

THESIS TITLE:
***DESIGN OF CONVENTIONAL TYPE FLOCULATOR
BASED WATER TREATMENT PLANT FOR PINGLA
& PANSKURA BLOCK IN WEST BENGAL***

*A Thesis Submitted Towards Partial Fulfilment of the Requirements
for The Degree of*

***Master of Engineering
in
Water Resources and Hydraulic Engineering (6 seme)***

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DECLARATION OF ORIGINALITY AND COMPLIANCE OF ACADEMIC ETHICS

I hereby declare that this thesis contains literature survey and original research work by the undersigned candidate, as part of my Master of Engineering in Water Resources and Hydraulic Engineering in the Faculty Council of Interdisciplinary Studies, Law & Management, Jadavpur University during academic session 2023-24.

All information in this document have been obtained and presented in accordance with academic rules and ethical conduct.

I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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CERTIFICATE OF RECOMENDATION

This is to certify that the project report entitled “Design of Conventional Type Flocculator Based Water Treatment Plant for Pingla & Panskura Block in West Bengal” submitted by **Ashis Saha**, Exam Roll No: **M6WRP24001** in partial fulfilment of the requirements for the award of M.E Degree in **School of Water Resources Engineering** at the Jadavpur University, Kolkata is an authentic work carried out by him under my supervision and guidance.

To the best of my knowledge, the matter embodied in the report has not been submitted to any other University/Institute for the award of any Degree.

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CERTIFICATE OF APPROVAL

This foregoing thesis is hereby approved as a credible study of an engineering subject carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite to the degree for which it has been submitted. It is understood that by this approval the undersigned do not endorse or approve any statement made or opinion expressed or conclusion drawn therein but approve the thesis only for purpose for which it has been submitted.

**Committee of Final Examination
for the Evaluation of the Thesis**

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ABSTRACT

The aim of water treatment is to produce and maintain water that is hygienically safe, aesthetically pleasing, and palatable in an economical manner. Though the treatment of water would achieve the desired quality, the evaluation of its quality should not be confined to the end of the treatment facilities but should be extended to the point of consumer use.

Water to be supplied for public use must be potable i.e., satisfactory for drinking purposes from the standpoint of its chemical, physical and biological characteristics. Drinking water should, preferably, be obtained from a source free from pollution. The raw water normally available from surface water sources is, however, not directly suitable for drinking purposes. The objective of water treatment is to produce safe and potable drinking water. Some of the common treatment processes used in the past include Plain sedimentation, Slow Sand filtration, Rapid Sand filtration with Coagulation-flocculation units as essential pretreatment units. Pressure filters and Diatomaceous filters have been used though very rarely. Roughing filters are used, under certain circumstances, as pretreatment units for the conventional filters.

The treatment processes may need pretreatment like pre-chlorination and aeration prior to conventional treatment. The pretreatment processes comprising of Coagulation and Flocculation have been discussed under the main title of Rapid Sand filters in para 5.4 of this chapter. Detailed discussion on all such aspects as well as recommended unit operations, is given in the Manual on Water Supply and Treatment (1999 Edition) Ministry of Urban Development.

Water is a precious commodity. Most of the earth water is sea water. About 2.5% of the water is fresh water that does not contain significant levels of dissolved minerals or salt and two third of that is frozen in ice caps and glaciers. In total only 0.01% of the total water of the planet is accessible for consumption. Clean drinking water is a basic human need. Unfortunately, more than one in six people still lack reliable access to this precious resource in developing world.

India accounts for 2.45% of land area and 4% of water resources of the world but represents 16% of the world population. With the present population growth-rate (1.9 per cent per year), the population is expected to cross the 1.5 billion marks by 2050. The Planning Commission, Government of India has estimated the water demand increase from 710 BCM (Billion Cubic Meters) in 2010 to almost 1180 BCM in 2050 with domestic and industrial water consumption expected to increase almost 2.5 times. The trend of urbanization in India is exerting stress on civic authorities to provide basic requirement such as safe drinking water, sanitation, and infrastructure. The rapid growth of population has exerted the portable water demand, which requires exploration of raw water sources, developing treatment and distribution systems.

The raw water quality available in India varies significantly, resulting in modifications to the conventional water treatment scheme consisting of aeration, chemical coagulation, flocculation, sedimentation, filtration, and disinfection. The backwash water and sludge generation from water treatment plants are of environment concern in terms of disposal. Therefore, optimization of chemical dosing and filter runs carries importance to reduce the rejects from the water treatment plants. Also, there is a need to study the water treatment plants for their operational status and to explore the best feasible mechanism to ensure proper drinking water production with least possible rejects and its management. With this backdrop, the Central Pollution Control Board (CPCB), studied water treatment plants located across the country, for prevailing raw water quality, water treatment technologies, operational practices, chemical consumption and rejects management.

The method of treatment to be employed depends on the nature of raw water constituents and the desired standards of water quality as per IS: 10500 (2012). The traditional surface water sources are streams, rivers, tributaries, manmade and natural lakes, and canals.

Traditional ground water sources are dug well and bore wells. The seawater desalination and reuse of treated sewage (indirect potable use) are considered as prospective sources. The impurities in raw water can be classified as suspended solids, colloidal solids, and dissolved solids which may be harmful to humans. Impurities also can be classified as inorganic, organic, and microbial contaminants. For drinking water treatment to remove suspended or precipitated solids and contaminants, unit processes viz. coagulation, flocculation, clarification, filtration, and disinfection are a must. Recently, biological filtration (after conventional filtration) is also included to remove organics and Disinfection by Products (DBP). The degree of treatment shall be directly related to the quality of raw water including emergent contaminants and DBPs.

As mentioned earlier, Coagulation, Flocculation, Clarification/ precipitation, Filtration and Disinfection are the main unit operations and processes classified as Conventional Treatment. Normally these processes and units are employed to treat surface waters and ground water influenced by surface water. The surface water sources in India have predominantly inorganic suspended solids. However, in the lean flow season due to pollution by sewage, industrial wastewater, farm discharges organic suspended and colloidal impurities also occur in the raw water. Coloured water (due to Natural decay of vegetation) also contributes to organic load. Microbial contaminants viz., algae is also present in many polluted water in lean flow season. Jar tests with different coagulants and coagulant aid give a representative analysis of settleable floc formation. Maximum organic loading in terms of BOD and COD should be restricted to 5 mg/L and 10 mg/L respectively.

1. CHAPTER 1 : INTRODUCTION

BACKGROUND

Public Health Engineering Directorate has decided to set up a Surface Water Based Scheme for PINGLA, KHARAGPUR-II & PANSKURA-I BLOCK for PASCHIM & PURBA MEDINIPUR.

PINGLA BLOCK

Pingla is a community development block that forms an administrative division in the Kharagpur subdivision of Paschim Medinipur district in the Indian state of West Bengal.

Pingla CD Block is a flood-prone area affected by water logging leading to the loss of crops. In this block, 100% of the cultivated area has highly productive alluvial soil.

It is located 36 km from Midnapore, the district headquarters.

Pingla CD Block has an area of 228.844 km². It has 1 panchayat samity, 10 Gram Panchayats, 142 Gram Sansads (village councils), 182 Mouzas, and 175 inhabited villages. Pingla police station serves this block. The headquarters of this CD Block is at Pingla.

Gram panchayats of Pingla block/ panchayat samiti are: Kusumda, Jamna, Dhaneswarpur, Karkai, Maligram, Khirai, Gobardhanpur, Pindrui, Jalchak-I, Jalchak-II.

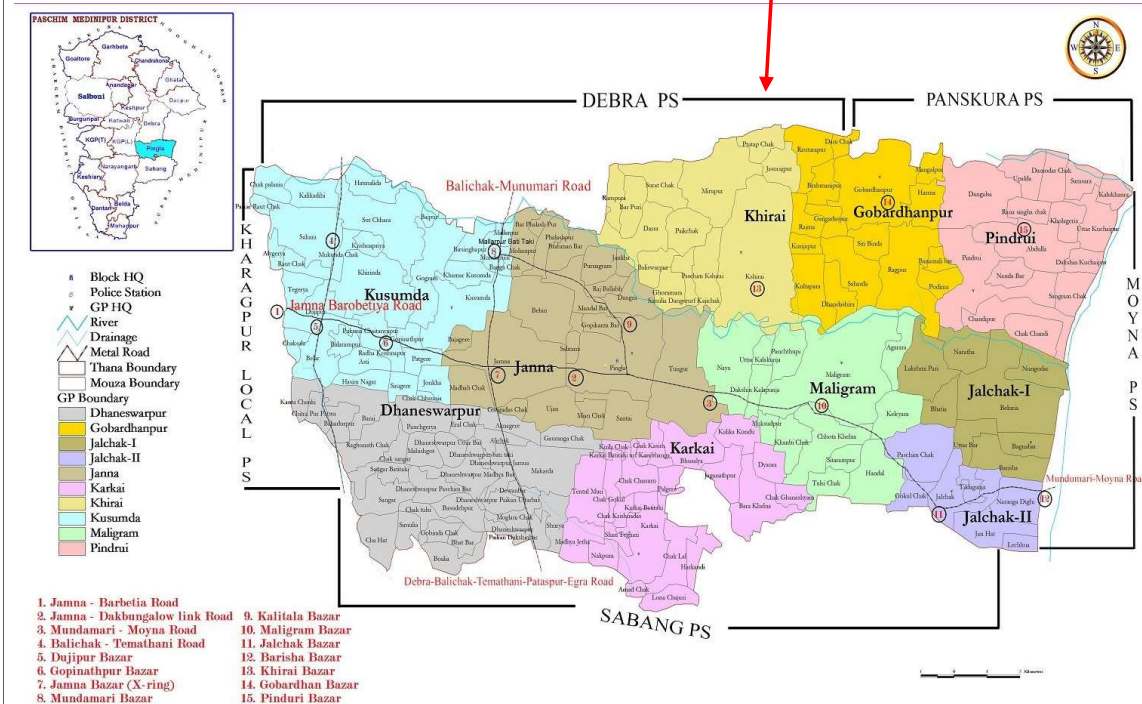
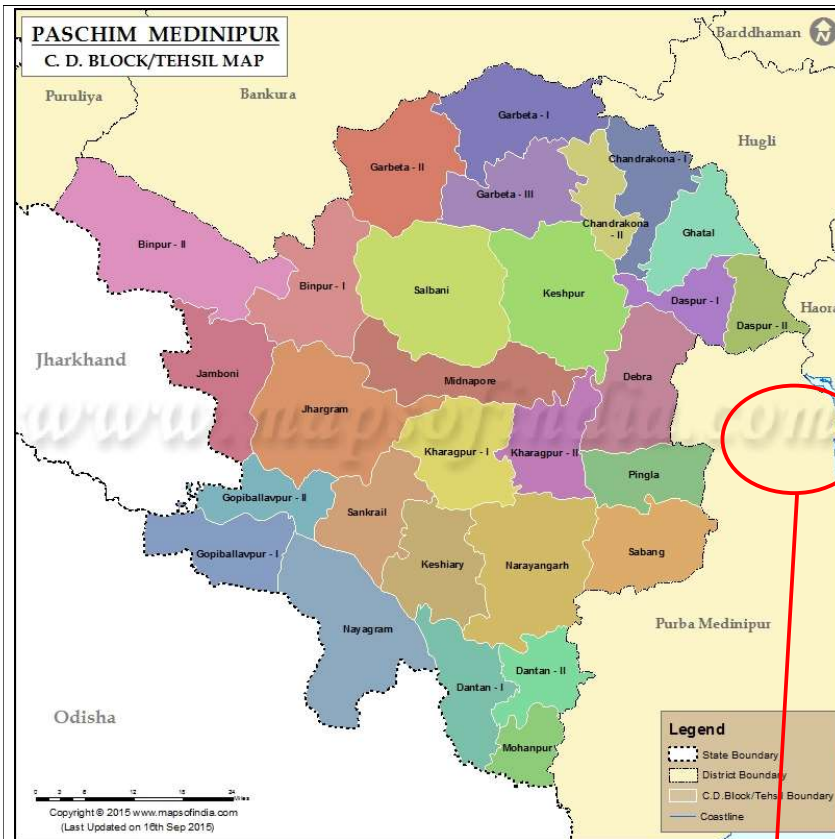
As per the 2011 Census of India Pingla, CD Block had a total population of 194,809, all of which were rural. There were 99,988 (51%) males and 94,821 (49%) females. The population below 6 years was 22,719. Scheduled Castes numbered 16,428 (8.43%) and Scheduled Tribes numbered 19,322 (9.92%).

As per the 2001 census, the Pingla block had a total population of 170,792, out of which 88,251 were males and 82,541 were females. Pingla block registered a population growth of 14.25 percent during the 1991-2001 decade. Decadal growth for the combined Midnapore district was 14.87 percent. Decadal growth in West Bengal was 17.45 percent. Large villages (with 4,000+ population) in Pingla CD Block are (2011 census figures in brackets): Pingla (5,253), Khirai (6,427), Maligram (11,337), Pindrui (4,384), Dangalsa (5,190) and Jalchak (6,793).

Other villages in Pingla CD Block are (2011 census figures in brackets): Gobardhanpur (3,665), Karkai (3,113), Dhaneswarpur Uttar Bar (539), Dhaneswarour Madhyam Bar (1,247), Dhaneswarpur Jamua (152), Dhaneswarour Paikan Uttar Bar (697), Dhaneswarpur Paikan Dakhin Bar (270), Dhaneswarpur Paschim Bar (1,852), Jamna (3,336) and Karkai (3,113).

As per the 2011 census, the total number of literates in Pingla CD Block was 143,882 (83.57% of the population over 6 years) out of which males numbered 79,657 (90.22% of the male population over 6 years) and females numbered 64,165 (76.57% of the female population over 6 years). The gender gap in literacy rates was 13.65%.





PANSKURA-I BLOCK

Panskura is a community development block that forms an administrative division in the Tamluk subdivision of Purba Medinipur district in the Indian state of West Bengal.

