाठी अधिशासी अधिकारी (अधोहस्ताक्षरी) की अध्यक्षता में आहूत की गयी, जिसमें बिजनौर शहर के व्यापार मण्डल, मीडिया, विभिन्न विभागों के अधिकारी एवं शहर के प्रतिष्ठित व्यक्तियों ने प्रतिभाग किया, जिसमें निम्नलिखित उपस्थिति रहीं:–

क्र0सं0	नाम	पद नाम
01.	श्रीमती रूख़साना परवीन	अध्यक्ष
02.	दुर्गेश्वर त्रिपाठी, अधिशासी अधिकारी, नगर पालिका परिषद, बिजनौर।	सदस्य/सचिव
03.	श्री शमशाद अंसारी, पति चेयरपर्सन	सदस्य
04.	श्रीमती संध्या रस्तौगी एन0जी0ओ0, बिजनौर	सदस्य
05.	श्री चन्द्रेश कुमार, डी0सी0, पंचायतीराज	सदस्य
06.	श्री के0एम0 सिंह, स्थानिक अभियन्ता, निर्माण और डिजाईन सेवाए जलनिगम बिजनौर	सदस्य
07.	श्री अनिल कुमार, प्रोजेक्ट डायरेक्टर, लो0नि0वि0, बिजनौर।	सदस्य
08.	डा0 शैलाल जैन ऐडिशनल चीफ मेडिकल ऑफिसर	सदस्य
09.	श्री शमीम अहमद, राजस्व निरीक्षक, न0पा0परि0बिजनौर	सदस्य
10.	श्री यशवंत कुमार अवर अभियन्ता (सिविल), न0पा0परि0 बिजनौर	सदस्य
11.	श्री मानव सचदेवा, वार्ड कॉउसीलर	सदस्य
12.	श्री अमित गौतम अवर अभियन्जा (जलकल), न0पा0परि0बिजनौर	सदस्य
13.	श्री ऋषिपाल सिंह, राजस्व निरीक्षक न0पा0परि0बिजनौर	सदस्य
14.	श्री सुन्दर लाल, राजस्व निरीक्षक न0पा0परि0बिजनौर	सदस्य
15.	श्री ज्यौतिलाल शर्मा, पत्रकार राष्ट्रीय सहारा, बिजनौर	सदस्य
16.	श्री वसीम अख्तर, पत्रकार ज़ी न्यूज़, बिजनौर	सदस्य
17.	श्री इफ़्तिख़ार मलिक, पत्रकार, जनवाणी, बिजनौर	सदस्य
18.	श्री भितुष लूथरा, कार्यक्रम प्रबंधक, सी0एस0ई दिल्ली	सदस्य
19.	श्री भाविक गुप्ता, वरिष्ठ खोज सहयोगी, सी0एस0ई0, दिल्ली	सदस्य
20.	श्री राहुल मनकोटिया, कार्यक्रम प्रबंधक, सी0एस0ई0 दिल्ली	सदस्य

पृष्ठ 1/3

कार्यवाही बैठक

बैठक के दौरान मुख्य बिन्दुओं पर चर्चा की गई

बिन्दु संख्या–1: सेंटर फॉर साईंस एण्ड एनवायरनमेंट नई दिल्ली टीम के द्वारा ड्राफ्ट मॉडल शहरी स्वच्छता योजना (C.S.P) का प्रेजेंटेशन और सुझाओं पर चर्चा, जिसके माध्यम से ड्राफ्ट मॉडल शहरी स्वच्छता योजना (C.S.P) को बेहतर बनाया जा सके।

सेंटर फॉर साईंस एण्ड एनवायरमेंट और बिजनौर नगर पालिका परिषद्, बिजनौर द्वारा तैयार मॉडल सिटी सेनिटेशन प्लान को सी0एस0ई0 टीम ने बैठक में प्रस्तुत करते हुए यह रखांकित किया गया कि एक मसौदा योजना है। SBCLTF के सदस्यों द्वारा की गयी टिप्पणियों/प्रतिक्रिया को अंतिम दस्तावेज में शामिल करते हुए हल किया जायेगा।

सी0एस0ई0 ने सी0एस0पी0 के महत्व को "सिटी औनर्स प्लान" के रूप में रेखांकित करते हुए सी0एस0पी0 की तैयारी में SBCLTF और भी प्रबल भागीदारी की जाये। नगर बिजनौर में स्वच्छता योजना को विकसित करने के लिए प्रमुख साक्षात्कार, समूह चर्चा, घरेलू सर्वेक्षण और क्षेत्र टिप्पणीयों का उपयोग किया गया है तथा SBCLTF को आवश्यक होने पर दस्तावेज में संशोधन किया जाये।

बिन्दु संख्या–2: शहरी स्वच्छता योजना (C.S.P) को लागू करने हेतु और तकनीकी सप्पोर्ट हेतु -MoU हस्ताक्षर, सेंटर फॉर साईंस एण्ड एनवायरनमेंट नई दिल्ली टीम और नगर पालिका परिषद्, बिजनौर के बीच।

सी0एस0ई0 और नगर पालिका परिषद्, बिजनौर में उक्त कार्यक्रम को जारी रखने के लिए दोनों संगठनों के बीच एक समझौता ज्ञापन (एम0ओ0यू0) पर हस्ताक्षर किए गए, जिसमें नगर पालिका परिषद्, बिजनौर द्वारा मल–कीचड़ और सेप्टेज प्रबंधन को लागू करने तथा नगर बिजनौर को अग्रिम कार्यवाही द्वारा (ODF ++) प्राप्त के लिए सी0एस0ई0 से तकनीकी सहायता ली जायेगी।

बिन्दु संख्या–3: सेंटर फॉर साईंस एण्ड एनवायरनमेंट नई दिल्ली टीम के द्वारा बिजनौर एस0टी0पी0 में को–ट्रीटमेंट की संभावनाओं पर चर्चा।

बिजनौर सीवेज ट्रीटमेंट प्लांट (एस0टी0पी0) अभी भी अच्छी तरह चल रहा है। इसलिए एस0टी0पी0 में सीवेज के साथ सह–उपचार अपशिष्ठ जल उपचार का एक संभव तरीका है। इसके लिए सीएसई पूर्व से ही व्यवहार्यता अध्ययन कर रहा है। सी0एस0ई0 ने SBCLTF को अपडेट किया और उनकी टीम शहर में मल–कीचड़ आदि के लक्षण–वर्णन की प्रक्रिया में है, जिसके नमूने पूर्व से ही एकत्रित किये जा चुके है, जिनका प्रयोगशाला में परीक्षण किया जा रहा है, जिसे परिणाम आने के पश्चात् साझा कियो जायेगा। बैठक में उपस्थित सभी लोगो द्वारा बिजनौर को स्वच्छ, समृद्धि एवं सुन्दर बिजनौर बनाने की प्रतिज्ञा लेने के साथ समाप्त हुई। प्रस्तावित परियोजना एक उच्च क्षमता व प्रभाव वाला मॉडल परियोजना साबित होगी, जिसे प्रदूषण वाले इलाकों में सीवरेज नेटवर्क (विशेषकर निकटवर्ती गांवों में) उपलब्ध नहीं किया जा सकता है।

पृष्ठ 2/3

बिन्दु संख्या–4: सेंटर फॉर साईंस एण्ड एनवायरनमेंट नई दिल्ली टीम के द्वारा भारत सरकार की स्वच्छ भारत मिशन–(नगरीय) के तहत ODF+ और ODF++ की दिशानिर्देशों (Guidelines) पर चर्चा और जागरूकता।

सी0एस0ई0 ने स्वच्छ भारत मिशन के अन्तर्गत दिशा–निर्देशों के बारे में टास्क फोर्स के सदस्यों को शहर को खुले में शौच मुक्त प्लस (ODF)'' । आवास और शहर कों ''खुले में शौच से मुक्त प्लस प्लस (ODF++) से प्रमाणित करने के लिए आवेदन करने के बारे में अवगत कराया। SBCLTF सदस्यों द्वारा यह भी अवगत कराया गया कि नगर पालिका परिषद्, बिजनौर पूर्व से ही (ODF +) के प्रमाण पत्र हेतु आवेदन कर चुकी है और (ODF+) स्थिति प्राप्त करने का लक्ष्य है। सी0एस0ई0 द्वारा निजी वैक्यूम टैंकर ऑपरेटरों के पंजीकरण और बाईलॉज़ के पारित होने जैसे कुछ तत्काल कार्य बिन्दुओं का सुझाव दिया गया, जिससे नगर पालिका परिषद्, बिजनौर द्वारा शहर में फीकल कीचड़ को नियंत्रण किया जा सकता है। ये एक्शन प्वाइंट अधिकतर प्रकृति में प्रशासनिक है और इसके लिए बहुत अधिक धन की अवश्यकता नहीं है। उपरोक्त से सहमत होकर SBCLTF ने सी0एस0ई0 से फीकल स्लज और सेप्टेज मैनेजमेंट के लिए उपनियम तैयार करने का अनुरोध किया। मॉडल सी0एस0पी0 पॉच घटकों पर केंद्रित है– (अ)जलापूर्ति, (ब)शौचालय तक पहुँच, (स)मल–कीचड़, (द)सेप्टेज और अपशिष्ठ जल प्रबंधन एवं (ड़)तूफानी जल का प्रबंधन और ठोस अपशिष्ठ प्रबंधन। इस योजना में आधार भूत जानकारी, मुद्दे और चुनौतियां और इनमें से प्रत्येक घटक के लिए कार्य योजना शामिल है। इस योजना में प्रस्तावित हस्तक्षेपों को स्थायी बनाने के लिए आवश्यक संस्थागत तंत्र और वित्तीय मॉडल का विवरण भी शामिल है। खुले में मूत्र करना संबंधी खतरे के बारे में फीडबैक लिया गया और चिंताएं व्यक्त की गयी। माननीया अध्यक्ष नगर पालिका परिषद्, बिजनौर ने शहर में तूफान के पानी की नालियों में ठोस अपशिष्ठ के विशाल निपटान पर प्रकाश डाला। SBCLTF के सदस्यों द्वारा अनुरोध किया गया कि उन मुद्दों को शहर की स्वच्छता योजना में प्राथमिकता के आधार पर संबोधित किये जाने हेतु प्रयास किया जाना है।