Purba Medinipur district is part of the lower Indo-Gangetic Plain and Eastern coastal plains. Topographically, the district can be divided into two parts – (a) almost entirely flat plains on the west, east, and north, and (b) the coastal plains on the south. The vast expanse of land is formed of alluvium and is composed of younger and coastal alluvial. The elevation of the district is 10 meters above the mean sea level. The district has a long coastline of 65.5 km along its southern and southeastern boundaries. Five coastal CD Blocks, namely, Khejuri II, Contai II (Deshapran), Contai I, Ramnagar I, and II, are occasionally affected by cyclones and tornadoes. Tidal floods are quite regular in these five CD Blocks. Normally floods occur in 21 of the 25 CD Blocks in the district. The major rivers are Haldi, Rupnarayan, Rasulpur, Bagui, and Keleghai, flowing in the north to south or south-east direction. River water is an important source of irrigation. The district has a low 899-hectare forest cover, which is 0.02% of its geographical area.

It is located 26 km from Tamluk, the district headquarters.

Panskura CD Block has an area of 251.209 km² (including Panskura municipality). It has 1 panchayat samity, 14 Gram panchayats, 208 Gram Sansads (village councils), 247 Mouzas, and 225 inhabited villages. Panskura police station serves this block. The block was earlier named Panskura I and in 2011 it was renamed Panskura. The headquarters of this CD Block is at Panskura.

Gram panchayats of Panskura block/ panchayat samiti are: Chaitanyapur I, Chaitanyapur II, Ghoshpur, Gobindanagar, Haur, Keshapat, Khandakhola, Mysora, Panskura I, Pratapur I, Pratapur II, Purusottampur, Radhaballavchak and Raghunathbari.

As per the 2011 Census of India, Panskura CD Block had a total population of 283,303, all of which were rural. There were 145,563 (51%) males and 137,740 (49%) females. The population below 6 years was 32,726. Scheduled Castes numbered 29,183 (10.30%) and Scheduled Tribes numbered 12,531 (4.42%).

As per the 2001 census, Panskura I block had a total population of 298,163, out of which 152,618 were males and 145,545 were females. Panskura I block registered a population growth of 15.62 percent during the 1991-2001 decade. Decadal growth for the combined Midnapore district was 14.87 percent. Decadal growth in West Bengal was 17.84 percent.

Large villages (with 4,000+ population) in Panskura CD Block (2011 census figures in brackets): Jiakhali (6,672), Kamila (4,369), Baharputa (4,660) and Radhaballav Chak (4,489).

As per the 2011 census, the total number of literates in Panskura CD Block was 209,614 (83.65% of the population over 6 years) out of which 116,589 (56%) were males and 93,025 (44%) were females. As per the 2011 census, literacy in the Purba Medinipur district was 87.02%. Purba Medinipur had the highest literacy amongst all the districts of West Bengal in 2011.





The entire Water Supply Project shall overall be under the Executive Engineer, Executive Engineer, Planning & Design Division IV, PHE Dte., Govt. of West Bengal, and the Superintending Engineer, Superintending Engineer, Planning Circle-II, PHE Dte., Govt. of West Bengal. The entire Mechanical and Electrical portion of the Project will be looked after by the Executive Engineer, South 24-Pgns. Mechanical Division, P.H.E. Dte., 33 & 33/1, Chetla Central Road, 3rd Floor, Kolkata- 700027 through their respective Sub-Divisions and the Superintending Engineer, Mechanical Circle-I, Phears Lane Comm. Complex, Kol- 12. The relevant offices may change if required.

CHAPTER 2 : AREA

2.1 LOCATION

PINGLA

Pingla is located at 22°16'19"N 87°35'08"E.

Pingla CD Block is bounded by Debra CD Block in the north, Panskura, and Moyna CD Blocks, in Purba Medinipur district, in the east, Sabang CD Block in the south, and Kharagpur II CD Block in the west.

PANSKURA-I

Panskura is located at 22°23'49"N 87°44'28"E.

Panskura CD Block is bounded by Daspur I CD Block, in Paschim Medinipur district, in the north, Kolaghat and Tamluk CD Blocks, in the east, Moyna CD Block in the south, and Debra and Pingla CD Blocks, in Paschim Medinipur district, in the west.

2.2 COMMUNICATION

PINGLA

Pingla CD Block has 24 originating/ terminating bus routes. The nearest railway station is 11 km from the CD Block headquarters.

PANSKURA-I

Panskura CD Block has 15 ferry services and 15 originating/ terminating bus routes.

Panskura railway station is on the Howrah-Kharagpur line. The Howrah-Kharagpur line was constructed in 1900. The Howrah-Kharagpur line was electrified in 1967-69.

The Dankuni-Kharagpur sector of NH 16 passes through this block.

CHAPTER 3 : COMMAND AREA OF THE SCHEME

This scheme includes the whole Pingla and Panskura-I block. There are 10 nos of Gram Panchayet in Pingla block and 14 nos of Gram Panchayet in Panskura-I block. The whole area covered under this scheme is 471.40 km², out of which 224.48 km² comes under Pingla Block and 246.92 km² comes under the Panskura-I block.

Again this Pingla and Panskura-I block is divided into zones so that a smooth distribution network can be formed at the time of designing the network. Pingla has been divided into 24 Zones and the Panskura-I block has been divided into 21 zones.

The command area comprises 411 nos. rural Mouzas and with 707 nos. Habitations in 24 nos. GPs with a total population of 4,78,112 according to the 2011 Census. Names of the 24 Gram Panchayats are given in Table-1:

Table - 1

Name of the Block	Name of the Gram Panchayat
Pingla	Kusumda, Jamna, Dhaneswarpur, Karkai, Maligram, Khirai, Gobardhanpur, Pindrui, Jalchak-I, Jalchak-II
Panskura-I	Chaitanyapur-I, Chaitanyapur-II, Ghoshpur, Gobindanagar, Haur, Keshapat, Khandakhola, Mysora, Panskura-I, Pratapur-I, Pratapur-II, Purusottampur, Radhaballavchak, Raghunathbari

In the above list, Panskura-I's water supply comes from the Municipality area.

The command area covers an area of 47140 Ha.

The Command area of the scheme comprising of above Mouzas has been shown in the index Map annexed with this DPR.

CHAPTER 4: JUSTIFICATION OF THE SCHEME

This project has been conceived as instructed by the Honorable Minister In-charge of the Public Health Engineering Department and the Department of Environment of Govt. of West Bengal, and further approved by the Principal Secretary, Public Health Engineering Department, Govt. of West Bengal.

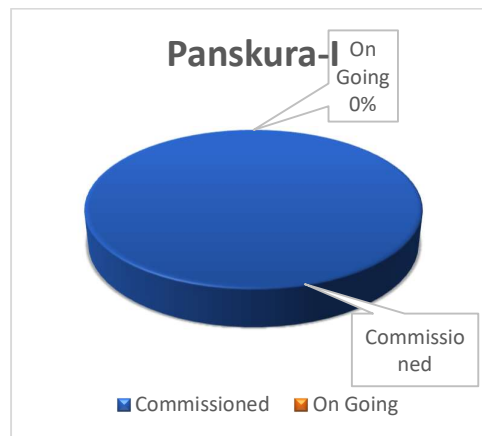
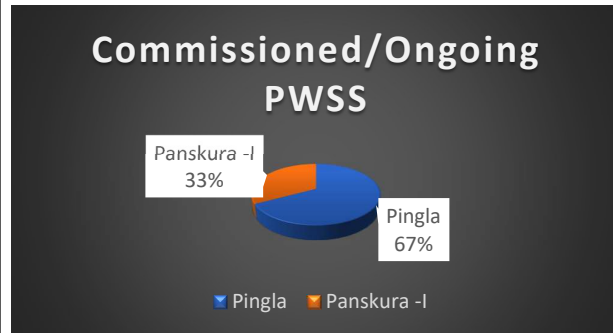
CHAPTER 5 : PRESET STATUS OF WATER SUPPLY WITHIN THE COMMAND AREA

5.1 Present status of PWSS

The present status of PWSS is given in the Table-2

Present Status of PWSS for the Entire Blocks -Table-2

Name of the Block	Nos. Commissioned PWSS	Nos. of On-going PWSS	Total	Remarks
Pingla	11 (97 Mouzas)	4 (26 Mouzas)	15 (123 Mouzas)	All PWSSs fall within the command area.
Panskura-I	8 (60 Mouzas)		8 (60 Mouzas)	All PWSSs fall within the command area.
Total	19 (157 Mouzas)	4 (26 Mouzas)	23 (183 Mouzas)	



CHAPTER 6 : POPULATION STUDY

The census population (2011) of the blocks and the proposed command areas have been indicated in **Table-3 & Table-4**.

The design population has been calculated, as per present norms, and projected up to the year 2052. The growth rates for computing the current population have been considered at the rate of 14.44% per decade for the Pingla block, 15.32% per decade for the Panskura-I block & 14.44% per decade for the Kharagpur block as per recent PHED guidelines. Accordingly, the ultimate population (2052) has been calculated as per JJM guideline which is 32% growth every 30 years.

Total Population of the Blocks (Table-3)

SI NO	Name of the Block	No. of Mouzas / CT	Area (Hectare)	Population (2011 Census)			Remarks
				Total	Considered in the proposed scheme	In %	
1	Pingla	182	22448	194809	194809	100	
2	Panskura-I	229	24692	283303	283303	100	
3	Kharagpur - II	353	26563	183440	183440	100	
	TOTAL	764	73703	661552	661552		

The population of the Proposed Command Area (Table-4)

SI NO	Name of the Block	No. of Mouzas / CT	Area (Hectare)	Population (2011 Census)			Remarks
				Total	SC	ST	
1	Pingla	182	22448	194809	16428	19332	Details of considered mouza are mentioned below
2	Panskura-I	229	24692	283303	19183	12531	
3	Kharagpur - II	353	26563	183440	34138	46899	
				661552	69749	78762	

Pingla Block Census Population 2011

SI No	Village Name	Code	JL No	Total Pop	SC Pop	ST Pop
1	Chak Palania	342539	1	0	0	0
2	Paikar Raut Chak	342540	2	327	9	113
3	Alygerya	342541	3	114	16	1
4	Sahara	342542	4	1872	302	637
5	Kalikadihi	342543	5	367	30	89
6	Hatmalida	342544	6	1031	124	278
7	Sut Chhara	342545	7	2468	729	671
8	Bajpur	342546	8	283	127	0

9	Gogram	342547	9	901	166	157
10	Khirinda	342548	10	2031	439	335
11	Krishnapriya	342549	11	237	0	80
12	Mukunda Chak	342550	12	82	24	21
13	Raut Chak	342551	13	534	65	339
14	Tegerya	342552	14	244	68	42
15	Dujipur	342553	15	915	137	128
16	Chaksala	342554	16	87	0	57
17	Belar	342555	17	1152	672	299
18	Kanta Chauki	342556	18	269	5	179
19	Chitra Pur Patwa	342557	19	464	75	267
20	Bahadurpur	342558	20	249	0	91
21	Barai	342559	21	634	87	227
22	Hasim Nagar	342560	22	404	71	67
23	Asti	342561	23	797	109	220
24	Balarampur	342562	24	290	278	12
25	Pukuria Chaitanyapur	342563	25	192	17	4
26	Radha Krishnapur	342564	26	410	48	11
27	Gopinathpur	342565	27	749	51	24
28	Patgere	342566	28	313	0	4
29	Saugere	342567	29	294	23	0
30	Chak Chhaunia	342568	30	31	0	29
31	Jonkha	342569	31	401	0	93
32	Madhab Chak	342570	32	752	86	212
33	Jamna	342571	33	3336	231	742
34	Bajagere	342572	34	415	0	65
35	Kusumda	342573	35	1836	175	566
36	Khamar Kusumda	342574	36	440	14	81
37	Mundamari	342575	37	869	233	162
38	Birsinghapur	342576	38	926	49	221
39	Banga Chak	342577	39	38	0	0

40	Mallarpur Bati Taki	342578	40	41	25	0
41	Mallarpur	342579	41	532	37	81
42	Mohanpur	342580	42	897	5	116
43	Bar Phalash Pur	342581	43	368	226	55
44	Phalashpur	342582	44	243	136	71
45	Brahman Bar	342583	45	548	4	303
46	Mandal Bar	342584	46	483	131	269
47	Belun	342585	47	1099	300	93
48	Dangra	342586	48	1547	246	295
49	Raj Ballabh	342587	49	819	89	67
50	Purnagram	342588	50	887	488	163
51	Jankha	342589	51	100	86	14
52	Darra	342590	52	1688	323	512
53	Rampura	342591	53	852	152	95
54	Bar Puri	342592	54	475	4	103
55	Surat Chak	342593	55	1289	67	23
56	Mirupur	342594	56	2309	164	418
57	Ptatap Chak	342595	57	647	14	63
58	Jasorajpur	342596	58	706	3	53
59	Rautarapur	342597	59	1425	118	50
60	Dani Chak	342598	60	259	11	0
61	Brahmanipur	342599	61	708	10	26
62	Gangadaspur	342600	62	546	0	1
63	Rajma	342601	63	604	19	3
64	Kunjapur	342602	64	299	5	11
65	Kultapara	342603	65	1452	14	35
66	Kshirai	342604	66	6427	119	539
67	Panchthupi	342605	67	1486	238	27
68	Dakshin Kalapunja	342606	68	564	46	20
69	Uttar Kalakunja	342607	69	395	0	0
70	Naya	342608	70	3960	20	498