अधिशासी अधिकारी
नगर पालिका परिषद, बिजनौर/
सदस्य/सचिव, टास्क–फोर्स

प्रतिलिपि :–

अपर जिलाधिकारी (प्रशासन) महोदय बिजनौर एवं समस्त सदस्यों टास्क फोर्स की सेवा में सूचनार्थ प्रेषित।

अधिशासी अधिकारी
नगर पालिका परिषद, बिजनौर/
सदस्य/सचिव, टास्क–फोर्स

पृष्ठ 3/3

Annexure 3: Minutes of the meeting with SMCG

Website-www.sgrca.org
Phone No.0522-2235542

OFFICE OF PROJECT DIRECTOR
STATE MISSION FOR CLEAN GANGA
PLOT-18, SECTOR -7, GOMTI NAGAR EXTENSION,
DULB BUILDING, LUCKNOW-226010

Letter no. 0673 / 0449 / SMCG / 05 date- 10/06 2019

Sub:- Minutes of the meeting dated 15.05.2019 regarding Faecal Sludge Treatment Plant at Chunar.

Dear Sir,

A meeting has been conducted on 15th May 2019 regarding Faecal Sludge & Septage Management at Chunar & Bijnore.

The minutes of the meeting attached herewith for kind action please.

Yours sincerely,

10/6/19

(Javed Ahmed Ansari)
Technical Advisor

Encl: As above.

Copy forwarded for information to:

1. General Manager, Ganga Pollution Control Unit, UP Jal Nigam, Varanasi
2. S.E. (Ganga), UP Jal Nigam, Lucknow
3. Shri. U. K. Tayal, Specialist (Water Supply & Sewerage), Atal Mission for Rejuvenation & Urban Transformation, UP
4. Centre for Science & Environment, New Delhi
5. APD, SMCG UP Lucknow

Technical Advisor

b/c

Stakeholder Meeting for Chunar FSSTP followed by Debriefing with PS, DoUD

Date: 15 May 2019

Venue: State Mission for Clean Ganga (Uttar Pradesh) Office, Lucknow

Time: 11:15 AM to 12:45 PM

Chaired by: Mr Javed Ahmad Ansari, Technical Advisor UPSMCG and Nodal Officer for Chunar FSSTP Project

Attendees:

Name	Designation	Organisation
Keshav Gupta	S.E. (Ganga)	UP Jal Nigam
S. K. Rai	General Manager	Ganga Pollution Control Unit, UP Jal Nigam
Rohit Chaurasia	Assistant Engineer	Ganga Pollution Control Unit, UP Jal Nigam
U. K. Tayal	Specialist (Water Supply & Sewerage)	Atal Mission for Rejuvenation & Urban Transformation, UP
A. N. Gupta	Consultant (Tech.)	National Mission for Clean Ganga
Aviral Saxena	SWM Expert	State Mission for Clean Ganga (Uttar Pradesh)
Bhitush Luthra	Programme Manager	Centre for Science and Environment, New Delhi
Bhavik Gupta	Senior Research Associate	Centre for Science and Environment, New Delhi
Sarim Ansari	Research Associate	Centre for Science and Environment, New Delhi

CSE welcomed all the members to the meeting. The salient features of the proposed 10KLD Faecal Sludge & Septage Treatment Plant (FSSTP) for Chunar city were presented to the group. Major discussions revolved around the current and proposed capacity of the FSSTP, tendering process to be followed, responsible agencies for all the 4 components of the project, size and type of vacuum tanker to be procured; and proposed technology of the FSSTP.

Key points discussed during the meeting / way forward:

Items	Proposed Action	Responsible agency / department	Proposed timeline
The capacity and technology of proposed FSSTP shall be abided to in accordance with the DPR	No action required		
Roles & responsibilities of each stakeholder in terms of completing the 4 components of the project	Floating of a single tender for the first 3 components i.e. FSSTP, additional infrastructure and O&M	Ganga Pollution Control Unit, UPJN and overseen by SMCG	June 2019
	Procurement of the vacuum tanker and handing it over to CNPP		September 2019
	4th component i.e. Enabling Environment	Chunar Nagar Palika Parishad with CSE as knowledge partner, overseen by SMCG	Ongoing
Mode of tendering of the project - DBOT	No action required		
Technical knowledge support by CSE TSU for Planning, Designing and Implementation - tender, selection of agency/contractor to implement – during construction, commissioning and monitoring of FSTP	Letter to UPJN and implementing agency	SPMG / UPJN	May / July 2019

10/6/19

Annexure 4: NOC issued by UP Jal Nigam

E mail: ceganga_upjn@yahoo.in

उत्तर प्रदेश जल निगम

प्रधान कार्यालय 6, राणा प्रताप मार्ग, लखनऊ 226001

संख्या– 1020 /022-505/2019, दिनांक – 29.11.2019

To,
Mr. Rahul Mankotia
Programme Manager ,
Programme Support Unit ,Water Programme
Centre for Science and Environment ,New Delhi

Subject : Regarding NOC for Co-treatment of Faecal Sludge at STP in Bijnor

Dear Sir,

This is in reference to your letter no - CSE/DoUD/2019-10-24, Dated : 24th October 2019 regarding NOC for co-treatment of Faecal Sludge at 24 MLD capacity STP, Bijnor addressed to Managing Director, U.P. Jal Nigam.

In this regard, UP Jal Nigam has **No Objection** on the proposal of CSE for proposing and implementing FSS co-treatment at Sewage Treatment Plant at Bijnor, subject to the condition that CSE will submit a detailed technical proposal to the Chief Engineer (Moradabad), U.P.Jal Nigam, Moradabad for approval, before implementing at site.

This is being issued after the approval of competent authority.

Thanking you

With Regards

29/11/19

(Ajaya Rastogi)
Chief Engineer (Ganga)

Copy to following for information and necessary action :-

1. Managing Director , UP Jal Nigam Lucknow
2. Director , Local Bodies Directorate, Lucknow
3. Additional Project Director, State Mission for Clean Ganga UP
4. Shri Ramakant Pandey (IAS), District Magistrate, Bijnor
5. Shri A. K Rai, Chief Engineer, Moradabad Zone, UP Jal Nigam,Moradabad
6. Shri Durgeswar Tripathi, Executive Officer, Bijnor
7. Shri K. B. Jain, Executive Engineer, U. P. Jal Nigam ,Bijnor
8. Shri Javed Ansari, Technical Advisor, State Mission for Clean Ganga UP
9. Dr.Suresh Kumar Rohilla, Senior Director , Water Programme , CSE, New Delhi

Chief Engineer (Ganga)

Left- on 25.11.2019

Annexure 5: Result of Physico-chemical and microbiological parameters in faecal sludge samples

Environment Monitoring Laboratory
A unit of Centre for Science and Environment
Anil Agarwal Environment Training Institute
Nimli, District Alwar, Rajasthan-301019
TEST REPORT FORM

EML Form No.: 4

Date: Mar 2nd, 2019
Report ID –EML/TRF/046

CSE Team Participating	Water Team & FSM Lab
Sample Identity	Sludge Samples from Bijnor, UP
Number of samples	11 (From Bijnor) + 1 (Composite sample prepared in Lab)
Samples collected/delivered by	Self-Collected
Date of sample submission at AAETI	Feb 8th, 2019

Result of Physico-chemical and Microbiological parameters in Fecal Sludge samples

S No	Sample Location	pH ± Error % (95% C.I.)	Moisture Content %	TS ± Error % (95% C.I.) (ppm)	COD ± Error % (95% C.I.) (ppm)	BOD_5 (5 days at 20°C) (ppm)	TKN ± Error % (95% C.I.) (ppm)	Ammoniacal N ± Error % (95% C.I.) (ppm)	Total Phosphate ± Error % (95% C.I.) (ppm)	Fecal coliform (MPN/100 ml)	Calorific Value (cal/g)
1.	HCT-B	6.5 ± 0.2%	98.1	50,328 ± 0.8%	32,600 ± 0.5%	4,280	851.2± 2.4%	164.6 ± 0.5%	166.0 ± 2.8%	1.2×10^7	3424.0
2.	RCR-B	7.2 ± 0.2%	99.2	25,360 ± 0.8%	20,550 ± 0.5%	1,380	862.4± 2.4%	236.3 ± 0.5%	221.0 ± 2.8%	5.6×10^5	3950.5
3	HMK-B	6.5 ± 0.2%	84.3	118,648 ± 0.8%	120,100 ± 0.5%	5,430	3080.0±2.4%	116.5 ± 0.5%	656.0 ± 2.8%	1.5×10^6	2768.6
4	HWV-B	7.3 ± 0.2%	96.7	31,398 ± 0.8%	35,900 ± 0.5%	4,630	1013.6±2.4%	136.6 ± 0.5%	262.0 ± 2.8%	2.3×10^5	3534.0
5	JLP-B	7.5 ± 0.2%	93.0	34,388 ± 0.8%	26,900 ± 0.5%	2,420	806.4 ± 2.4%	177.0 ± 0.5%	238.5 ± 2.8%	1.5×10^5	2696.1
6	KCS-B	7.2 ± 0.2%	99.4	1,278 ± 3.1%	1,040 ± 1.7%	870	126.0 ± 2.4%	67.2 ± 0.5%	24.5 ± 2.8%	9.2×10^4	2276.7
7	HFU-B	6.8 ± 0.2%	94.2	42,264 ± 0.8%	45,550 ± 0.5%	1,640	1428.0±2.4%	227.4 ± 0.5%	458.0 ± 2.8%	2.3×10^5	3264.9
8	CTR-B	6.9 ± 0.2%	99.2	2,638 ± 3.1%	6,200 ± 0.5%	630	210.0 ± 2.4%	82.9 ± 0.5%	56.5 ± 2.8%	4.3×10^5	2813.5
9	DHR-B	7.4 ± 0.2%	98.9	9,766 ± 0.8%	16,200 ± 0.5%	1258	571.2± 2.4%	168.0 ± 0.5%	131.0 ± 2.8%	2.3×10^5	3643.6
10	DMR-B	7.8 ± 0.2%	93.4	79,622 ± 0.8%	71,950 ± 0.5%	3850	2329.6±2.4%	169.1 ± 0.5%	738.0 ± 2.8%	1.1×10^7	2364.1
11	AVI-B	7.5 ± 0.2%	96.4	41,424 ± 0.8%	49,300 ± 0.5%	3010	1584.8±2.4%	278.9 ± 0.5%	333.0 ± 2.8%	1.2×10^7	2815.7

% Error added for certain parameters where error quantification has been done

Environment Monitoring Laboratory
AAETI
Nimli, Tijara, Alwar
Rajasthan-301019
Centre for Science and Environment

Page 1 of 2

Composite Sample Data

S No	Sample Location	pH ± Error % (95% C.I.)	Moisture Content %	TS ± Error % (95% C.I.) (ppm)	COD ± Error % (95% C.I.) (ppm)	BOD_5 (5 days at 20°C) (ppm)	TKN ± Error % (95% C.I.) (ppm)	Ammoniacal N ± Error % (95% C.I.) (ppm)	Total Phosphate ± Error % (95% C.I.) (ppm)	Fecal coliform (MPN/100 ml)	Calorific Value (cal/g)
1.	COM-B	7.2 ± 0.2%	98.1	27,594 ± 0.8%	37,900 ± 0.5%	2,690	1282.4± 2.4%	178.1 ± 0.5%	335.0 ± 2.8%	4.3×10^5	Not Available

Sample Collection Points and Dates

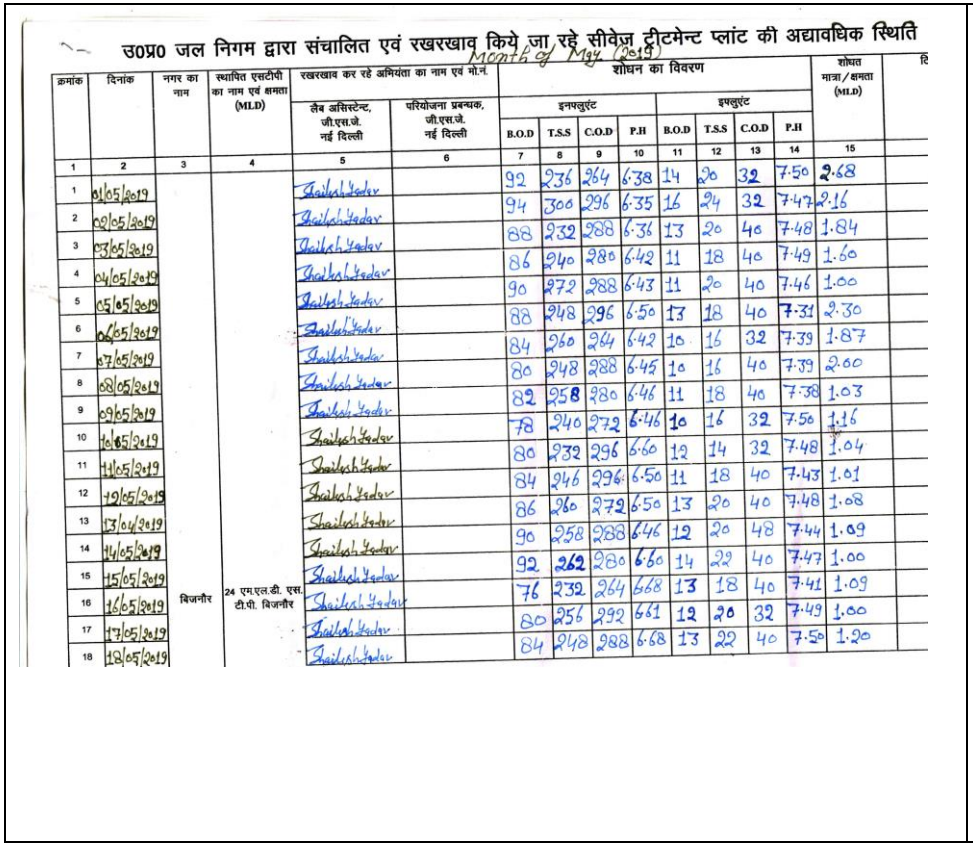
S No	Code	Place	Date of Collection
1.	HCT-B	Hotel Chetali, Taimoorpur	Feb 05, 2019
2.	RCR-B	Household, Railway Colony, Rashidpur Garhi	Feb 05, 2019
3	HMK-B	Household, Mukarpur Khema	Feb 05, 2019
4	HWV-B	Household Ward No.1, Valmik iBasti	Feb 06, 2019
5	JLP-B	Household, Ladapura Village, Jyothi Nagar	Feb 06, 2019
6	KCS-B	Krishna College, Shahbazpur Khana	Feb 06, 2019
7	HFU-B	Household, Faridpur Uda	Feb 06, 2019
8	CTR-B	Community Toilet, Ravidas Nagar	Feb 06, 2019
9	DHR-B	District Hospital, Rambagh	Feb 07, 2019
10	DMR-B	District Magistrate Residence, Sadar Bazar	Feb 07, 2019
11	AVI-B	Household, Aawas Vikas Colony, Islampur Das	Feb 07, 2019

Dr. Vinod Vijayan
Sr. Research Scientist

Environment Monitoring Laboratory
AAETI
Nimli, Tijara, Alwar
Rajasthan-301019
Centre for Science and Environment

Dr. Mrinal Mallik
Head, EML

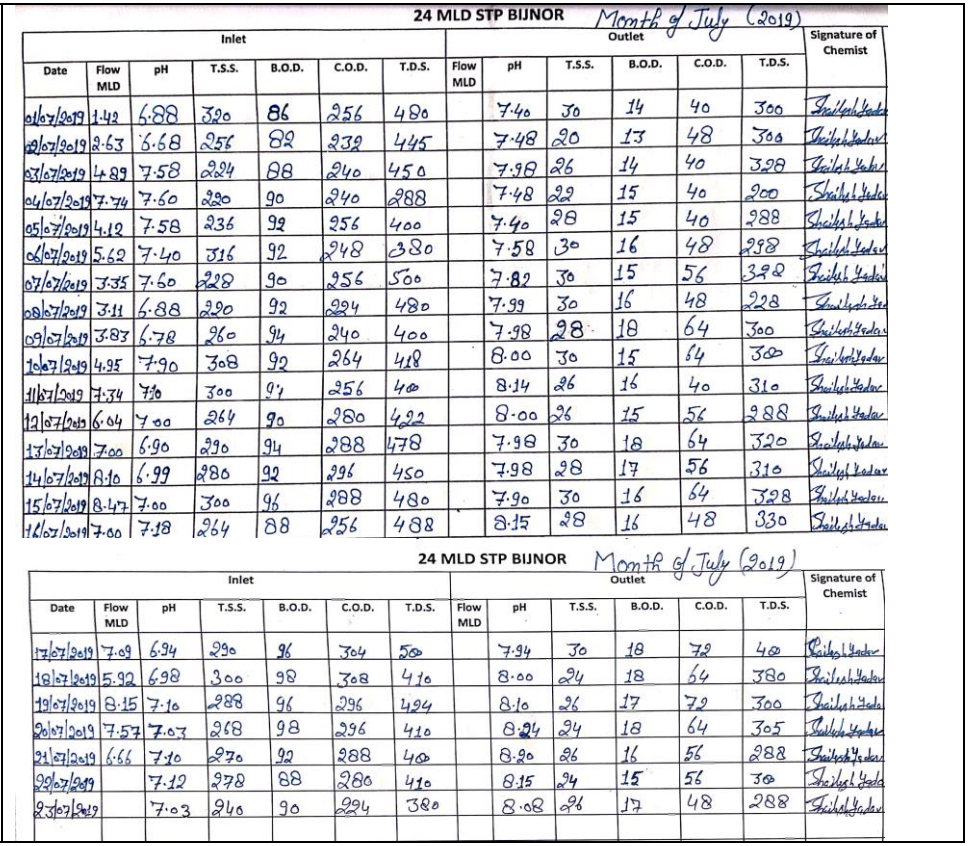
Annexure 6: Sewage treatment plant test result (Source: UPJN)



उ0प्र0 जल निगम द्वारा संचालित एवं रखरखाव किये जा रहे सीवेज ट्रीटमेन्ट प्लांट की अद्यावधिक स्थिति

Month of May (2019)