71	<i>Paschim Kshirai</i>	342609	71	744	40	153
72	<i>Paikchak</i>	342610	72	540	12	117
73	<i>Baliswarpur</i>	342611	73	1102	96	118
74	<i>Ghoramara</i>	342612	74	1259	86	26
75	<i>Simulia Dangerurf Kajichak</i>	342613	75	151	0	0
76	<i>Tungur</i>	342614	76	2835	377	863
77	<i>Kalika Kundu</i>	342615	77	2669	70	20
78	<i>Bhusalya</i>	342616	78	650	3	30
79	<i>Palgere</i>	342617	79	720	31	45
80	<i>Chak Kasim</i>	342618	80	240	0	79
81	<i>Karkai Batitaki urf Karabhanga</i>	342619	81	99	29	24
82	<i>Santai</i>	342620	82	1067	13	179
83	<i>Pingla</i>	342621	83	5253	389	511
84	<i>Gopikanta Bar</i>	342622	84	434	0	0
85	<i>Salmarā</i>	342623	85	295	103	27
86	<i>Ujan</i>	342624	86	1415	40	478
87	<i>Mian Chak</i>	342625	87	315	0	0
88	<i>Gauranga Chak</i>	342626	88	714	72	94
89	<i>Aknagere</i>	342627	89	538	0	113
90	<i>Gangadas Chak</i>	342628	90	508	12	116
91	<i>Eral Chak</i>	342629	91	600	0	148
92	<i>Panchgerya</i>	342630	92	674	0	189
93	<i>Raghunath Chak</i>	342631	93	949	29	432
94	<i>Chak Sangar</i>	342632	94	0	0	0
95	<i>Mahishgot</i>	342633	95	402	30	54
96	<i>Dhaneshwarpur Uttar Bar</i>	342634	96	539	0	141
97	<i>Dhaneshwarpur Madhya Bar</i>	342635	97	1247	100	306
98	<i>Dhaneshwarpur Bati Taki</i>	342636	98	0	0	0
99	<i>Alichak</i>	342637	99	239	0	112
100	<i>Dhaneshwarpur Jamua</i>	342638	100	152	0	14
101	<i>Dhaneshwarpur Paikan Uttarbar</i>	342639	101	697	2	76

102	Dewanbar	342640	102	0	0	0
103	Moglan Chak	342641	103	726	23	144
104	Dhaneshwarpur Paikan Dakshinbar	342642	104	270	0	92
105	Dhaneshwarpur Paschim Bar	342643	106	1852	159	283
106	Sangar Batitaki	342644	107	348	33	169
107	Sangar	342645	108	749	149	192
108	Cha Hat	342646	109	954	258	393
109	Simulia	342647	110	40	29	11
110	Chak Tulsi	342648	111	0	0	0
111	Basudebpur	342649	112	701	180	63
112	Bhat Bar	342650	113	308	24	65
113	Gobinda Chak	342651	114	216	4	80
114	Boalia	342652	116	485	24	99
115	Shurya	342653	126	150	0	42
116	Makarda	342654	127	1282	51	182
117	Tentul Muri	342655	128	1091	62	151
118	Madhya Jetha	342656	129	764	34	11
119	Nakpura	342657	131	578	252	21
120	Shan Teghari	342658	132	219	0	15
121	Chak Gokul	342659	133	158	0	17
122	Kuila Chak	342660	134	362	0	6
123	Chak Chanuru	342661	135	39	0	0
124	Chak Krishnadas	342662	136	770	21	237
125	Karkai Batitaki	342663	137	346	36	28
126	Karkai	342664	138	3113	322	550
127	Amad Chak	342665	183	263	0	54
128	Lona Chajuri	342666	184	109	0	0
129	Chak Lal	342667	185	177	0	21
130	Harkandi	342668	186	629	45	18
131	Jaganathpur	342669	190	901	102	67

132	Bara Khelna	342670	191	1793	91	153
133	Chak Ghanashyam	342671	192	344	0	0
134	Tulsi Chak	342672	193	741	0	0
135	Sitarampur	342673	194	557	4	5
136	Chhota Khelna	342674	195	2229	107	224
137	Khanbi Chak	342675	196	766	59	6
138	Dyaora	342676	197	620	5	49
139	Muksudpur	342677	198	307	0	0
140	Maligram	342678	199	11337	428	253
141	Dhandashira	342679	200	844	43	0
142	Saharda	342680	201	1966	86	0
143	Siti Binda	342681	202	843	14	0
144	Ragpur	342682	203	3041	275	5
145	Gobardhanpur	342683	204	3665	126	308
146	Mangalpur	342684	205	363	38	14
147	Harma	342685	206	1275	228	0
148	Banamali Bar	342686	207	0	0	0
149	Podima	342687	208	1122	66	56
150	Pindrui	342688	209	4384	801	54
151	Nanda Bar	342689	210	722	116	0
152	Abdulla	342690	211	1568	2	15
153	Dangalsa	342691	212	5190	77	4
154	Rana Singha Chak	342692	213	0	0	0
155	Upalda	342693	214	1061	46	0
156	Damodar Chak	342694	215	763	43	0
157	Kholageria	342695	216	616	0	0
158	Samsara	342696	217	1019	41	0
159	Kalukhanra	342697	218	849	77	0
160	Uttar Kuchaipur	342698	219	694	0	0
161	Dakshin Kuchaipur	342699	220	413	0	0
162	Sangram Chak	342700	221	619	0	14

163	Chandipur	342701	222	1869	29	0
164	Chak Chandi	342702	223	1561	533	0
165	Nungodar	342703	224	1658	16	0
166	Beluria	342704	225	3689	52	0
167	Naratha	342705	226	1284	3	0
168	Lakshmi Pari	342706	227	1856	149	13
169	Agarara	342707	228	918	10	0
170	Keleyara	342708	229	1910	358	81
171	Bhatia	342709	230	797	14	0
172	Uttar Bar	342710	231	1069	269	0
173	Baguabar	342711	232	845	106	0
174	Barisha	342712	233	3302	20	8
175	Naranga Dighi	342713	234	3406	7	0
176	Tildaganja	342714	235	994	29	0
177	Jalchak	342715	236	6793	129	0
178	Paschim Chak	342716	237	2198	889	46
179	Handal	342717	238	2072	68	0
180	Gokul Chak	342718	250	1153	8	20
181	Jan Hat	342719	255	2335	64	0
182	Lechhua	342720	256	333	0	0
				194809	16428	19332

Panskura-I Block Census Population 2011

Sl No	Village Name	Code	JL No	Total Pop	SC Pop	ST Pop
1	Radhaballavpur	344120	1	782	751	0
2	Bikra Chandangerya	344121	2	775	474	0
3	Gopalhazra	344122	3	818	799	0
4	Balarampur	344123	4	910	874	13
5	Mugdawri	344124	5	166	0	3
6	Shyamsundarpur	344125	6	3259	146	679
7	Maishora	344126	7	2073	70	298

8	Purbba Gurtala	344127	8	516	10	80
9	Paschim Gurtala	344128	9	435	72	129
10	Kishorpur	344129	10	487	121	6
11	Parlanka	344130	11	805	0	235
12	Shyampur	344131	12	924	5	110
13	Mahapur	344132	13	623	8	34
14	Nachhipur	344133	14	203	17	59
15	Gobinda Nagar	344134	15	3525	356	73
16	Jagatpur	344135	16	1184	187	47
17	Rajsahar	344136	17	1026	42	256
18	Mohanpur	344137	18	958	188	109
19	Fakirbazar	344138	19	490	14	113
20	Brindabanpur	344139	20	575	96	0
21	Paschim Bakulda	344140	21	2114	859	362
22	Dharenda	344141	22	1552	108	309
23	Patanda	344142	23	2189	291	85
24	Manglai Shyamballavpur	344143	24	1713	289	97
25	Brinchibar Chak Paschimi Itra	344144	25	920	305	53
26	Teghari	344145	26	595	496	0
27	Sahalajpur	344146	27	1194	1,088	0
28	Chak Gopal	344147	28	1309	1,248	0
29	Jashara	344148	29	418	415	0
30	Purbba Bakulda	344149	30	3531	91	0
31	SANTRABASAN	344150	31	0	0	0
32	Baruipur	344151	32	220	0	0
33	Uttar Maynadal	344152	33	264	0	9
34	Pakuria	344153	34	372	0	0
35	Talitya	344154	35	999	31	0
36	Nachhipur	344155	36	837	126	0
37	Kenduata	344156	37	838	0	8
38	Malida	344157	38	1960	282	1

39	Harinarayanpur	344158	39	688	481	0
40	Jiakhali	344159	40	6672	1,323	25
41	Uttar Panchberya	344160	42	907	279	0
42	Keshapat	344161	50	2000	475	33
43	Hatisal	344162	51	1980	8	41
44	Dakshin Maynadal	344163	52	1024	3	137
45	Gopimohanpur	344164	53	1634	75	233
46	Dakshin Barhat	344165	54	1304	73	21
47	Dalpara	344166	55	1306	85	82
48	Uttar Gopalpur	344167	56	425	53	0
49	Jogibar	344168	57	309	0	0
50	Akhuar	344169	58	348	0	0
51	Palsa	344170	59	1239	7	19
52	Simulhanda	344171	60	2282	25	0
53	Shanktikri	344172	61	722	20	0
54	Baju	344173	62	295	0	7
55	Laskardighi	344174	63	1834	171	125
56	Uttar Palsa	344175	64	320	0	14
57	Janabar	344176	65	675	0	168
58	Mahatpur	344177	66	2491	102	59
59	Uttar Mechgram	344178	67	3072	548	412
60	Purbba Gopalpur	344179	68	1110	3	138
61	Purbba Pitpur	344180	69	2355	4	161
62	Dakshin Mechgram	344181	74	2832	69	81
63	Dokanda	344182	89	1267	42	16
64	Serhati	344183	90	383	33	3
65	Bakharabaj	344184	91	523	0	7
66	Meghadangar	344185	92	434	107	19
67	Gajna	344186	93	545	2	56
68	Gotpota	344187	94	1540	272	0
69	Dakshin Katal	344188	95	855	6	0

70	Uttar Katal	344189	96	892	44	77
71	Joykrishnapur	344190	97	2765	23	14
72	Nekra Paschim	344191	98	2014	207	5
73	Dharmmapur	344192	99	554	108	0
74	Raniara	344193	100	1500	9	125
75	Kaya	344194	101	1013	44	42
76	Dhananjoypur	344195	102	857	107	28
77	Bipulhanda	344196	103	595	0	4
78	Nawapara	344197	104	794	90	30
79	Manur	344198	105	1928	182	347
80	Belda	344199	106	367	0	1
81	Sanita	344200	107	437	0	159
82	Golahat	344201	108	481	143	46
83	Chiara	344202	109	631	48	103
84	Rajnagar	344203	110	1565	205	276
85	Anupganj	344204	111	609	16	115
86	Debhog	344205	112	427	0	28
87	Tilagere	344206	113	515	0	227
88	Gobindapur	344207	114	560	80	159
89	Bijawarpur	344208	115	1061	4	216
90	Alalpara	344209	116	518	0	180
91	Banamalipur	344210	117	874	198	174
92	Manoharganj	344211	118	485	0	161
93	Benagalisa	344212	119	632	1	271
94	Ratulua	344213	120	793	0	326
95	Paschim Arjjunda	344214	121	532	0	205
96	Ratulua Dalbar	344215	122	1228	4	72
97	Paltaberya	344216	123	360	11	0
98	Mangalduari	344217	124	1283	73	0
99	Lal Chak	344218	125	609	605	0
100	Medinipur Ratudya	344219	126	1433	168	69

101	Nayabasan	344220	127	623	0	0
102	Masimabad	344221	128	1165	0	0
103	MUKTAGHATA	344222	129	0	0	0
104	DAYARAM CHAK	344223	130	0	0	0
105	Gopinathchak	344224	131	58	0	0
106	Erapur Shiromani Chak	344225	132	1186	65	34
107	ERAPUR	344226	133	0	0	0
108	Aror	344227	134	1366	288	69
109	Rajhati	344228	135	904	108	184
110	Kenduara	344229	136	1044	35	232
111	Krishnanagar	344230	137	388	91	157
112	Chhyarasia	344231	138	664	52	360
113	Ghoshpur	344232	139	669	6	43
114	Arangabar	344233	140	359	0	16
115	Kharu Radhanagar	344234	141	2048	106	557
116	Raisanda	344235	142	544	34	66
117	Purul	344236	143	2126	254	374
118	Haur	344237	144	2701	144	348
119	Sarifabad	344238	145	1433	192	41
120	Alugram Barada	344239	146	1034	253	198
121	Alugram	344240	147	544	8	145
122	Hariharpur	344241	148	564	207	79
123	Saranbar	344242	149	875	0	12
124	Chhenyagar	344243	150	746	0	0
125	Pulshita	344244	151	1093	15	4
126	Harashankarpur	344245	152	1198	0	39
127	Kalidan	344246	153	2244	62	82
128	Gobindapur	344247	154	353	0	0
129	Jardai	344248	155	1241	0	0
130	Paramhansapur	344249	156	477	282	0
131	Gholamdan	344250	157	464	0	17

132	Amdan	344251	158	2324	279	155
133	Dhamat	344252	159	416	0	41
134	Kulia	344253	160	1097	0	140
135	Dashang	344254	161	786	0	132
136	Atang	344255	162	687	13	65
137	Gobinda Chak	344256	163	492	0	12
138	Tikarpara	344257	164	530	0	0
139	Usatpur	344258	165	526	25	9
140	Saharda	344259	166	426	0	0
141	Markandapur	344260	167	164	10	0
142	Kunarpur	344261	168	352	0	0
143	Jagannath Chak	344262	169	1262	693	52
144	Narui Ramchandrapur	344263	170	655	11	2
145	Naruigopinath Chak	344264	171	143	0	0
146	Dumdan	344265	172	768	0	0
147	Dhalshwar	344266	173	394	47	0
148	Nilmaniram Chak	344267	174	931	0	0
149	Nilichhaku Chak	344268	175	902	0	0
150	Fate Chak	344269	176	832	824	0
151	Uryagar	344270	177	737	613	0
152	Paobanki	344271	178	974	536	2
153	Sahanagar	344272	179	518	20	0
154	Ramgar	344273	180	1059	0	0
155	Saraighata	344274	181	674	328	0
156	Bijayram Chak	344275	182	2625	0	0
157	Harirampur	344276	183	1377	107	0
158	Gurya	344277	184	440	86	0
159	Radhaban	344278	185	1893	579	0
160	Chaulyakuri	344279	186	280	56	0
161	Chaitanpur	344280	187	916	0	0
162	Dakshin Arjjunda	344281	188	572	0	4

163	Chak Radhaban	344282	189	598	0	0
164	Kalai	344283	190	1532	0	0
165	Mohanpur	344284	191	2043	0	0
166	Bijaynagar	344285	192	1172	34	14
167	Paramananda Chak	344286	193	741	113	0
168	Gholmaguri	344287	194	1996	40	0
169	Kenasi Brindaban Chak	344288	195	707	7	0
170	Maguri Jagannath Chak	344289	196	2288	9	4
171	Kismat Jagannath Chak	344290	197	1736	0	0
172	Harinarayan Chak	344291	198	1512	0	0
173	Mahishdol	344292	199	2439	562	0
174	Udaypur	344293	200	2442	39	0
175	Kalandipur	344294	205	1141	123	40
176	Kedarpur	344295	206	613	148	0
177	Uttar Chanchiara	344296	208	1197	2	0
178	Dakshin Chan Chiara	344297	209	2135	21	49
179	Basantabar	344298	210	748	0	0
180	Amdubi	344299	211	565	57	5
181	Suarasatya	344300	212	1838	68	68
182	Kamila	344301	213	4369	296	0
183	Raghubir Chak	344302	214	847	0	0
184	Dhuliapur	344303	215	2036	13	38
185	Murail	344304	216	1849	0	0
186	Baharputa	344305	319	4660	84	0
187	Bar Baharpota	344306	320	1156	23	0
188	Chanupur	344307	321	1713	1	0
189	Ukharapara	344308	322	621	0	0
190	Chakdaha	344309	323	3791	60	0
191	Purbba Itara	344310	324	1844	30	0
192	Purbba Shuktia	344311	325	1244	29	0
193	Kunarara	344312	326	1086	6	3

194	Khandakhola	344313	327	2720	120	5
195	Gogras Keshab Bar	344314	328	2007	60	0
196	Gogras Kottaluk	344315	329	1714	170	0
197	Beraberia	344316	330	1600	161	31
198	Purushottampur	344317	331	2371	112	18
199	Fakirganja	344318	332	1270	294	3
200	Raghunathbari	344319	333	2091	328	5
201	Khasharban	344320	334	2049	84	0
202	Sundarnagar	344321	335	3165	914	50
203	Atberia	344322	336	1919	186	42
204	Hanrijhama	344323	338	1654	25	0
205	Amraghoal	344324	339	3168	0	0
206	Indulia	344325	340	626	0	0
207	Isahakpur	344326	341	1410	0	0
208	Raybandh	344327	342	2226	469	0
209	Kenasi Brindaban Chak	344328	343	1733	0	0
210	Maguri Uttarsai	344329	344	1020	0	0
211	Sitarampur	344330	345	443	0	0
212	Gaurangapur	344331	346	1020	0	0
213	Chandipur	344332	347	687	282	0
214	Radha Krishnapur	344333	348	2684	0	0
215	Chaugere	344334	349	403	0	0
216	Dabuapukur	344335	350	1472	42	0
217	Dayal Chak	344336	351	683	15	0
218	Mahammad Murad	344337	352	889	0	0
219	Chakgogras	344338	353	169	0	0
220	Baidbar	344339	354	1606	1	0
221	Mahadol Rupchak	344340	355	764	0	0
222	Radhaballav Chak	344341	356	4489	86	0
223	Jayram Chak	344342	357	1850	225	0
224	Shrirampur	344343	358	1325	230	0

225	Paschim Chilka	344344	359	2745	120	0
226	Purbba Chilka	344345	360	2713	169	0
227	Sadhuapota	344346	361	3437	92	0
228	Kalagechhe	344347	362	2385	0	0
229	Rajnarayan Chak	344348	363	1032	309	0
				283303	29183	12531

SC (10.54%) & ST (11.90%) population comes to 22.44%.

CHAPTER 7 : WATER DEMAND

Water demand has been calculated as per the latest JJM guideline considering every Rural House/Premises shall be covered under house connections. PHED, West Bengal decided for providing 100% house connections through PWSS in rural areas with a per capita supply rate of 55 Lpcd net based on the JJM guideline.

Institutional and other demands have been considered as 5% of the domestic need as per the NRDWP guideline.

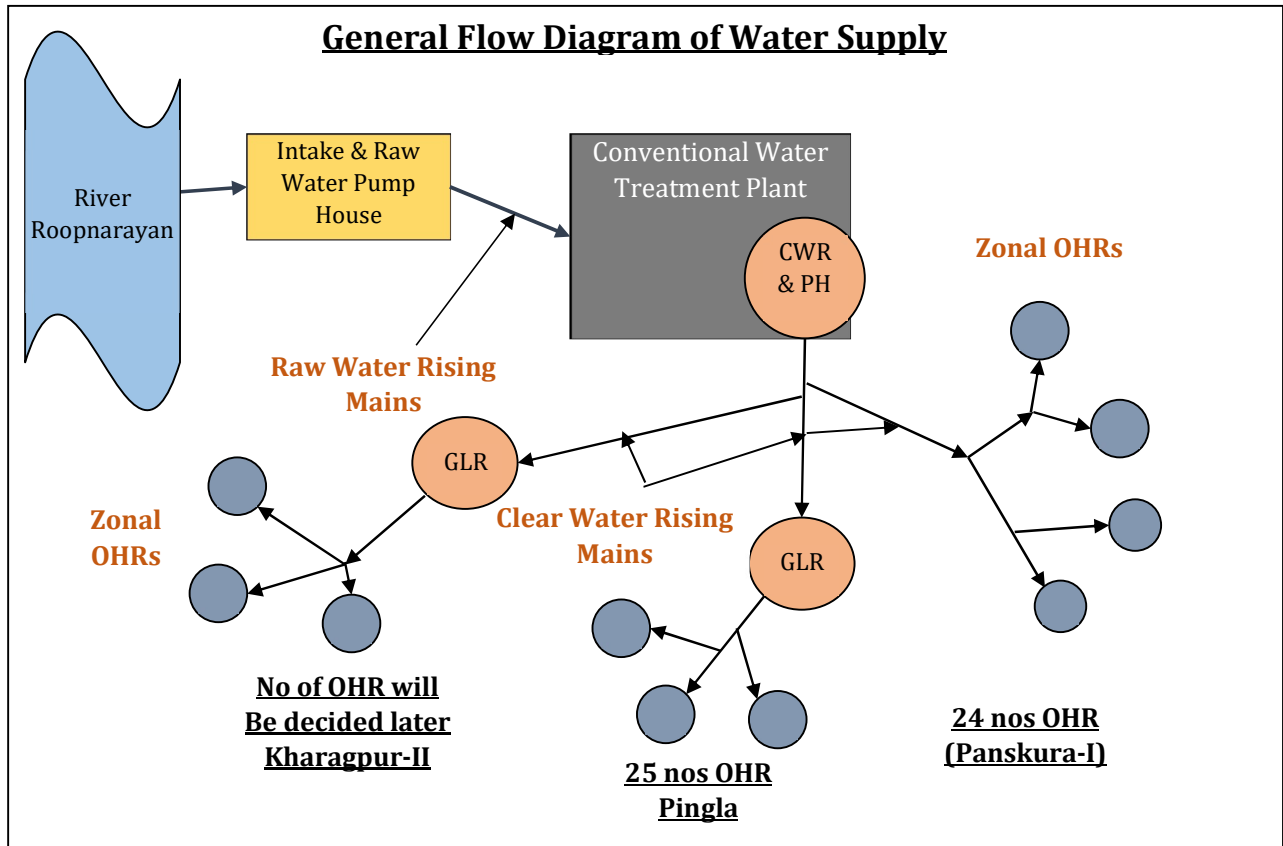
The rate of losses of water in the Treatment process has been considered to be 5%, whereas losses during transmission have been taken as 10% as per CPHEEO Manual. The following table represents the quantity of water required for Net Water demand, Clear Water demand after treatment, and Raw Water demand at Intake.

1. Population 2011	: 661552
2. population 2022	: 769375
3. population 2052	: 1015576
4. Domestic demand @55 lpcd Design in kLD	: 55857
5. Institutional /Industrial demand @5% of domestic demand in kLD	: 2793
6. Net Water Demand in kLD [(4)+(5)]	: 58649
	Or 12.92 MGD
7. Distribution loss @10% of net demand in kLD [(6)/9]	: 6517
8. Clear Water Demand in kLD [(6)+(7)]	: 65166
	Or 14.35 MGD
9. Rising Main Transmission loss @2% of domestic demand in kLD:	1330
10. Clear Water Demand in kLD [(8)+(9)]	: 66496
	Or. 14.65 MGD
11. Treatment plant loss @5% of clear water demand in kLD	: 3326
12. Raw Water Demand [(10)+(11)]	: 69821 KLD
	SAY : 70000 KLD
Raw Water Demand [(10)+(11)]	: 70.00 MLD
	or 15.40 MGD

A graphical representation is also furnished aside showing water demands at different stages at different points of time.

4. CHAPTER 8 : PROJECT COMPONENTS

The project proposal has been framed in the light of using surface water to supply safe water to the blocks after adequate treatment in a good designed conventional water treatment plant. The gross water demand is 70 MLD and the scheme covers a large area. Therefore, considering techno-economical aspects it is necessary to divide the project area into suitable nos. of zones. Each zone shall have adequate storage capacity to balance supply and demand and a well-designed distribution network for providing house connections considering 55 lpcd of treated water.



8.1 Intake System:

Raw Water R.C.C Intake Well Pumping Station on the Hooghly River near existing Intake at Dongaria including connecting approach bridge from the river bank.

1. 33 KV Electrical Sub-Station Building including Switch Yard.
2. All electrical and mechanical works for Pump House, Sub-Station, Switch Yard, Approach Bridge etc., including V.T. Pump, Motor, Transformer, Illumination etc. complete for intake system.

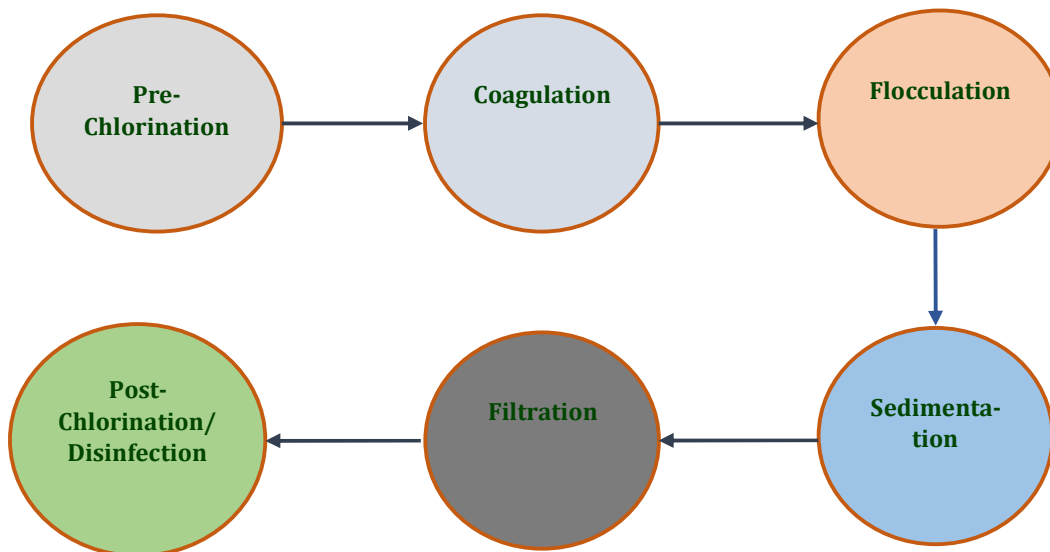
8.2 Raw Water Conveyance system:

1. Laying of techno economically most feasible raw water twin delivery mains for transportation of water from the intake to the treatment plant at Laskardighi Mouza JL. No. 63 of Panskura-I block (22.41469163° N, 87.70564471° E) through the proposed route of a total of 20 KM as per our survey drawing.
2. Structures for a crossing of drains, roads, etc. thrust blocks valves, valve chambers, etc.

8.3 Water Treatment Plant {WTP}:

1. Inlet stilling well, raw water measuring open channel with Parshall Flume, Flash mixer, Chemical House, Clariflocculator, Filter house, Connecting pipes and Channels, Clear Water Reservoir (CWR), Clear water pump house, Overhead backwash tank, sludge handling system with the provision of sludge pump house-cum-sump, sub-station yard & building, Filter House Annex Building with Air Blower, laboratory, SCADA and C.C TV room, etc.
2. Internal roads, sewerage, drainage system along with peripheral drains of treatment plant complex with culverts etc. including necessary land development works within the Water Treatment Plant compound.
3. Staff quarter, boundary wall with gates, guard room etc.
4. All electrical and mechanical works for the treatment plant complex including pump, motor, transformer, sub-station switchyard, compound illumination, internal wiring, external cable laying, permanent electrification works, etc. all complete.
5. Instrumentation and control devices for the operation of the water treatment plant from the Control room.

8.4 Clear Water Transmission and Distribution:



1. For facilitating the distribution of water from the CWR, the entire command area has been divided into 45 Service Sectors having 48 individual Overhead reservoirs.
2. The treated filtered disinfected water from Clear Water Reservoir will be transmitted to 48 Nos. Overhead Reservoir through a network of pipelines to be termed as Primary Grid
3. Water from Ground Level Reservoir in the pingla block (01 Nos) will be pumped through another network of pipelines, to be termed as a secondary grid to the required nos of Elevated Service Reservoirs in the block. The secondary grid will be separate and independent in this Block.
4. Valves and appurtenances for both primary and secondary grids.
5. Water distribution lines to the community
6. Domestic and bulk meters.
7. Electro-mechanical works at GLR pump-houses at pingla block.

8.5 Land for Construction:

WBPHE Dte. has confirmed that the land for the Water Treatment Plant, GLRs, OHRs and Right of Way as required for laying of rising mains & distribution networks will be provided by them. The land for the Water Treatment Plant is available at Laskardighi Mouza JL. No. 63 of Panskura-I block (22.41469163° N, 87.70564471° E). The location of the WTP is marked in the base Map enclosed with the report. Further, land required for OHR of distribution network and GLR has been proposed and needs to be acquired by WBPHE Dte.