क्रमांक	दिनांक	नगर का नाम	स्थापित एसटीपी का नाम एवं क्षमता (MLD)	रखरखाव कर रहे अभियंता का नाम एवं मो.न.		शोधन का विवरण								शोधन मात्रा/क्षमता (MLD)	हि
				लैब असिस्टेन्ट, जी.एस.जे. नई दिल्ली	परियोजना प्रबन्धक, जी.एस.जे. नई दिल्ली	इनफ्लुएंट				इफ्लुएंट					
						B.O.D	T.S.S	C.O.D	P.H	B.O.D	T.S.S	C.O.D	P.H		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	01/05/2019	बिजनौर	24 एम.एल.डी. एस.टी.पी. बिजनौर	Shailesh Yadav		92	236	264	6.38	14	20	32	7.50	2.68	
2	02/05/2019			Shailesh Yadav		94	300	296	6.35	16	24	32	7.47	2.16	
3	03/05/2019			Shailesh Yadav		88	232	288	6.36	13	20	40	7.48	1.84	
4	04/05/2019			Shailesh Yadav		86	240	280	6.42	11	18	40	7.49	1.60	
5	05/05/2019			Shailesh Yadav		90	272	288	6.43	11	20	40	7.46	1.00	
6	06/05/2019			Shailesh Yadav		88	248	296	6.50	13	18	40	7.31	2.30	
7	07/05/2019			Shailesh Yadav		84	260	264	6.42	10	16	32	7.39	1.87	
8	08/05/2019			Shailesh Yadav		80	248	288	6.45	10	16	40	7.39	2.00	
9	09/05/2019			Shailesh Yadav		82	258	280	6.46	11	18	40	7.38	1.03	
10	10/05/2019			Shailesh Yadav		78	240	272	6.46	10	16	32	7.50	1.16	
11	11/05/2019			Shailesh Yadav		80	232	296	6.60	12	14	32	7.48	1.04	
12	12/05/2019			Shailesh Yadav		84	246	296	6.50	11	18	40	7.43	1.01	
13	13/04/2019			Shailesh Yadav		86	260	272	6.50	13	20	40	7.48	1.08	
14	14/05/2019			Shailesh Yadav		90	258	288	6.46	12	20	48	7.44	1.09	
15	15/05/2019			Shailesh Yadav		92	262	280	6.60	14	22	40	7.47	1.00	
16	16/05/2019			Shailesh Yadav		76	232	264	6.68	13	18	40	7.41	1.09	
17	17/05/2019			Shailesh Yadav		80	256	292	6.61	12	20	32	7.49	1.00	
18	18/05/2019			Shailesh Yadav		84	248	288	6.68	13	22	40	7.50	1.20	



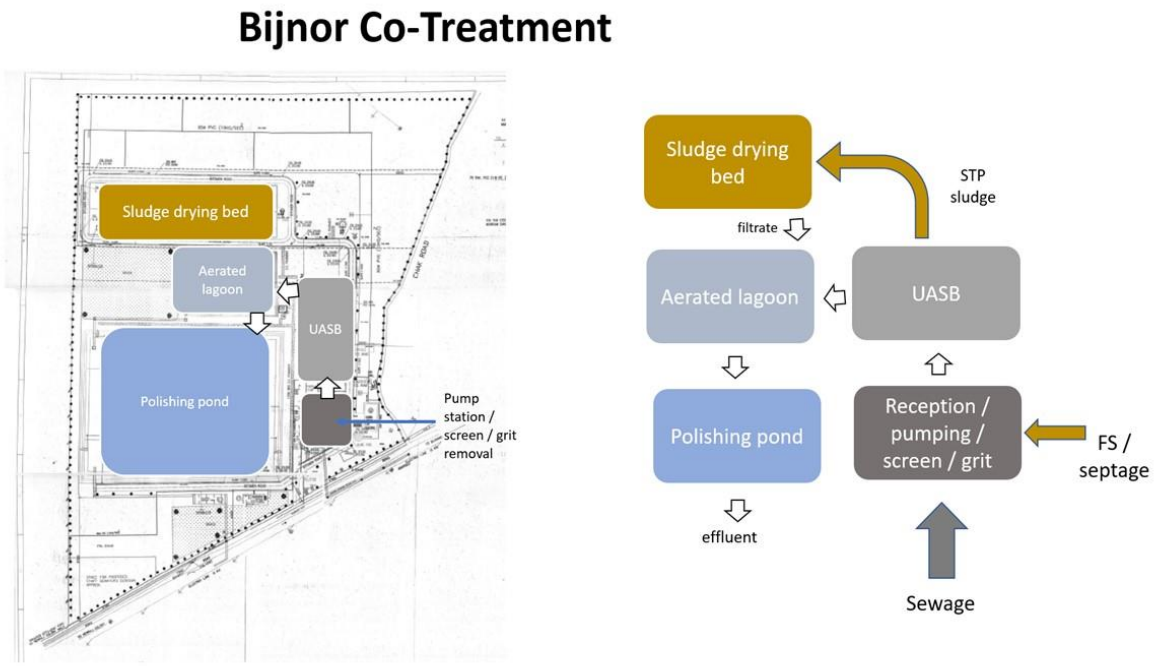
24 MLD STP BIJNOR Month of July (2019)

Inlet							Outlet						Signature of Chemist
Date	Flow MLD	pH	T.S.S.	B.O.D.	C.O.D.	T.D.S.	Flow MLD	pH	T.S.S.	B.O.D.	C.O.D.	T.D.S.	
01/07/2019	1.42	6.88	320	86	256	480		7.40	30	14	40	300	Shailesh Yadav
02/07/2019	2.63	6.68	256	82	232	445		7.48	20	13	48	300	Shailesh Yadav
03/07/2019	4.89	7.58	224	88	240	450		7.98	26	14	40	328	Shailesh Yadav
04/07/2019	7.74	7.60	220	90	240	288		7.48	22	15	40	200	Shailesh Yadav
05/07/2019	4.12	7.58	236	92	256	400		7.40	28	15	40	288	Shailesh Yadav
06/07/2019	5.62	7.40	316	92	248	380		7.58	30	16	48	298	Shailesh Yadav
07/07/2019	3.35	7.60	228	90	256	500		7.82	30	15	56	328	Shailesh Yadav
08/07/2019	3.11	6.88	220	92	224	480		7.99	30	16	48	228	Shailesh Yadav
09/07/2019	3.83	6.78	260	94	240	400		7.98	28	18	64	300	Shailesh Yadav
10/07/2019	4.95	7.90	308	92	264	418		8.00	30	15	64	300	Shailesh Yadav
11/07/2019	7.34	7.10	300	94	256	400		8.14	26	16	40	310	Shailesh Yadav
12/07/2019	6.64	7.00	264	90	280	422		8.00	26	15	56	288	Shailesh Yadav
13/07/2019	7.00	6.90	290	94	288	478		7.98	30	18	64	320	Shailesh Yadav
14/07/2019	8.10	6.99	280	92	296	450		7.98	28	17	56	310	Shailesh Yadav
15/07/2019	8.47	7.00	300	96	288	480		7.90	30	16	64	328	Shailesh Yadav
16/07/2019	7.00	7.18	264	88	256	488		8.15	28	16	48	330	Shailesh Yadav

24 MLD STP BIJNOR Month of July (2019)

Inlet							Outlet						Signature of Chemist
Date	Flow MLD	pH	T.S.S.	B.O.D.	C.O.D.	T.D.S.	Flow MLD	pH	T.S.S.	B.O.D.	C.O.D.	T.D.S.	
17/07/2019	7.09	6.94	290	96	304	500		7.94	30	18	72	400	Shailesh Yadav
18/07/2019	5.92	6.98	300	98	308	410		8.00	24	18	64	380	Shailesh Yadav
19/07/2019	8.15	7.10	288	96	296	424		8.10	26	17	72	300	Shailesh Yadav
20/07/2019	7.57	7.03	268	98	296	410		8.24	24	18	64	305	Shailesh Yadav
21/07/2019	6.66	7.10	270	92	288	400		8.20	26	16	56	288	Shailesh Yadav
22/07/2019		7.12	278	88	280	410		8.15	24	15	56	300	Shailesh Yadav
23/07/2019		7.03	240	90	224	380		8.08	26	17	48	288	Shailesh Yadav

Annexure 7: Compatibility check of Co-treatment at UASB



Sludge thickness	BOD removal	COD removal	TSS removal
<20%	0%	0%	0%
20-30%	20%	20%	20%
30-50%	50%	50%	50%
50-80%	65%	65%	65%
80-90%	50%	50%	40%
>90%	20%	20%	10%

Sludge thickness and corresponding removal efficiency

Design considerations: - To check compatibility (in compliance to design) for discharging at inlet and FSS being treated at UASB reactor.

		Formula used for calculation (=)	**Value /calculation**	**Designed limit**	**OK/Not Ok**
Sewage (Se)	Flow (MLD)		10		
	BOD (mg/l)		120		
	COD (mg/l)		350		
	TSS (mg/l)		400		
	TDS (mg/l)		450		
Faecal Sludge (FSS)	Flow (KLD)		10		
	BOD (mg/l)		3500		
	COD (mg/l)		45000		
	TS (mg/l)		40000		
	TKN		1500		
Total Volume of the reactor	(m^3)	2 reactors * volume of one reactor	9140		
Combined load (in KG)	BOD	*(Se flow x Se BOD) + (FSS Flow x FSS BOD)/ 1000*	1235		
	COD	*(Se flow x Se COD) + (FSS Flow x FSS COD)/1000*	3950		
	TSS	*(Se flow x Se TSS) + (FSS Flow x FSS TSS)/1000*	4400		
Compliance check	COD Loading rate kg/m3	COD loading (kg)/Total Volume of reactor (m^3)	0.43	1.15 - 1.45	Not ok
	HRT (hrs)	Total Volume of reactor (m^3)/ (Sewage flow + Sludge flow)	21.91	8 - 12	Not ok
	Up-flow velocity (avg.) (m/hr)	Sewage flow + Sludge flow)/ Area of the reactor	0.23	0.5 – 0.6	Not ok
	Sludge thickness (% of sludge zone)	(Combined COD x COD removal efficiency x Total bacterial yield x degradation of organic compound) +	29%	@ 65% removal efficiency (% of sludge zone:	Not ok

		(Combined TSS x TSS reduction in reactor x Volatile TSS*[6]) (%solids x sludge retention time) / (Surface area of the reactor x Depth of sludge zone)		50% - 80%)	
	Sludge drying bed area required (m^2)	Combined COD x COD removal efficiency x Total bacterial yield x degradation of organic compound) + (Combined TSS x TSS reduction in reactor x Volatile TSS*[7]) (%solids x Drying cycle)/Depth of sludge application	2414	<6584 sq,m	OK
	BOD, COD and TSS %removal	See table 1	20		
Aerated lagoons	Oxygen requirement	If effluent BOD with FS is >designed effluent then = (BOD incoming – designed BOD)/ (Sewage flow + Sludge Flow) x 1.5 Kg O_2 required/Kg BOD removed	49	<77 kg	OK
Polishing pond	Retention time	Volume of the Pond/(Sewage flow + Sludge flow	58	>24 hrs.	OK
	TSS in effluent	90% removal at 24 hrs. retention time	35		Not ok, this is marginal high.