8.6 General

The major components of the project are;

- I. Intake Pump House with Fixed type Jetty with pumping machinery arrangement for the housing of MS Raw Water suction pipe
- II. River Bank protection work.
- III. Carriageway to connect the Intake Jetty with the bank of the river.
- IV. Electrical Sub-station for Raw water pumping machinery.
- V. DI Raw Water Main (MS pipes for bends).
- VI. Conventional Water Treatment Plant (WTP) with Administrative Building, Laboratory Building, Staff Quarters, Guard Rooms, Internal Roads, and Pathways. Electrical Sub-station with all Electrical/Mechanical works.
- VII. Clear Water Reservoir (CWR).
- VIII. Clear Water Pumping Station and Pumping Machineries.
- IX. Clear Water Mains.
- X. Boosting Stations (at Pingla).
- XI. Overhead Backwash Water Reservoir.
- XII. Zonal Overhead Reservoirs (including existing OHRs) including the Electrification of Headworks.
- XIII. Land development, Boundary walls at the zonal head works sites (including repair & renovation of existing units), and Arboriculture.
- XIV. Distribution Network with the provision of House Connections (including remodelling of existing distribution networks).
- XV. All other Electrical -Mechanical - Instrumentation works.
- XVI. SCADA
- XVII. SOLAR Power for Campus lighting.

It is also proposed for second stage chlorination/disinfection at zonal OHR points before supply to the community.

8.7 Operational hours

The supply of water will be for 8 hours a day through OHR. The hours of raw water pumping and treatment have been considered taking into account the factors of disruption, failures, and maintenance and also the availability of power supply. Pumping hours for clear water transmission lines and distribution networks have been selected in consideration of water requirements and local habits.

Daily Operational hours for the proposed water supply scheme are given below;

Raw Water pumping	-	20 hours
Clearwater pumping	-	20 hours
Distribution	-	8 hours
Other limits of the treatment plant - 20 hours		

8.8 Zoning

Considering the command area of the existing schemes, existing OHRs, and existing available land H/W sites, the project command area of the proposed scheme is divided into 45 Zones. Some of the existing OHRs with/without additional new reservoirs to meet up the demand of respective zones have been considered under the project. Few H/W sites from where water is now being supplied by direct pumping will be utilized for the construction of new OHRs under this project. Also, new H/W sites have been considered for areas where there is no PWSS at present.

Chapter 9 : WTP PROCESS DESIGN (UNIT SIZE CALCULATION)

UNIT SIZES OF 70 MLD CAPACITY IN 20 HRS./DAY,i.e,3500 m³/hr,INPUT CAPACITY WATER TREATMENT PLANT FOR PANSKURA ,PINGLA & KGP-II PROJECTS.

UNIT SIZE CALCULATION OF WTP :-

OPERATION PERIOD	20.000	hrs
	70.000	mld
	70000.000	m ³ /day
RAW WATER FLOW FROM INTAKE TO WTP	3500.000	m ³ /hr
	0.972	m ³ /sec
CLEAR WATER DISCHARGE FROM WTP TO SUPPLY, CONSIDERING 5% TREATMENT LOSS	66.5	mld
	66500	m ³ /day
	2770.833333	m ³ /hr
	0.769675926	m ³ /sec

REMARKS

INLET CHAMBER

Number of unit	1.000	
Design Discharge	0.972	m ³ /sec
Detention Time	60.000	sec
Volume required	58.333	m ³
Diameter provided	3.700	m
Required SWD	5.425	m
Provided SWD	5.500	m
volume available	59.137	m ³
Free board provided	0.500	m

U/S RAW WATER CHANNEL

Number of unit	1.000	
Design Discharge	0.972	m ³ /sec
Width of channel	2.000	m
Maximum SWD provided	0.830	m
Maximum Velocity	0.586	m/sec
Average Velocity	0.586	m/sec
A= AV. Cross aectional aera	1.660	m ²
P= Wetted perimeter	3.660	m
R= Hydraulic Mean Radius=A/P	0.454	m
n=Manning's Coefficient of Roughness	0.015	
S=Hydraulic Gradient	0.0002214767	
Length	6.000	m
Friction Head Loss	0.001	m
Provide Head Loss	0.000	m
Free board provided	0.500	M

PARSHALL FLUME (IS: 14371-19961)

Number of unit	1.000		
Design Discharge(Q_{max})	0.972	m^3/sec	
Throat Width of Flume	0.900	m	
Allowable Q_{max}	1.250	m^3/sec	
Allowable Q_{min}	0.030	m^3/sec	
C_D	0.372		
n	1.565		as per IS 14371:199 6, cl- 8.5.1
ha- head over flume	0.603	m	as per IS 14371:199 6, cl- 8.5.1
Head loss (Considered 30% as per Manufacturer's specification)	0.181	m	
Provide Head loss		m	
Froude Number	0.241		
l	0.600		
X	0.050		
Y	0.075		
hp_1	0.230		
hp_2	0.072		
hp_1-hp_2	0.158		
b_1	1.560		
l_1	1.650		
lc	1.683		
la	1.121		
l_2	0.920		
l_0	3.170		

D/S RAW WATER CHANNEL

Number of unit	1.000	
Design Discharge	0.972	m^3/sec
Width of channel	2.000	m
Provide a Drop of Base	0.150	
Maximum SWD provided	0.830	m
Minimum SWD provided	0.830	m
Average SWD provided	0.830	m
Maximum Velocity	0.586	m/sec
Minimum Velocity	0.586	m/sec
Average Velocity	0.586	m/sec
$A= AV$. Cross sectional area	1.660	m^2
$P=$ Wetted perimeter	3.660	m
$R=$ Hydraulic Mean Radius= A/P	0.454	m
$n=$ Manning's Coefficient of Roughness	0.015	
$S=$ Hydraulic Gradient	0.0002214767	
Length	3.000	m
Friction Head Loss	0.001	m
Provide Head Loss	0.000	m
Free board provided	0.500	m

FLASH MIXER INLET CHANNEL OR GATE

Number of unit	4.000	
Design Discharge	0.243	m ³ /sec
Width of Gate	1.000	m
Height of Gate	1.700	m
Velocity through Gate	0.143	m/sec
Entry Loss	0.001	m
Exit Loss	0.001	m
Total Head Loss	0.002	m
Provide Head Loss	0.075	m

FLASH MIXER

Number of unit	4.000	
Design Discharge	0.243	m ³ /sec
Detention Time	60.000	sec
Volume required	14.583	m ³
Length of tank	1.700	m
Width of tank	1.700	m
Side Water Depth	5.100	m
Volume Provided	14.739	m ³
Free Board	0.500	m

AGITATOR FOR FLASH MIXER

Width of tank	1.700	m	
Length of tank	1.700	m	
Side Water Depth	5.100	m	
Volume of Tank	14.739	m ³	
Di = Provide Diameter of Impeller	0.600		
Ratio of Impeller Diameter to Tank Size	0.353	: 1	
N=Impeller RPM	100.000		
V_p =Tangential Velocity of Blade at Tip= $\frac{\pi}{60} \times d_i \times N$	3.142	m/sec	range: >3m/s CPHEEO manual,p- 206
G=Velocity Gradient	350.000	sec ⁻¹	range: 300 to 900 IS:7090- 1985 & CPHEEO manual,p- 206
μ =Absolute viscosity of Water at 20°C	0.001	N.sec/m ²	
Power Input to Water= $P=\mu G^2 V$	1823.583	Watts	
Efficiency of Reduction Gear Box due to Frictional & Transmission Loss	80.000	%	
Power Required at Gear Box Input Shaft	2279.478	Watts	
Power Required per unit volume in watts/m ³ /hr	2.084		range: 1to 3 watts/m ³ /hr

CPHEEO
 manual,p-
 206 &
 table-
 7.1,page-
 207.

BLADE AREA FOR FLASH MIXER

C_D = Newtons coefficient of Drag

1.800

range: 0.8-
 1.9
 CPHEEO
 manual,p-
 213

Power Input to Water= $P=0.5 \cdot C_D \cdot A_p \cdot \rho \cdot V_r^3$

1823.583

Watts

ρ =density of water

1000.000

Kg/m³

V_r =Relative Velocity of Blade= $0.75 \cdot V_p$

2.356

A_p =Total area of Blade

0.155

m²

GEAR BOX FOR FLASH MIXER

Torque = Power in KW X 9550/RPM

217.690

Nm

MOTOR FOR FLASH MIXER

Power input to Water

1823.583

Watts

Efficiency of Reduction Gear Box

80.000

%

Power Required at Gear Box Input Shaft

2279.478

Watts

FLASH MIXER OUTLET GATE

Number of unit

4.000

Design Discharge

0.243

m³/sec

Width of Gate

1.000

m

Height of Gate

1.700

m

Velocity through Gate

0.143

m/sec

Entry Loss

0.001

m

Exit Loss

0.001

m

Total Head Loss

0.002

m

Provide Head Loss

0.050

m

STAND WELL

Number of unit

4.000

nos

dia provided

1.500

m

length provided

5.500

m

INFLUENT PIPE

Number of unit

4.000

nos

Design Discharge

875.000

m³/hr

diameter provided

0.600

m

velocity

0.860

m/sec

checking status

PASS

FLOCULATOR CENTRAL SHAFT

Number of unit	4.000	nos
Design Discharge	875.000	m ³ /hr
dia of central shaft provided(ID)	0.700	m
dia of cable pipe provided	0.080	m
velocity	0.632	m/sec
CENTRAL SHAFT SLOTS		
number of slots	4.000	nos
Design Discharge	0.061	m ³ /s
slot width provided	0.250	m
slot hight provided	0.600	m
velocity through slot	0.405	m/s
checking status	Pass	
FLOCCULATION ZONE		
number of slots	4.000	nos
Design Discharge	0.243	m ³ /s
	875.000	m ³ /h
detention period	30.000	min
voluime required	437.500	m ³
inner diameter provided	13.000	m
SWD provided	3.400	m
voluime provided	451.061	m ³
checking status	Pass	
CALCULATION FOR FLOCULATOR		
number of flocculator provided	4.000	
volume of flocculation zone provide	451.061	
G=velocity gradient	30.000	1/sec
checking status		
T= flocculation time	1800.000	sec
unitless GT values	54000.000	sec
checking status		
u=absolute viscosity of water at 20°C	0.001	N.sec/m
power input to water = $P=uG^2V$	410.014	watts
Dp=provide diameter of flocculator paddle	2.800	m
RPM of motor	1000.000	
gear box ratio	70:1	
ratio of bevel gear to pinion	5:1	
rpm of paddle	2.857	
=motor RPM/(gear box ratio X bevel gear ratio)		
checking status		
Vp= tangential velocity of paddle at tip= paddle RPM*3.14*Dp/60)	0.419	m/sec
checking status	pass	
		range-0.2 to 0.6, recommended 0.3-0.4 CPHEEO manual,p-213

PADDLE AREA FOR FLOCULATOR

			range- 0.8-1.9 CPHEEO manual,p-213
C_d =newton coefficient of drag	1.800		
power input to water $=P=0.5 \cdot C_d \cdot \rho \cdot A_p \cdot V_r^3$	410.014	watts	
density of water (ρ)	1000.000	kg/m ³	
V_r = velocity of water at paddle tip= $0.75 \cdot V_p$	0.314	m/sec	range-0.3-0.4 m/sec CPHEEO manual,p-624
A_p =total area of paddle	14.715	m ²	
ratio of paddle area to c/s area of flocculator zone	11.092	%	range- 10 to 25% CPHEEO manual,p-213
numbetr of flocculator paddle	4.000		
paddle area for each flocculator	3.679	m ²	
checking status	pass		

DRIVE MOTOR FOR FLOCULATOR

number of flocculator paddle provided	4.000		
Power input to water $=P$ /Flocculator	102.504	watts	
efficiency of gear box= η_g	0.900		
efficiency of bevel gear pinion $=\eta_p$	0.800		
power required at gear box input shaft $=P/\eta_g \cdot \eta_p$	142.366	watts	
starting power required= $2 \cdot P/(\eta_g \cdot \eta_p)$	284.732	watts	
service factor considered	1.500		
requiure wattage	427.098	watts	
	0.573	H.P	

GEAR BOX FOR FLOCULATOR

efficiency of gear box= η_g	0.900		
power of gear box output shaft $=P/\eta_g$	113.893	watts	
RPM of gear box out put shaft =	14.286		
motor of rpm/gear box ratio			
torque=power in KW $\cdot 102 \cdot 60 / (2 \cdot 3.14 \cdot \text{RPM})$	7.769	kgm	
	76.218	Nm	

CLARIFIER

number of units	4.000	nos	
design discharge	0.243	m ³ /sec	
	875.000	m ³ /hr	
	17500.000	m ³ /day	
detention period	2.500	hr	
volume required	2187.500	m ³	
allowable surface loading rate	32.000	m ³ /m ² /day	
surface area provided	546.875	m ²	
inner diameter of flocculator provided	13.000	m	

inner diameter of clariflocculator provided	32.000	m	
SWD provided	3.400	m	
volume provided	2281.995	m ³	
design discharge considering 20% Overload	21000.000	m ³ /day	20% overloadin g
allowable surface loading rate	38.400	m ³ /m ² /day	
checking status	pass		
total length of weir	100.531	m	
actual weir loading	174.076	m ³ /day/m	range- upto 300 m ³ /d/m
actual weir loading considering 20% Overload	208.891	m ³ /day/m	CPHEEO manual,p- 230
checking status	pass		
maximum sludge generated (assuming 3% sludge)	2100.000	m ³ /day	
	87.500	m ³ /hr	
	0.024	m ³ /sec	
provide width of sludge drain	0.600	m	
max SWD provided	0.600	m	
min SWD provided	0.450	m	
SWD provided	0.525		
max. velocity	0.090	m/sec	
min. velocity	0.068	m/sec	
avg. velocity	0.079	m/sec	
A= avg. c/s area	0.315	m ²	
P= wetted perimeter	1.650	m	
R=hydraulic mean radius=A/P	0.191		
n=mannings co-efficient	0.015		
S=hydraulic gradient	1.26993E-05		
length of sludge drain	32.524	m	
friction loss	0.000413033	m	
provide head loss	0.150	m	
checking status	pass		
depth of sludge zone provided			
base slope provided	8.33	%	
END CARRIAGE DRIVING EQUIPMENT			
diameter of wheel provided	0.200	m	
RPM of motor	1500.000		
gear box ratio	70.000		
chain socket ratio	6.000		
wheel	RPM=		
motor RPM/(gear box ratio*chain socket ratio)	3.571		
peripheral speed=dia of wheel*3.14*wheel rpm	2.244	m/min	genetally 2 to 3 m per minute.
dia of clariflocculator	32.000	m	
diameter of rail	32.200	m	
revolution of	bridge=		
3.14*dia of rail/peripheral speed	45.080	min	

r = radius of clarifloculator	16.000	m
W =sludge load considered	20.000	kg/m
absorbed torque at centre of clarifloculator $=W \cdot R^2$	5120.000	kgm
F =force at end carriage drive=torque/ R	320.000	kg
torque at driving wheel $=F \cdot \text{radius of wheel}$	32.000	kgm
P_w =power at wheel $=2 \cdot 3.14 \cdot \text{torque} \cdot \text{RPM} / (60 \cdot 102)$	0.117	kw
	0.157	HP
efficiency of gear box= n_g	0.900	
efficiency of chain socket $=n_s$	0.700	
HP input to gear box $=P_w / (n_g \cdot n_s)$	0.250	HP

END CARRIAGE DRIVE GEAR BOX

power at gear box output shaft $=P_w / n_s$	0.168	kw
RPM of gear box output shaft $= \text{motor RPM} / \text{gear box ratio}$	21.429	
torque at gear box output shaft $= (P_w / n_s) \cdot 102 \cdot 60 / (2 \cdot 3.14 \cdot \text{RPM})$	7.619	kgm

LAUNDER CHANNEL

design discharge	0.2430556	m ³ /sec
half discharge of launder channel	0.1215278	m ³ /sec
width of channel provided	0.7000000	m
SWD provided	0.6500000	m
max. velocity	0.2670940	m/sec
checking status		
avg. discharge	0.0607639	m ³ /sec
avg. velocity	0.1335470	m/sec
A = avg. c/s area	0.4550000	m ²
P = wetted perimeter	2.0000000	m
R =hydraulic mean radius $=A/P$	0.2275000	m
n =mannings co-efficient	0.0150000	
S =hydraulic gradient	0.0000289	m
half length	125.8404719	m
friction head loss	0.0036360	m

FILTER CONSISTING OF 12 (10W+2S) NUMBERS FILTERS(TWIN SECTION)

maximum raw water flow to WTP (20 nos. twin filter working)	70.000	mld
	70000.000	m ³ /day
design flow/twin filter	350.000	m ³ /hr
	0.097222	m ³ /sec
considered rate of filtration	4.800000	m ³ /hr/m ²
required area	72.916667	m ²
provide width of each filter bed	4.900	m
provide length of each filter rate	7.500	m
area provided	73.500	m ²
actual filtration rate	4.762	m ³ /hr/m ²
checking status	pass	

ESTIMATION OF SAND DEPTH

assume depth of sand	600	mm
----------------------	-----	----

minimum depth of sand required by hudson formula

$$Qd^3h/L = B \cdot 29323$$

where Q is in m³/m²/h, d in mm, h&l are in m.

assume

B= 4*10⁻⁴ for poor response of filtration and average degree of pre treatment

h= terminal head loss 2.5 m

d= mean diameter of sand considered 0.7 mm

Q= rate of filtration (assuming 100% over loading) 9.523809524 m³/m²/hr

minimum depth of sand required to avoid break through 0.696268004 m

d= mean diameter of sand considered 0.45 mm

Q= rate of filtration (assuming 100% over loading) 9.523809524 m³/m²/hr

minimum depth of sand required to avoid break through 0.184977906 m

cl.7.6.3.6
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manual,p-
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NB: uniformity coefficient shall not be more than 1.7 nor less than 1.3

ESTIMATION OF GRAVEL AND SIZE GRADATION

assume a size gradation 2 mm at top to 50 mm at bottom

depth of layer in mm = $10 \cdot 2.54 \cdot k \cdot (\log D)$, where

D= maximum size of gravel in mm

k 12
SIZE OF GRAVEL UPTO 6 MM SIZE 6 mm

required depth of gravel upto 6mm size 237.1805011 mm

provide depth of gravel upto 6mm size 250 mm

SIZE OF GRAVEL UPTO 10 MM SIZE 10 mm

required depth of gravel upto 10 mm size 304.8 mm

provide depth of gravel upto 10 mm size 310 mm

Increment, mm 60 mm

SIZE OF GRAVEL UPTO 20 MM SIZE 20 mm

required depth of gravel upto 20 mm size 396.5539427 mm

provide depth of gravel upto 20 mm size 400 mm

Increment, mm 90 mm

SIZE OF GRAVEL UPTO 30 MM SIZE 30 mm

required depth of gravel upto 30 mm size 450.2265584 mm

provide depth of gravel upto 30 mm size 450 mm

Increment, mm 50 mm

SIZE OF GRAVEL UPTO 50 MM SIZE 50 mm

required depth of gravel upto 50 mm size 517.8460573 mm

provide depth of gravel upto 50 mm size 520 mm

Increment, mm 70 mm

total depth of filter bed 1120 mm

NB: all filter media shall confirm to IS:8419

GRADATION OF FILTER BED FINALLY ADOPTED

sand of effective size 0.45 mm to 0.7 mm 650 mm

cl.7.6.3.10
CPHEEO
manual,p-
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top layer (3-6) mm size	150	mm
top layer (6-13)mm size	100	mm
top layer (13-25) mm size	100	mm
top layer (25-50) mm size	150	mm
total depth of filter bed	1150	mm

WASH WATER THROUGH / GUTTER

Backwashing flow rate	30.000	m3/hr/m2
numbers of gutter	4.000	
$Q = \text{design discharge / gutter} = 1.376 * b * h^{1.5}$	0.0851437	m3/sec
width of gutter provided	0.350	m
$h = \text{depth of gutter}$	0.315	m
side water depth of gutter provided at d/s	0.325	m
provide a drop	0.050	m
total water depth of gutter provided at u/s	0.375	m
free board	0.075	m
total water depth of gutter provided at d/s	0.400	m
total water depth of gutter provided at u/s	0.450	m

FILTER UNDERDRAINAGE SYSTEM

Dia(ID) of UPVC perforated laterals pipes fixing on a RCC tee which is located on top of central manifold	80.000	mm
no. of RCC Tee/ RGF	50.000	nos
no. of 80 mm ID X aprox 2.3 m long upvc pipe	100.000	nos
no. of rubber ring for fixing pipe with RCC Tee	100.000	nos
other fixtures,bolt,nut,etc as per requirements		

GULLET CHANNEL

required c/s area of gullet channel		
number of gutter		
width of gullet channel provided	1.000	m
depth of gullet channel provided	1.500	m
c/s area of gullet channel provided	1.500	m2

CENTRAL MANIFOLD

required c/s area of gullet central manifold	636172.512	mm2
width of central manifold provided	0.650	m
depth of central manifold provided	0.650	m
c/s area of gullet channel provided	422500.000	mm2
checking status		

FILTERED OUT PIPE TO CONTROL CHAMBER

design discharge	0.097222	m3/sec	
diameter of pipe provided	0.350	m	
velociry	1.01051	m/sec	<1.2m/sec
checking status	pass		

BACKWASH WATER INLET PIPE TO COMMON MANIFOLD

<i>flow rate</i>	30.000	m ³ /hr/m ²	range- 600 lpm/m ² CPHEEO manual,p- 250
<i>design discharge</i>	0.612500	m ³ /sec	
<i>diameter of pipe provided</i>	0.600	m	
<i>velocity</i>	2.1663	m ³ /sec	< 3.0 m ³ /sec
checking status	pass		
<u>BACKWASH WATER OUTLET GATE TO WASTE WATER CHANNEL</u>			
<i>design discharge</i>	0.6125000	m ³ /sec	
<i>width of gate provided</i>	0.6000000	m	
<i>depth of gate provided</i>	0.6000000	m	
<i>velocity</i>	1.7013889		
checking status	pass		
<u>BACK WASH OHR INCLUDING OTHER UTILITIES</u>			
<i>rate of back wash</i>	500.000	lpm/sqm	range- 600 lpm/m ² CPHEEO manual,p- 250
	30.000	m ³ /hr/m ²	
<i>maximum backwash time</i>	8.000	minutes	
<i>length of filter bed</i>	4.900	m	
<i>width of filter bed</i>	7.500	m	
<i>area of filter bed</i>	36.750	m ²	
<i>back wash water required</i>	294.000	m ³	
<i>say,</i>	300.00	m ³	
<i>for preparation of chemical solution</i>	70.00	m ³	
<i>for chlorination pump</i>	100.00	m ³	
<i>for laboratory & toilet</i>	100.00	m ³	
<i>however, capacity provided</i>	600.00	m ³	
<i>filling of OHR</i>	1.5	hrs	
<i>capacity of pump</i>	400.00	m ³ /hr	
<i>say,</i>	400.00	m ³ /hr	
<u>AIR BLOWING(1 WORKING +1 STANDBY)</u>			
<i>air scour rate</i>	42.0000000	m ³ /hr	range- 40- 45 m/hr CPHEEO manual,p- 251
<i>design discharge</i>	0.8575000	m ³ /sec	
	3087.0000000	m ³ /hr	
	1816.9464600	cfm	
<i>provide capacity o air blower</i>	3200.00	m ³ /hr @0.4kg/cm ²	
<u>CLEAR WATER INLET GATE</u>			

design discharge	0.4861111	m ³ /s	
provide width of gate	1.4000000	m	
provide height of gate	0.6500000	m	
velocity through gate	0.5341880	m/sec	<1.0 m/sec
checking status	pass		

CLEAR WATER RESEORVIOR

required capacity of CWR required	3500.000	m ³	
say,	3500.000	m ³	
number of compartment	2.000		
width of CWR compartment provided	22.500	m	
length of CWR compartment provided	20.000	m	
SWD of CWR provided	4.250	m	
free board	0.500	m	
volume provided	3825.000	m ³	
width of common sump	4.000	m	
length of Common sump	45.000	m	
SWD provided	4.250	m	
	765.000	m ³	
total volume	4590.000	m ³	
checking status	pass		

SLUDGE LINE

Total design discharge with mximum turbidity (assuming 6 % sludge)	231.00000	m ³ /hr	10% overload
number of clarifloculator	4.00000		
design discharge / clarifloculator	57.75000	m ³ /hr	
number of sludge line	2.00000		
design discharge / sludge line	28.87500	m ³ /hr	
	0.00802	m ³ /sec	
diameter of sludge pipe provided	0.25000	m	
velocity	0.16348	m ³ /sec	

BACKWASH WASTE SUMP

width of waste sump	17.500	m	
length of waste sump	8.000	m	
SWD provided	2.500	m	
volume provided	350.000	m ³	

BACKWASH DECANTED WATEER SUMP

width of waste sump	17.500	m	
length of waste sump	8.000	m	
SWD provided	2.500	m	
volume provided	350.000	m ³	

CLARIFIER SLUDGE SUMP

waste water from clarifloculator @ 3% of total flow	105.000	m ³	
width of waste sump	10.000	m	
length of waste sump	6.000	m	
SWD provided	2.500	m	
volume provided	150.000	m ³	

RECIRCULATION PUMP(1 WORKING +1 STANDBY)

total raw water to inlet	3500.000	m3/hr
considering 5% of raw water should be recirculate	175.000	m3/hr @ 20m head
	0.049	m3/sec
required discharged capacity of pump	48.611	lps
pump operation period	1.000	hr
type of pump	Either submersible type with cutter or horizontal non clog pumps or verticals non clog pumps	

PUMP SET FOR DISCHARGE INTO LAGOON FROM 1ST RESERVIOR (1 WORKING +1 STANDBY)

total raw water to inlet	3500.000	m3/hr
considering 3% of raw water should be recirculate	175.000	m3/hr @ 20m head
	0.049	m3/sec
required discharged capacity of pump	48.611	lps
pump operation period	1.000	hr
type of pump	Either submersible type with cutter or horizontal non clog pumps or verticals non clog pumps	

PUMP SET FOR DISCHARGE OF CLARIFLOCULATOR SLUDGE INTO LAGOON (1 WORKING +1 STANDBY)

total raw water to inlet	3500.000	m3/hr
considering 5% of raw water should be recirculate	105.000	m3/hr @ 20m head
say,	125.000	
	0.035	m3/sec
required discharged capacity of pump	34.722	lps
pump operation period	1.000	hr
type of pump	Either submersible type with cutter or horizontal non clog pumps or verticals non clog pumps	

NB:clarifloculator sludge is expected 3% of 3500 m3/hr ,i.e,105 m3/hr. hence above capacity is selected.