This shows that if the faecal sludge is discharged to sludge drying beds instead of passing through UASB reactor, the effluent will comply with the designed standards.

[6] Assumed Volatile TSS to be 70%
[7] Assumed Volatile TSS to be 70%

Annexure 8: To check compatibility (in compliance to design) for discharging at Sludge drying bed with preliminary treatment.

		Formula used for calculation (=)	**Value /calculation**	**Designed limit**	**OK/Not Ok**
Sewage (Se)	Flow (MLD)		10		
	BOD (mg/l)		250		
	COD (mg/l)		450		
	TSS (mg/l)		500		
	TDS (mg/l)		450		
	Volume of the UASB reactor (m^3)		9140		
Faecal Sludge (FSS)	Flow (KLD)		10		
	BOD (mg/l)		3500		
	COD (mg/l)		45000		
	TSS (mg/l)		40000		
	TKN		1500		
Sewage load (in KG)	BOD	*(Se flow x Se BOD)*	2500		
	COD	*(Se flow x Se COD)*	4500		
	TSS	*(Se flow x Se TSS)*	5000		
Compliance Check based on current flow of sewage with designed parameters* (*higher side values)	COD Loading rate kg/m3	COD loading (kg)/Total Volume of reactor (m^3)	0.49	1.15 - 1.45	Not ok
	HRT (hrs)	Total Volume of reactor (m^3)/ (Sewage flow (m^3/hr)	21.91	8 - 12	Not ok
	Up-flow velocity (avg.) (m/hr)	Sewage flow (m^3/hr)/ Area of the reactor (m^2)	0.23	0.5 – 0.6	Not ok
	Sludge thickness (% of sludge zone)	(Sewage COD x COD removal efficiency x Total bacterial yield x degradation of organic compound) + (Sewage TSS x TSS reduction in reactor x Volatile TSS*[8]) (%solids x sludge retention time) / (Surface	33%	@ 65% removal efficiency (% of sludge zone: 50% - 80%)	Not ok

[8] Assumed Volatile TSS to be 70%

		area of the reactor x Depth of sludge zone)			
	Sludge drying bed area required (m^2)	Sewage COD x COD removal efficiency x Total bacterial yield x degradation of organic compound) + (Sewage TSS x TSS reduction in reactor x Volatile TSS*[9]) (%solids x Drying cycle)/Depth of sludge application	2743	<6584 sq,m	OK (Around 8 beds would be required for sewage sludge)
	BOD, COD, TSS % removal	See table 1 and percentage of sludge zone	50%		Not ok
Faecal sludge on the Sludge drying bed	Flow (m^3/hr)	416.7 (10KLD)			
	BOD (mg/l)	3500			
	COD (mg/l)	45000			
	TSS (mg/l)	40000			
Filtrate	Volume (m^3)	Sludge volume applied x TSS x %Solid removal/ expected concentration of solids in thickened sludge (assumed 200000 mg/l)	8.10		
	BOD	BOD - %removal x BOD	700		
	COD	COD - %removal x COD	2250		
	TSS	TSS - %removal x TSS	2469		
Aerated lagoons	Oxygen requirement	If effluent BOD with FSS is >designed effluent then = (BOD incoming – designed BOD)/ (Sewage flow + Sludge Flow) x 1.5 Kg O_2 required/Kg BOD removed	79	<77 kg	OK, as the concentration of Sewage BOD (i.e. 250 mg/l) is taken as compared to 120 mg/l (actual). Sewage BOD till ~200 mg/l can be handled

[9] Assumed Volatile TSS to be 70%

					without extra aeration.
Polishing pond	Retention time	Volume of the Pond/(Sewage flow + Sludge flow	58	>24 hrs.	OK
	TSS in effluent	90% removal efficiency for 24 hrs. retention time	25	<30 mg/l	OK
	BOD in effluent	80% removal efficiency for 24 hrs. retention time	25	<20 mg/l	OK, as the concentration of BOD (i.e. 250 mg/l) is taken as compared to 120 mg/l . BOD till ~200 mg/l can be handled without extra aeration.
	COD in effluent	90% removal efficiency for 24 hrs. retention time	23	<100 mg/l	OK

Annexure 9: Photograph of proposed site for construction of Co-treatment units

Area available for construction of co-treatment module = 2 5 X 25 = 625m^2

Annexure 10: Cost estimation of Co-treatment module

Schedule of rates

Rates of labour and materials have been adopted from UP PWD 2019 and the latest rates of RCC and PVC pipes have been adopted in this detailed project report. The rates of Polycarbonate sheets for solar roofing of the sludge drying beds have been adopted as per market rates.

(I) Name of work: - Construction of R.C.C Screen Chamber for Co-Treatment at S.T.P Near Hemraj Raod .Bijnor

S.N.	Item	No	Length	Width	Height/ Depth	Quantity	Unit	Rate	Amount	S.I.No
1	Excavation in soil mixed with mooram/shining kankar requiring the use of special T& P such as pick axes sabbals etc. (as per P.W.D schedule S.I.No. 252)									252
		1	3.13	2.94	1.27	11.69	cum	100.00	1168.68	
2	Disposal of refuse Excavated Earth work up to 5 Km. i/c All Completion of work.									
	Same as Qty Item no. 2					11.69	cum	183.50	2144.53	231a
3	Concrete in 1:4:8 with cement, fine sand and Stone ballast of 4cm gauge including supply of all material, labour and T&P etc. Required for proper completion of work.									
		1	3.00	2.94	0.15	1.32	Cum	5250.00	6945.75	275
4	P.C.C in 1:2:4 with cement, coarse sand and stone grit of 2cm gauge including supply of all material, labour and T&P etc. Required for proper completion of work	1	2.70	2.89	0.10	0.78	cum	6250.00	4876.88	279a

5	Laying of C.C work in 1:1.5:3 with cement, coarse sand and stone ballast of 2cm gauge including supply of all material, labour and T&P etc. required for proper completion of work Wall & Footing									
	Raft	1	2.531	2.340	0.15	0.89				
	Wall	3	2.04	0.15	1.00	0.92				
	Wall	2	2.53	0.15	1.00	0.76				
						2.57	cum	8050.00	20653.73	289
6	Laying of C.C work in 1:2:4 with cement, coarse sand and stone ballast of 2cm gauge including supply of all material, labour and T&P etc. required for proper completion of work. Slab	1	2.531	2.340	0.08	0.44	cum	7300.00	3242.59	284
7	Mild steel Work for R.C.C i/c All completion of Work.	1	3.01	0.785	1.35	3.19	Qtl	6100.00	19457.24	504
8	12mm thick Plaster in 1:3 with cement, coarse sand mortar including supply of all material, labour and T&P etc. required for proper completion of work									
		4	2.040	-	1.00	8.16				
		4	1.00		1.00	4.00				
						12.16	sqm	180.00	2188.80	583

8	Providing & Fixing M.S Screening With angle Frame i/c All Completion of Work.	2	1.00	0.7	0.85	1.19	Qtl	6100.00	7259.00	502
9	Supply & Fixing of 10 cm A.C Down Pipe make complete band i/c all completion of work.	1	1.20			1.20	Rmt	300.00	360.00	730a
								Total(A)	**68297.19**	
								say	**68300.00**	

(II) Name of work: - Construction of R.C.C Homogenisation tank for Co-Treatment at S.T.P Near Hemraj Raod .Bijnor

S.N.	Item	No	Length	Width	Height/ Depth	Quantity	Unit	Rate	Amount	S.I.No
1	**Excavation in soil mixed with mooram/shining kankar requiring the use of special T& P such as pick axes sabbals etc. (as per P.W.D schedule S.I.No. 252)**									**252**
		1	**9.17**	**4.92**	**3.28**	**147.94**	**cum**	**100.00**	**14794.08**	
2	**Disposal of refuse Excavated Earth work up to 5 Km. i/c All Completion of work.**									
	Same as Qty Item no. 2					**147.94**	**cum**	**183.50**	**27147.14**	**231a**
3	**Concrete in 1:4:8 with cement, fine sand and Stone ballast of 4cm gauge including supply of all material, labour and T&P etc. required for proper completion of work.**									

		1	**9.17**	**4.92**	**0.15**	**6.78**	**Cum**	**5250.00**	**35573.56**	**275**
4	**P.C.C in 1:2:4 with cement, coarse sand and stone grit of 2cm gauge including supply of all material, labour and T&P etc. Required for proper completion of work**	**1**	**8.97**	**4.72**	**0.08**	**3.18**	**cum**	**6250.00**	**19871.80**	**279a**
5	**Laying of C.C work in 1:1.5:3 with cement, coarse sand and stone ballast of 2cm guage including supply of all material, labour and T&P etc. required for proper completion of work Wall & Footing**									
	Raft	**1**	**8.874**	**4.524**	**0.25**	**10.04**				
	Wall	**2**	**8.59**	**0.275**	**2.80**	**13.22**				
	Wall	**2**	**3.77**	**0.275**	**2.80**	**5.81**				
						29.07	**cum**	**8050.00**	**234020.70**	**289**
6	**Laying of C.C work in 1:2:4 with cement, coarse sand and stone ballast of 2cm gauge including supply of all material, labour and T&P etc. required for proper completion of work. Slab**	**1**	**8.598**	**4.336**	**0.15**	**5.59**	**cum**	**7300.00**	**40822.62**	**284**