SLUDGE LAGOON

flow considered	3500.000	m3/hr
turbidity considered	200.000	NTU
no. of sludge lagoon	2.000	nos
time	90.000	days
solid available	840.000	m3
size of each lagoon	420.000	m3
depth provided	2.000	m
length provided	35.000	m
width provided	12.000	m
volume provided	840.000	m3

WASTE WATER CHANNEL

<i>backwash flow rate</i>	36.000	m ³ /hr/m ²	range- 600 lpm/m ² CPHEEO manual,p- 250
<i>design discharge</i>	0.612500	m ³ /sec	
<i>width of channel provided</i>	1.650	m	
<i>SWD provided</i>	1.000	m	
<i>average velocity</i>	0.371	m ³ /sec	
<i>checking status</i>	pass		

ALUM TANK

<i>maximum discharge from intake to WTP</i>	70.000	mld
	3500.000	m ³ /hr
<i>maximum dosing of alum</i>	50.000	mg/lit
	0.050	kg/m ³
<i>requirement of alum</i>	175.000	kg/hr
<i>strength of alum solution</i>	10.000	%
<i>dilluted volume of alum solution required</i>	1750.000	lit/hr
	1.750	m ³ /hr
<i>total water required for alum solution</i>	42.000	m ³
<i>detention period of each tank</i>	8.000	hr
<i>no of tanks provided</i>	3.000	nos
<i>required volume of tank</i>	14.000	m ³
<i>liquid depth provided</i>	1.600	m
<i>width provided</i>	3.000	m
<i>length provided</i>	3.000	m
<i>free board</i>	0.300	m
<i>volume provided</i>	14.400	m ³
<i>checking status</i>	pass	

PE(POLY ELECTROLITE TANK)

<i>maximum discharge from intake to W.T.P</i>	70.000	mld
	70000.000	m ³ /day
	3500.000	m ³ /hr
<i>maximum alum dosing</i>	1.500	mg/lit
	0.0015	kg/m ³
<i>requirement of alum</i>	5.250	kg/hr
<i>strength of alum solution</i>	1.000	%
<i>diluted volume of alum solution required</i>	525.000	lit/hr
	0.525	m ³ /hr
<i>total water required for alum solution</i>	12.600	m ³
<i>detention period of each tank</i>	12.000	hrs
<i>no of tanks</i>	2.000	nos
<i>volume required of each tank</i>	6.300	m ³

liquid depth provided	1.600	m
width provided	2.000	m
length provided	2.000	m
free board	0.400	m
volume provided	6.400	m ³
checking status	pass	

CHAPTER 10 : DESIGN DESCRIPTION OF EACH COMPONENTS

10.1 RAW WATER INLET COLLECTING CHAMBER:

- No. of chamber : 1 (One)
- MOC of chamber : RCC
- Flow considered : 35 m³/hr.
- Detention time : 60 Secs
- Volume required : 58.33 m³
- Liquid depth provided : 5.50 m
- Area required : 10.606 m²
- Dia. of chamber provided: 3.674 m, Say 3.7 m dia.
- Rise rate available : 0.092 m/Sec.
- Raw water inlet pipe : 900 NB DI-K9/MS
- Control valves on R.W. pipe : 900 NB BFV (2 Nos. Actuator & 2 Nos. Manual)
- Free board : 0.50 m.

10.2 OPEN CHANNEL WITH PARSHALL FLUME:

- No. of channel : 1 (One)
- MOC of channel : RCC
- Flow considered : 3500 m³/hr.
- Head rise at Throat : 600 mm
- Length of Parshall flume : Approx. 3.5 m
- Upstream length : 6.0 m
- Downstream length : 3.0 m
- Configuration of flume : As per IS-14371 (latest edition)
- Width of channel : 2.0 m
- Liquid depth at channel : 230 mm+600 mm=830 mm
- Free board provided : 400 to 500 mm
- Measurement of flow : Through ultrasonic type flow transmitter.

10.3 DISTRIBUTION CHAMBER:

- No. of chamber : 1 (One)
- MOC of chamber : RCC
- Liquid depth available : 500 mm=0.5 m
- Detention period : Approx. 10 Sec
- Volume required : 9.73 cum
- Size required : 10 m X 3 m (Vol. available=15 m³)

10.4 FLASH MIXERS:

- No. of flash mixer : 4 (Four)
- MOC of flash mixer : RCC
- Detention time : 60 Sec

- Flow per flash mixer : $3500/4=875$ m³/hr.
- Volume required : 14.58 m³
- Depth of liquid provided : 5.1 m
- Shape of flash mixer : Square
- Size of flash mixer : 1.70 m X 1.70 m
- Free board provided : 0.5 m
- Ratio of tank height to size : 5.1: 1.7 (3:1)
- KW rate of SS-304 Agitator : 3.7 KW

10.5 CLARIFLOCCULATORS:

- No. of Clariflocculators : 4 (Four)
- MOC of Clariflocculators : RCC
- Flow per Clariflocculator : $3500/4 = 875$ m³/hr.
- OD of Clariflocculator : 32 m Dia.
- Collecting launder : Outside and collection through orifices on peripheral wall
or V-notch MS plates.
- Dia. Of Flocculator = 13 m Dia.
- OD of Central Shaft = 1.2 m dia with clean ID as 0.7 m.
- Side water depth (SWD) = 3.4 m.
- Retention period
 - i. In Clarification Zone : Min 2.5 Hrs.
 - ii. In Flocculation Zone : Min 30 minutes.
- Surface Loading at Normal : Max. 32 m³/m²/day
Design flow of 875 m³/hr. (Available 31.55 m³/m²/day)
- Surface Loading with 20% : Max. 40 m³/m²/day
overloading i.e., 1050 m³/hr. (Available 37.9 m³/m²/day)
- Wier Loading : Max. 300 m³/m²/day (Available 210 m³/m²/day) and the same with 20%
- Flow Slope provided : 8.33% (1 in 12)
- Sludge Outlet Pipe : 250 mm dia DI-K9 with 80 mm dia Telescopic bleed.
- Free board provided = 500 mm.
- Walkway all round CIF = 1.0 m wide provided & approach to Filter House from Clariflocculators.
- Size of collecting launder : 700 mm wide x 0.65 m liquid depth.
- Velocities to be taken
 - i. Inlet Pipe = Not more than 1.0 m/sec.
 - ii. At ports on shaft = Not more than 0.6 m/sec.
 - iii. Orifices = Not more than 0.6 m/sec.
 - iv. Collecting launder = Not more than 0.4 m/sec

10.6 RAPID GRAVITY FILTER (RGF):

- Design Flow rate considered : 3500 m³/hr.
- No. of RGF provided : 132 (10 out of 25)
- Type of Filter Load : Twin Section, constant rate
- Flow per RGF : 350 m³/hr.
- Rate of Filtration : 4.8 m³/hr/m²
- Area required per RGF : $350/4.8 = 72.92$ m²
- Area required per section : $72.92/2 = 36.46$ m²
- Size provided : 7.5 m x 4.9 m

- Total Area provided per RGF: $7.5 \times 4.9 \times 2 = 73.50 \text{ sqm}$.
- MOC of Filter Bed : RCC
- MOC of superstructure : Brick wall plastering
- To locate/arrange of filters : In 2 rows, i.e., each row shall be provided with 6 (six)
In Filter House Nos. RGF
- Filtered water Outlet Channel: To be located centrally on either side of pipe gallery
of Filters.
- Velocities to be adopted while :
designing
 - i. Filter Inlet Channel - $> 0.6 \text{ m/sec}$
 - ii. Filter Outlet Channel - $> 1.0 \text{ m/sec}$
 - iii. Filter Inlet - $> 0.75 \text{ m/sec}$
 - iv. Filter Outlet - $> 1.5 \text{ m/sec}$
 - v. Filter wash - $> 3.0 \text{ m/sec}$
 - vi. Filter waste - $> 2.5 \text{ m/sec}$
 - vii. Filter Air - $> 20.0 \text{ m/sec}$
- No. of trough to be provided: 4 (Four) with center to center distance of 1875 mm of Length wise standard size of trough.
- Sizes of Gates/BFV to be :
Selected
 - i. Inlet – 400 mm x 400 mm sluice gate
 - ii. Outlet – 350 mm dia. BFV
 - Note: Above two isolations considered with 20% overload.
 - iii. Wash – 500 mm dia. BFV
 - iv. Waste – 550 mm x 500 mm SI Gate
 - v. Air – 250 mm dia. BFV
- Quantity of gate/valve : 1 – No. of each above variety per Filter Bed.
- Operation of Gates/Valves : All gates and valves shall be operated with electrical
suggested Actuator through PLC type control desk (Console).
Each Filter shall have 1 No. Console.
- Free board in Filter Bed : 500 mm (0.5 m)
- Depth of water with : 2.5 m sieve constant rate of filtration.
Filter Media
- Depth of Filter Media :
 - a. Sand = 650 mm of 0.45 to 0.7 mm size
 - b. Gravel = 500 mm in 4 – layers as hereunder
 - 150 mm dep – 50 x 25 mm – bottom layer
 - 100 mm deep – 25 x 13 mm – next upper layer
 - 100 mm deep – 13 x 6 mm – next higher layer
 - 150 mm deep – 6 x 3 mm – top layer

Note: All Filter Media shall conform to IS – 8419

- Outlet control valve in : 350 mm dia
Inspection Chamber
- Size of Rectangular weir in : 600 mm wide x 300 mm approx. height for measureme of filtered water on
RDF.

- *Size of filter inlet channel: Approx. 1.2 to 1.4 m wide with depth as available which is around 600 mm or 700 mm deep with 300 mm free board 1 No. on either side of Filter House.*
- *Size of filter outlet channel: 1.5 mm wide x 0.65 mm liquid depth and 0.35 m free board.*

- *Waste water channel : 1.5 m wide 1.0 m deep on either side of Filter House connected together before leading to backwash waste water reservior.*
- *Wash water waste gullet : 0.9 or 1.0 m wide with depth of approx. 1.5 m for discharging channel at the centre of the twin section backwash waste water in waste water channel.*
- *Underdrain System : Approx. 80 mm ID UPVC perforated lateral pipes fixed on a RCC Tee which is located in top of central manifold.
No. of RCC Tee/GRF = 50 Nos.
No. of 80 mm ID x Approx 2.3 m long UPVC pipes = 100 Nos.
No. of Rubber ring for fixing pipe with RCC Tee = 100 Nos.*
- *Underdrain System : Approx. 80 mm ID UPVC perforated lateral pipes fixed on a RCC Tee which is located in top of central manifold.
No. of RCC Tee/GRF = 50 Nos.
No. of 80 mm ID x Approx 2.3 m long UPVC pipes = 100 Nos.
No. of Rubber ring for fixing pipe with RCC Tee = 100 Nos.
Other fixtures, boults, nuts, etc. = As per requirement.*
- *Size of Central Manifold : 650 mm x 650 mm RCC duct called as central manifold on which RCC Tee are located of approx. 300 mm centre to centre distance.*
- *Capacity of Air Blower : 2 sets (1w + 1s), each of 3200 m³/hr @ 0.4 kg/cm², required for backwashing. (Considered 700 lpm/m²).*
- *Capacity of OHR for backwashing and other utilities : a) (Considered 500 1pm/m²)
Required for 8 to 9 minutes is 75 x 0.5 x 8 = 300 m³
b) For preparation of chemical solution = 70 m³
c) For chlorination booster pump = 100 m³
d) Laboratory & Toilet = 100 m³
However, 700 m³ OHR cap. has been selected. Filling of OHR shall be in 1.5 hrs, ie., pump capacity = 470 m³/hr mins.*

10.7 CLEAR WATER RESERVOIR & CW PUMP HOUSE

- *No. of Reservoir : 1 (One)*
- *MOC of Reservoir : RCC with top surface epoxy painted.*
- *No. of Compartment : 2 (Two) compartment & 1 (One) no. common sump.*
- *Size provided a) 22.5 m x 20m - each comp.
b) 45.0 m x 4 m - common sump*
- *Liquid depth considered : 4.25 m*
- *Volume Available : (22.5 x 20 x 2 x 4.25) + (45 x 4 x 4.25) = 3825 + 765 = 4590 cum*
- *Size of Pump House : 45 m x 12 m.*
- *Pump House to house : 9 sets (6w + 3s) of 584 m³/hr @ 100 m head and 2 sets (1w + 1s) of 400 to 500 m³/hr @ 20 m head for backwash water OHR.*

- *Types of Pumps in Pump House* : *Horizontal Split Casing (HSC)*
- *Free board in reservoir* : *500 mm min. with 300 mm min. below the beam.*
- *Slope of reservoir towards sump* : *1 in 200.*
- *Sump depth* : *4.25 m + 1.60 m = 5.85 m*
- *Height of Pump House above plinth level* : *Min. 6.0 m and suitable for Gantry Girder EOT Crane.*
- *Loading & Unloading Bay (Approx.)* : *125 m x 4.0 m at operating floor inside pump house.*
- *Handling of Pumps* : *By EOT Crane gantry girder (Cap. To be decided so as to handle the highest weight. Probably around 5 MT.*
- *Overflow of reservoir & Air-Vent* : *To be provided as per requirement.*

10.8 CHEMICAL HOUSE

- *Size of House* : *25 m x 15 m = 350 m² area.*
- *Tupe of House* : *2 storied building and each floor shall have 350 m² area.*
- *Area in Ground floor* :
 - a) *Stair* = *15 sqm*
 - b) *Toilet* = *10 sqm*
 - c) *Storage = 275 sqm (suitable for 3 months storage of Alum Blocks and liquid Toxic free Polyelectrolyte)*
 - d) *Passage/Corridor, etc. = 50sqm*
- *Area of First Floor* :
 - a) *Stair* = *15 sqm*
 - b) *Toilet* = *10 sqm*
 - c) *Alum & PE Solution handling area inch = 150 sqm Metering Pumps.*
 - d) *Laboratory* = *65 sqm*
 - e) *MCC room* = *35 sqm*
 - f) *Operator's room* = *25 sqm*
 - g) *Passage/corridor, etc = 50sqm*
- *Notes of Areas* : *Tentative informations provided above. These may be modified.*

10.8.1. ALUM DOSING DEVICE

- *Design rated flow* : *3500 m³/hr*
- *Maximum Dosing* : *50 mg/l*
- *Strength of solution* : *10%*
- *Holding time/tank* : *8 hours*
- *No. of tanks* : *3 (Three)*
- *MOC & Liming* : *RCC and internally lined with acid proof tiles/FRP/Chlorinated rubber paint/anticorrosive epoxy.*
- *Volume required* : *(3500 x 3500)/(1000 x 100) = 14 cum.*
- *Liquid depth considered* : *1.6 m*

- *Size provided* : 3.0 m x 3.0 m (square)
- *Total height of tank* : 0.1 m (at bottom containing debris, etc.) + 1.6 m (liquid depth) + 0.3 m (free board) = 2.0 m
- *Dosing of Alum Solution* : By Metering Pump.
 i) No. of pump = 2 (Two)(1W + 1S)
 ii) Discharge Cap/Pump = 2000 LPH @ 2.0 Kg/cm²
 iii) Type = Diaphragm
- *Agitating Assembly* : Provided with agitator, either wooden or SS-316 and driven by a 2.2 KW, 1500 rpm compiled with a A-287 Reduction gear (1:50) to have a gentle agitation of 28 to 30 rpm.
- *Location of Alum Preparation Tanks & Metering Pumps* : In the first floor of Chemical House
- *Additional Gravity feeding* : MSRL Constant Head Tank complete with Ball Float Valve and taper needle valve with a scale manually operated. The arrangement is a stand by one which will be operated in case of failure of Metering pumps.
- *Feed water pipelines* : 50 mm dia G.I. pipe with GM screwed pits valve in each preparation tank drawing clear water from OHR through a dedicated pipeline.
- *Solution handling pipes* : SS-316/UPVC/HDPE/MSRL
- *Solution handling valves* : PP (Polypropylene)/CIRL/SS-316 Ball Valve.
- *Point of Application of Alum Solution* : Near to the hydraulic jump at Parshall Flume

10.8.2. PE (POLY-ELECTROLYTE) DOSING DEVICE

- *Design rated flow* : 3500 m³/hr
- *Maximum Dosing* : 1.5 mg/lit
- *Strength of solution* : 1.00%
- *Holding time/tank* : 12 hrs
- *No. of tank provided* : 2 (Two)
- *MOC & Lining* : Similar to Alum preparation tanks
- *Volume required* : (3500 x 1.5 x 12)/(1000 x 10) = 6.3 cum.
- *Liquid depth considered* : 1.6 m
- *Tank size provided* : 2.0 m x 2.0 m (Square)
- *Total height of Tank* : 1.6 m + 0.4 m free board = 2.0 m
- *Dosing of PE solution* : By Metering Pumps
 i) No. of pump = 2 Nos. (1W + 1S)
 ii) Discharge Cap = 750 LPH @ 2.0 Kg/cm²
 iii) Type = Plunger
- *Agitating Assembly* : Same as Alum solution but the KW rate is 1.5 KW, 1500 motor
- *Location of Tanks* : By the side of Alum Preparation Tanks
- *Location of Metering Pumps* : Near to the PE preparation tanks

- *Additional Graavity Dosing Device* : Same as Alum Preparation Tanks
- *Feed water supply* : Same as Alum Preparation Tanks
- *Solution handling pipes and valves* : Same as Alum Preparation Tanks
- *Point of application of PE solution* : Just before entering Flash Mixers at Distribution chamber or at the inlet to Flash Mixers.