7	**Mild steel Work for R.C.C i/c All completion of Work.**	**1**	**34.66**	**0.785**	**1.35**	**36.73**	**Qtl**	**6100.00**	**224078.31**	**504**
8	**12mm thick Plaster in 1:3 with cement, coarse sand mortar including supply of all material, labour and T&P etc. required for proper completion of work**									
		2	**8.000**	**-**	**2.80**	**44.80**				
		2	**3.77**		**2.80**	**21.13**				
						65.93	**sqm**	**180.00**	**11868.19**	**583**
8	**Providing & Fixing Ms. Chamber Frame with angle Frame i/c All Completion of Work.**	**3**	**0.60**	**0.6**	**0.45**	**0.49**	**Qtl**	**6100.00**	**2964.60**	**502**
9	**Supply & Fixing of 10 cm A.C Down Pipe make complete band i/c all completion of work.**	**1**	**5.00**			**5.00**	**Rmt**	**300.00**	**1500.00**	**730a**
								Total(A)	**612641.01**	
								say	**612640.00**	

(III) Name of the work:- Construction of R.C.C road and drain at S.T.P Hemraj, Bijnor

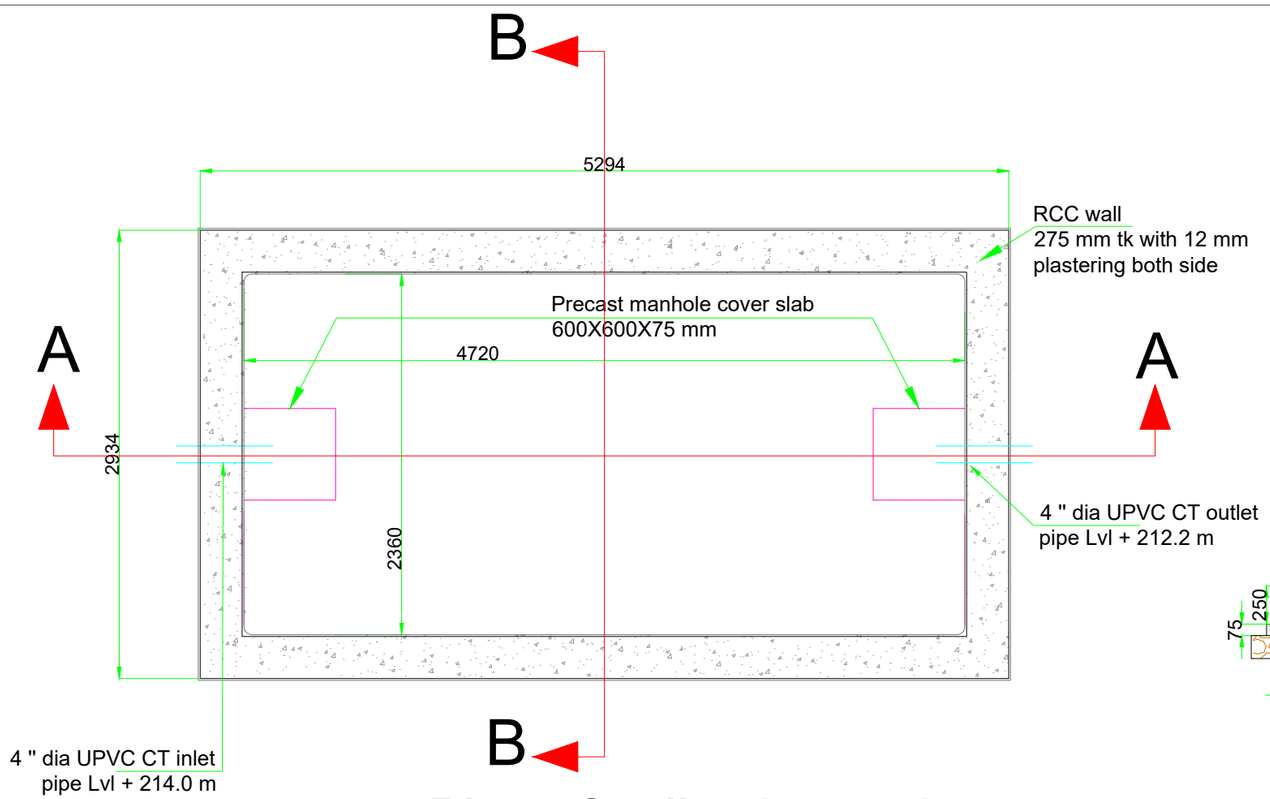
S.N.	Item	No	Length	Width	Height/ Depth	Quantity	Unit	Rate	Amount	S.I.No
1	Earth work in excavation in soil mixed with mooram/shining kankar requiring the use of special T& P such as pick axes sabbals etc. (as per P.W.D schedule S.I.No. 252)									
		1	25.00	4.00	0.30	30.00	cum	100.00	3000.00	251
2	Disposal of Excavated Earth road material with cartage upto distance 3.00 km i/c loading and unloading 80 % of item no-1 including supply of all material,labour and T&P etc.required for proper completion of work									
		1	30.00	0.10	0.80	2.40	Cum	183.50	440.40	231(a)
3	Concrete in 1:4:8 with cement, fine sand and brick ballast of 4cm gauge including supply of all material, labour and T&P etc. required for proper completion of work.									
		2	25.00	0.60	0.12	3.60	Cum	3250.00	11700.00	275
4	M-150 brick work in 1:3 with cement, coarse sand mortar including supply of all material, labour and T&P etc. required for proper completion of work									
		4	25.00	0.23	0.23	5.29	"			
					Total	5.29	Cum	4800.00	25392.00	307

5	**12mm thick Plaster in 1:3 with cement, coarse sand mortar including supply of all material, labour and T&P etc. required for proper completion of work**									
		4	**25.00**	**-**	**0.23**	**23.00**	**Sqm**	**180.00**	**4140.00**	**583**
6	**1" thick P.C.C in 1:2:4 with cement, coarse sand and stone grit of 2cm gauge including supply of all material, labour and T&P etc. required for proper completion of work**									
		4	**25.00**	**0.23**	**-**	**23.00**	**Sqm**	**230.00**	**5290.00**	**601(a)**
7	**Providing, laying and compaction of two layer stone ballast with fine sand including supply of all material, labour and T&P etc. required for proper completion of work**									
		1	**25.00**	**4.00**	**0.15**	**15.00**	**Cum**	**2665.00**	**39975.00**	**NSI**
8	**Providing & laying of polythene sheet 125 micron including supply of all material, labour and T&P etc. required for proper completion of work**									**Chp-01**
		1	**25.00**	**4.00**	**-**	**100.00**	**Sqm**	**16.00**	**1600.00**	**15(31)**
									Page No-03	

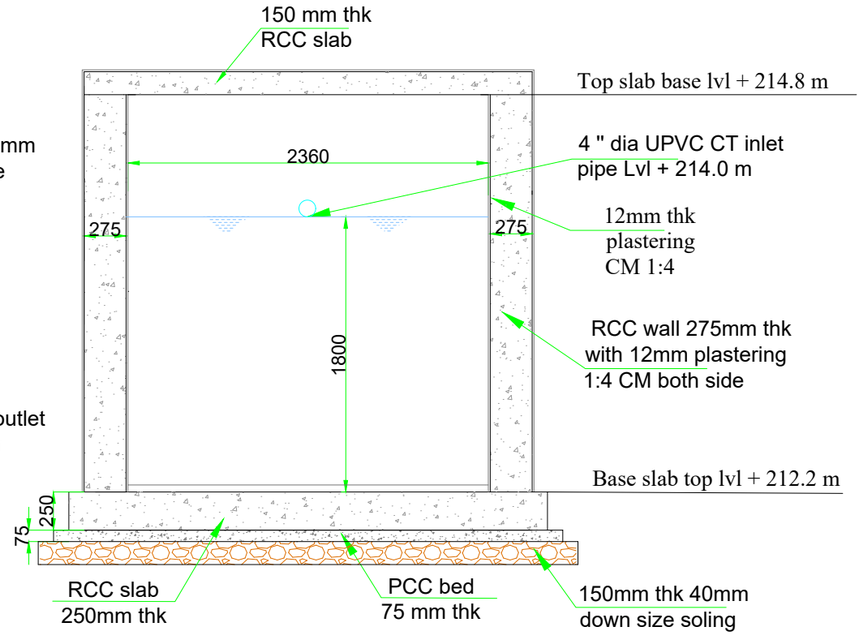
9	**Laying of R.C.C work in 1:1.5:3 with cement, coarse sand and stone ballast of 2cm gauge including supply of all material, labour and T&P etc. required for proper completion of work**									
		1	**25.00**	**4.00**	**0.15**	**15.00**	**Cum**	**7150.00**	**107250.00**	**283a**
10	**Making Expansion/contraction joints in c.c road i/c approved filler materials in joints. Depth of joint 10cm/require depth at the joints of panels and giving them a uniform finish including supply of all material, labour and T&P etc. required for proper completion of work**									
		6	**-**	**4.00**	**-**	**24.00**	**Rmt**			**Chp-20**
					Total	**24.00**	**Rmt**	**35.00**	**840.00**	**New(6)**
11	**Supply and fixing of mild steel bars for RCC work and angle for channel including supply of all material, labour and T&P etc. required for proper completion of work**									
		1	**15.00**	**0.785**	**1.30**	**15.31**	**Qtl**	**6100.00**	**93375.75**	**504**
								Total(A)	**293003.15**	
								say	**293000.00**	

Annexure 11: General abstract of cost

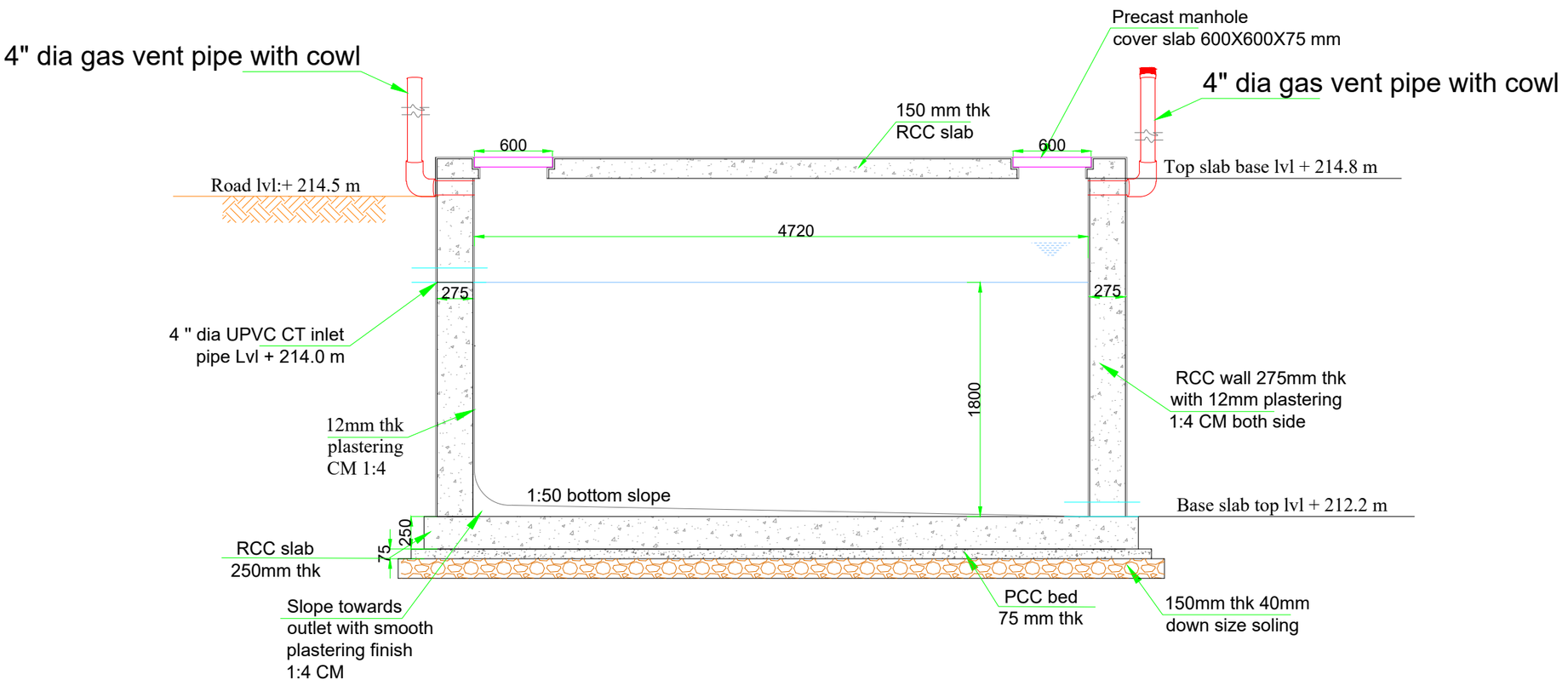
Sl. No	Description of work	Amount in thousands (Rs)
1	A) Civil works Screen Chambers Homogenisation tanks Fencing, internal road and landscaping	9,73,941
	Cost of solar roofing @180 sq.ft for 2 beds	13,95,000
	Total Cost of civil works	**23,68,941**
2	B) E&M works 5 HP submersible pump (as and when to be replaced)	35,000
	Total cost of E&M works	**35,000**
	Contingencies @5%	25,24,138
	Centage charges @ 12.5%	28,51,467
	Total Cost	**28,51,467**



Plan of collection tank



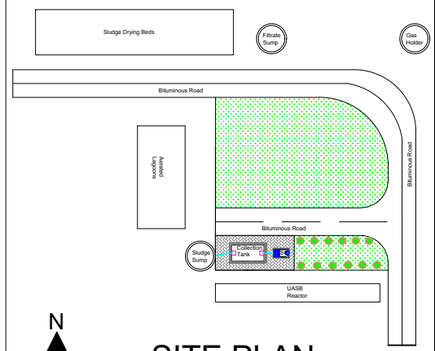
Cross section B-B



Cross section A-A

PROJECT NAME:

Co-treatment of faecal sludge at Bijnor Sewage Treatment Plant



SITE PLAN

NOTES:

- All dimensions are in 'mm' unless mentioned otherwise.
- All dimensions are to be checked and co-related with the design drawings and structural drawings. Any discrepancy or omission shall be brought to the
- All inner dimensions are excluding plastering in design drawings and including plastering in structural drawings unless otherwise mentioned.
- All plastering to be of waterproofing nature.
- Use UPVC pipes (25.4mm, 55mm, 110mm & 150 mm dia (1", 2", 4" & 6")) which can withstand pressure of 6kg/cm².
- All BBM walls to be with cement mortar ratio of 1:5 unless otherwise mentioned.
- All soling to be with sufficient sand filling at top surface

TITLE:

Collection Tank

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4	NTS	

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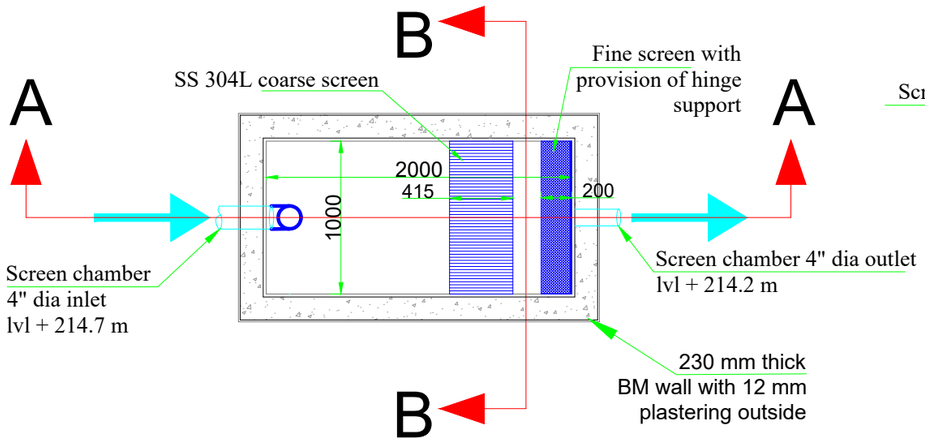
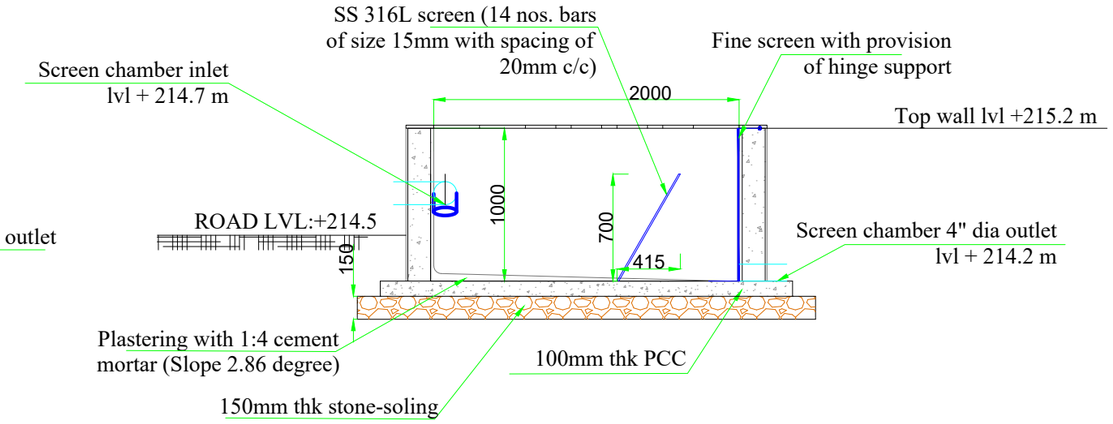
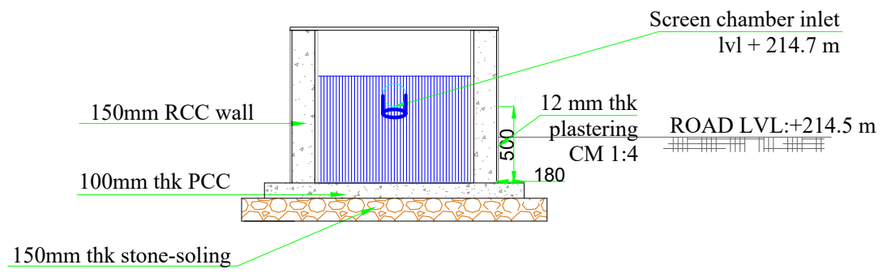


Plan of Screen Chamber



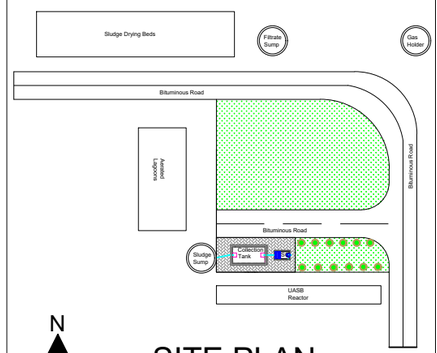
Cross Section of A-A



Cross Section of B-B

PROJECT NAME:

Co-treatment of faecal sludge at Bijnor Sewage Treatment Plant



SITE PLAN

NOTES:

- All dimensions are in 'mm' unless mentioned otherwise.
- All dimensions are to be checked and co-related with the design drawings and structural drawings. Any discrepancy or omission shall be brought to the
- All inner dimensions are excluding plastering in design drawings and including plastering in structural drawings unless otherwise mentioned.
- All plastering to be of waterproofing nature.
- Use UPVC pipes (25.4mm, 55mm, 110mm & 150

mm dia (1", 2", 4" & 6")) which can withstand pressure of 6kg/cm².

- All BBM walls to be with cement mortar ratio of 1:5 unless otherwise mentioned.
- All soling to be with sufficient sand filling at top surface

TITLE:

Screen Chamber

SHEET NO.	SCALE	PAGE NO.
3	NTS	

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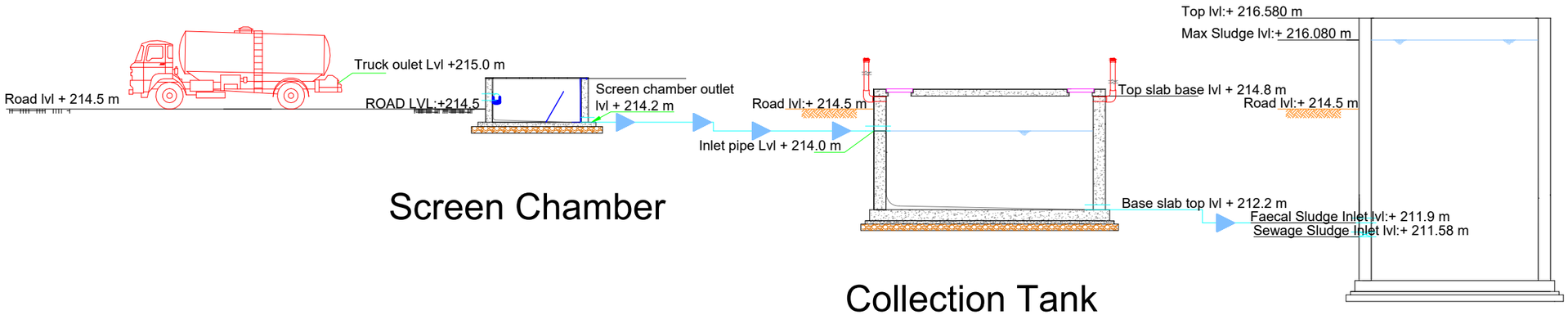


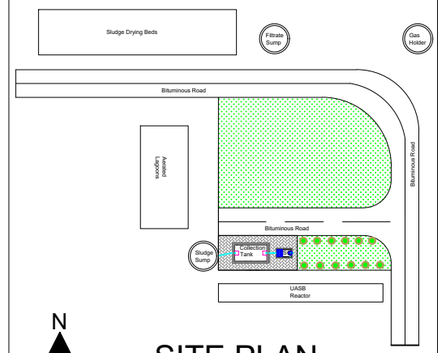
Screen Chamber

Collection Tank

Sewage Sludge Sump Well

PROJECT NAME:

Co-treatment of faecal sludge at Bijnor Sewage Treatment Plant



SITE PLAN

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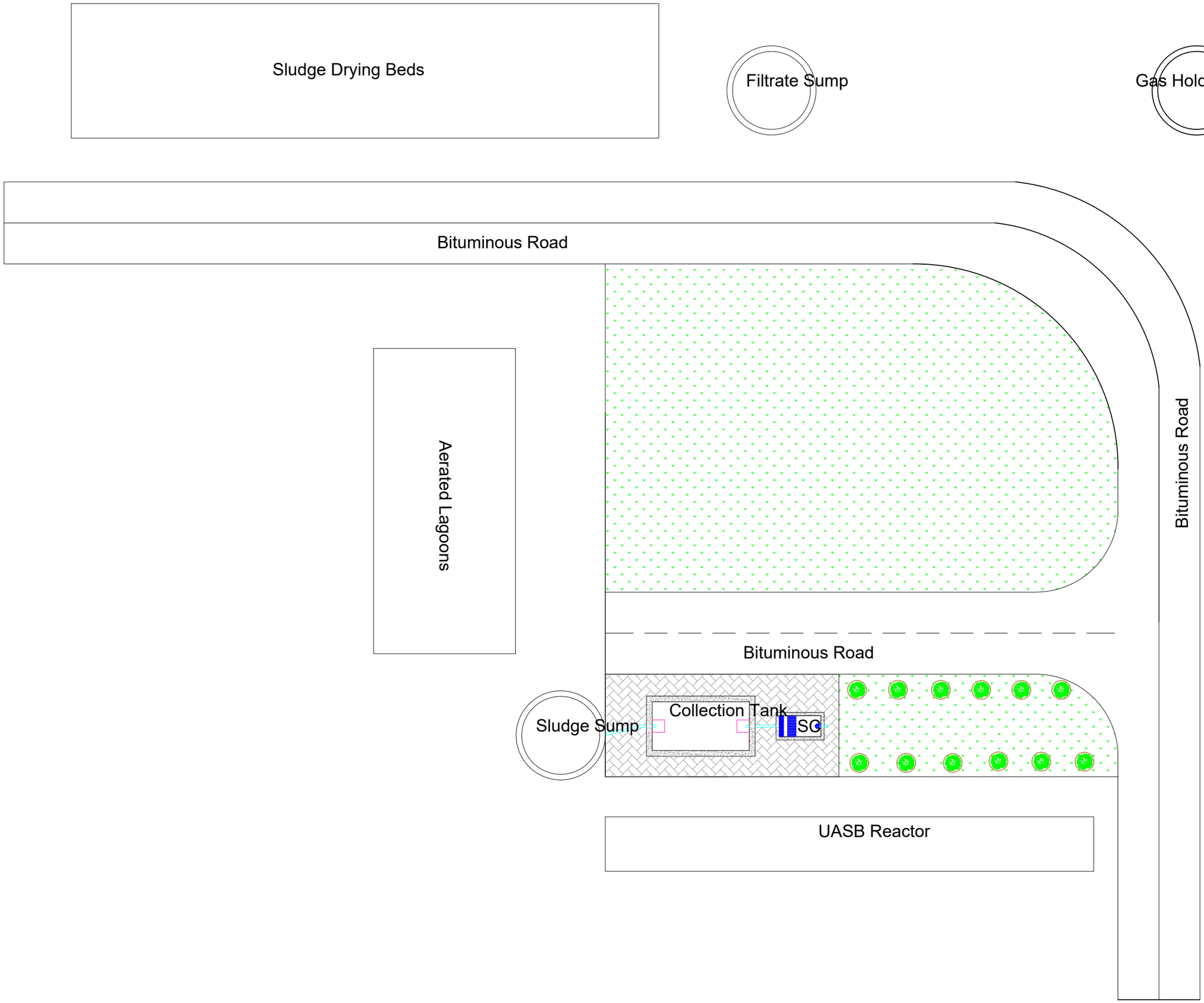
TITLE:

Hydraulic Profile of co-treatment modules

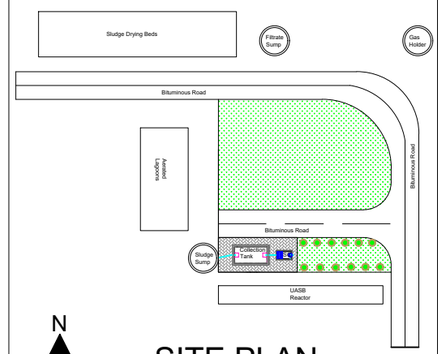
SHEET NO.	SCALE	PAGE NO.
2	NTS	

Centre for Science and Environment



PROJECT NAME:

Co-treatment of faecal sludge at Bijnor Sewage Treatment Plant



SITE PLAN

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- All dimensions are to be checked and co-related with the design drawings and structural drawings. Any discrepancy or omission shall be brought to the
- All inner dimensions are excluding plastering in design drawings and including plastering in structural drawings unless otherwise mentioned.
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TITLE:

Site Plan

SHEET NO.	SCALE	PAGE NO.
1	NTS	

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Annexure 16: Co-treatment of Faecal Sludge

Co-treatment is a process where Sewage Treatment Plant (STP), in addition to treating the domestic sewage conveyed through sewers, also treats Faecal Sludge & septage (FSS) emptied from various Onsite Sanitation Systems (OSS) in the city.

For cities that are partially covered with sewerage system, co-treatment of FSS in existing STPs provides a cheaper alternative to treat FSS generated from a dedicated faecal sludge treatment plant. 100% coverage of sewerage network in a city is costly and difficult to be implemented especially in densely populated areas. Setting up of a dedicated faecal sludge treatment plant (FSTP) is comparatively a time-consuming affair due to issues such as non-availability of land, clearances, tendering process. Further, in case of co-treatment, the existing facilities, site infrastructure and manpower of the STP can also be used and thus can eliminate the problem of engaging a new O&M operator and additional cost related to site infrastructure.

In many cities in India, FSS is directly added without any pre-treatment, either at the inlet of the STP or at the nearest pumping station or directly in sewerage network through access covers. There are learnings from various countries on the detrimental impact of co-treatment of FSS in an STP without doing the feasibility study for the same.

The considerably higher solids, organic and nutrient load of FSS as compared to sewage, can lead to severe operational problems such as solids deposition, clogging and corrosion of sewerage infrastructure, including STP. This is because the diameter and slope of sewers are designed for the conveyance of municipal wastewater typically containing 250 to 600 mg TSS/L and not the 12,000 to 52,500 mg TSS/L as in case of FSS. Further, the high strength of FSS can have a considerable effect on the suspended organic solids and nitrogen loads of the STP and thus impact its treatment efficiency. The intermittent nature of FSS loading will give rise to high instantaneous loads and thus amplify the problems.

To assess the feasibility of co-treatment in an STP, the following points need to be studied:

1. The spare capacity in the STP to treat the additional load from FSS
2. The treatment process of the STP and the limiting factors, which can affect treatment efficiency like F/M ratio, oxygen requirement in case of aerobic process and pH, ammonical nitrogen content in anaerobic process
3. Existing treatment efficiency of the STP
4. Land availability for construction of co-treatment modules

Distance of STP from the non sewered areas of the city and beyond to assess the economic feasibility of co-treatment of FSS