10.8.3. OTHER ITEMS/EQ. IN CHEMICAL HOUSE

- a) 1.0 MT Cap. Platform Dial Type Weighing Machine.
- b) 1.0 MT Cap. Monorail travelling electrical hoist (CPB) complete with I-Joint (approx. 18 m long ISMB 250) for lifting chemicals from ground floor to preparation.
- c) 1-Nos. : Alum crusher unit.
- d) 2-Nos. : 1 m³ Cap. Wooden lifting bucket with hook.
- e) 1-Nos. : SS-316 Tray in each Alum preparation Tanks.

10.9 CHLORINATION BUILDINGS

- *No. of building* : 1 (One)
- *Type of building* : Single storied
- *Size of building* : 25 m x 10 m = 250 sqm.
 i) Size of Tonner room for 20 Nos. = 15 m x 10 m
 ii) Chlorinator & Pump area = 10 m x 10 m
- *Open Space for leaked chlorine absorption Tower* : 150 m² (15 m x 10 m) adjacent to Chlorine Tonner room.
- *No. of Chlorinator* : a) 2 Nos. (1w + 1S) for pre-chlorination
 b) 2 Nos. (1w + 1s) for post-chlorination
- *Capacities of Chlorination* : a) 15 kg/hr for pre
 b) 7.5 kg/hr for post
- *Operating pressure for creating vaccum* : 4-sets of Booster Pumps 2 Sets (1w + 1s) for each variety
- *Approx. dosing choosen* : 4 ppm as pre-chlorination and 2 ppm as post- chlorination.
- *No. of Tonner selected* : 20 Nos. (14 Nos. for pre & 6 Nos. for post)
- *Point of application of pre-chlorination water* : a) Into the bottom of Inlet collecting chamber for pre-chlorination.
 B) Into the clear water filtered channel at the end leaving for CWR or at the inlet of CWR.
- *Source of clear water* : From a 200 NB dedicated pipeline from OHR.
- *Leaked chlorine absorption system* : 1-No. Absorption Tower filled with Raschik ring complete with 2 sets each (1w + 1s) Air Blower & NaOH recirculation pump.
- *Handling of Tonner* : Through 3.0 MT EOT Gantry Crane.

10.10 SLUDGE PLUS BACKWASH WASTE WATER HANDLING SYSTEM

10.10.1.BACKWASH WASTE WATER

- Waste water collecting reservoir : 1 (one) No. of approx. 350 m³cap which is approx. backwash waste water generated after backwashing of one RGF and this quantity is expected in 8 to 10 minutes dine.
- No. of waste water reservoir : 2 (Two), One ne reservoir will collect the waste water and the Supernatant will be transferred into the second tank. Recirculation to Parshall Flume will be done from second tank with 2 Sets (IW+IS) pump sets of 175 m³/hr discharge Cap, which is exactly 5%. of Raw Water Input of 3500 m³/hr.
- Size of each reservoir : 17.5 m long x 8.0m wide/Breath 2.0 m liquid depth of RCC.
- Trough on collecting reservoir : Once the reservoir which is collecting the waste water after backwash will be provided with RCC trough of 4 or 5 Nos. which will collect Supernatant and deliver into the second reservoir. The dirty water of first reservoir will be pumped entirely into the Sludge Lagoon.
- Waste water open Channel around Filter House : For volume calculation this channel may be taken as a part of sv reservoir. The size of channel is approx. 150m x 1.0 = 150 m³ holding cap.
- Size of pipe for waste water channel to first reservoir :
 Through. 600 mm dia RCC hume pipe. If the distance is more than 20m, an in intermediate pit of around 1.0m, dia shall be made. Laying of pipe shall be in a slope of 1 in 100 so as to avoid deposition in pipe.
- Slope in both reservoir at the bathroom/floor :
 A slope of 1 in 50 shall be made with further deep sump of 1.0m for pump suction at the end of 2.0 m away from the wall of pump house/ reservoir.

10.10.2 SLUDGE WASTE WATER OF CLARIFLOCCULATOR

- Volume of collecting chamber : 120 cum although 105 cum/hr is expected.
- No. of Sludge water reservoir : 1 (one) of RCC
- Size Sludge water reservoir : 10m x 6 m x 2m. liquid depth.
- Location : Adjustment to Backwash waste water reservoir which will help pumping for a single place.
- Floor Slope from entry to pump sump : 1 in 50
- Size of common pipe from all clariflocculator: 300 mm dia RCC Hume pipe auth- intermediate pits (1.0m) if required.

10.10.3 PUMP SETS & AGITATES IN PUMP HOUSE & RESERVOIR

10.10.3.1 PUMP SET FOR RECIRCULATION

- No. pump set provided : 2 (1W +1S)
- Type of pump sets : Either Submersible type with cutter or horizontal non-clog pumps or vertical non-clog pumps.

Discharge capacity of each pump	: 175 m ³ /hr @20 m-head
Point of discharge	: At Parshall Flume for recirculation of 5 % of 3500 m ³ /hr.
Type of pipeline (MOC)	: CI/DI/MS of 200 NB Size.
Nature of valves	: CIDF Sluice Valve with delivery size as 200 NB

10.10.3.2 PUMP SET FOR DISCHARGE INTO LAGOON FROM FIRST RESERVOIR

No. of pump set provided	: 2 (1W+1S)
Type of pumps	: Either submersible type with Cather non-clog or horizontal non-clog pumps or vertical non-clog type supe.
Discharge Cap. of each pump	: 175 m ³ /hr @20m head.
Point of discharge	: To Sludge lagoons
Type of pipeline (MOC)	: CI/DI/MS 200 NB size
Type of Valves	: CIDF Sluice Valves of 200 NB Size

10.10.3.3 PUMP SET FOR DISCHARGE OF CLARIFLOCCULATOR SLUDGE INTO SLUDGE LAGOONS

No of pump sets provided	: 2 (1W +1S)
Type of pump	: Similar to above
Discharge capacity (each)	: 125 m ³ /hr @20 m head
Note:	Clarification sludge is expected 3% of 3500 m ³ /hr, i.e., 105m ³ /hr. There above capacity selected.
Point of discharge	: To Sludge Lagoons
Type Of pipe Line (MOC)	: CI/DI/MS of 200 NB
Type of Valve	: 200 NB CIDF Sluice valve.

10.10.3.4 AGITATORS IN ALL 3 NOS RESERVOIRS

No. of Agitator	: 2 (Two) Per Reservoir, i.e., total 6Nos.
Type of Agitator	: wall mounting type like exhaust fan for agitation of push the sludge water pump suction.
Nos of Agitator	: SS-316/FRP/EQ.
Electrical Connection	: To be more suitably
Size of Agitator	: Will be priced by the Manufacture during detail design.

10.10.3.5 COMMON ITEM IN PUMP HOUSE

Since all the 3 nos. reservoirs are bodily attached side by side, a single pump house is envisaged. The pump house sizing shall be dependent on the type of pumps selected. If it is horizontal centrifugal type of pumps selected than a pump house needs to be constructed with positive suction of pump sets and plinth level of 600 mm above HFL. If submersible or vertical non-clog pumps are used a platform may be constructed 600 mm above HFL to locate pump sets. Submersible type shall be pulled to the top by means of a 2 MT cap. chain pulley block, manually operated. Submersible pump up-down is made through guide fixed on wall. Hence the following are must:

1-No. – 2 MT cap. manually operated travelling chain pulley block for handling pump sets.

1-No. – MCC for operating all pump sets, Agitator's drive motor, dewatering pumps illumination, exhaust forms, etc.

2-Sets – Dewatering pump of 10 m³/hr @ 20m head (1W+1S) complete self-priming type with GM screwed valves & G.I. pipes.

Chapter 11 : WATER TREATMENT PLANT(WTP)

11. Water Treatment Plant (WTP):

On the basis of a combination of results of field surveys and initial data collection including raw water sample, an economic and user friendly conventional design have been adopted in water treatment plant. The assumptions, detailed design criteria with recommended IS codes and practices have been included in this report.

The design report with respect to the water treatment plant includes the following:

- a) System Design
- b) Design period and phasing
- c) Water (Raw and Treatment) qualityA
- d) Prioritization
- e) Design criteria and plant layout
- f) Broad design consideration for civil work
- g) Broad design consideration for electromechanical works

11.1. System Description:

Treatment of raw water will take place in the proposed water treatment plant. Raw water will be pumped from river Subarnarekha, around 20 km away from WTP with the help of pumping machineries and raw water transmission main. Raw water pumping machineries will be constructed and installed on a jetty type pump house located at Chatinda Mouza in Kolaghat Block. Raw water will be treated by conventional treatment process (Clariflocculator for sedimentation and rapid gravity filters with conventional rate of filtration) for further transmission to the consumer of command area duly disinfected by chlorine. The command area comprises Panskura-I in Purba Medinipur district and Pingla and Kharagpur-II block in Paschim Medinipur district.

The capacities of different systems of WTP is detailed below:

- a) Running hours of WTP in a day = 20 hrs.
- b) Input capacity of the treatment plant = 70 MLD (3500 m³/hr)
- c) Output capacity of the treatment plant = 66.5 MLD (3325 m³/hr)
- d) Location of WTP site = Laskardighi Mouza in Panskura-I Block

Note: The output capacity has been designed/ determined on the basis of consumer requirement (55 lpcd) in the command area at Panskura and Pingla.

11.2. Design Period and Phasing:

Water Treatment plant is designed for a period of 30 years considering the directives of PHED, Government of West Bengal with 55 lpcd for entire population of 10, 15,575 in 2052 calculated with increase in population based on current census population available in the year 2011.

11.3. Water Quality:

11.3.1. Raw Water:

Raw water of river Rupnarayan at the proposed intake point collected from the nearby Laboratories is appended below or attached/enclosed in annexure –

With seasonal variations it is expected that maximum turbidity maybe in the region of 1000 to 1500 NTU whereas during lean period it may be 150 to 250 NTU. The basis of design of water treatment plant have been considered accordingly with other parameters available in raw water.

11.3.2. Treated Water Quality:

The treated water quality from the water treatment plant constructed under this project shall confirm to the criteria as lay down in IS-10500 (latest edition).

However, as far as the turbidity is concerned, every Endeavour has to be taken for achieving less than 1.0 NTU and nothing beyond 1.5 NTU.

11.4. Prioritization:

The following criterias are to be address:

- a) A land free from any hindrances need to be handed over to the Turnkey Contractor before taking up the construction and installation works of WTP. Sufficient land in the figure has already been acquired by PHE Dte. for such construction.
- b) Development of the land shall be made in such a fashion that the finished ground level (FGL) is above flood level (HFL).
- c) Prior to the construction work of WTP, the entire area already earmarked shall be provided with boundary wall with Gates etc. for proper protection during construction.
- d) 415 v constructional power shall be arranged and provided near or at a fixed place within WTP area and thereafter all enabling work shall be carried out by the contractor agency at his own cost including payment towards consumption.
- e) Construction water shall be arranged by PHED at a dedicated point near WTP for contractor to carryout balance plumbing work by themselves at their own cost. However, it shall be informed to the contractor that in case supply by PHE Dte is not feasible the contractor shall arrange the same without imposing any claim to the client, but client shall assist contractor to overcome situation.
- f) Temporary Bond within WTP area or nearby is to be made available by PHE Dte during construction for storing cement, bar etc. godown (constructional material and equipment), fabrication yard, and site office, Labour hutments etc. for contractor's use and this area shall be handed over to PHE Dte in cleaned condition once the contract period is over.
- g) Provision of 33 KV/11 KV power supply in substation shall be arranged by PHE Dte at their cost for dedicated power supply during commissioning, trial run and of course for O&M (operation and maintenance) period from WBSEDCL and all cost involved shall be paid by PHE Dte. However, necessary electrical and instrumentational work required for WTP shall be arranged by the contractor at their own cost.

11.5. Design criteria and plant layout:

Design of different units of the water treatment plant is based on the guidelines provided in the manual of water supply and treatment prepared by the expert Committee of Central Public Health and Environmental Engineering Organization (CPHEEO), Ministry of Urban Development, New Delhi (latest edition).

The raw water will be pumped from river Rupnarayan at intake Jetty Pump House and conveyed through 1 No. 900 mm dia DI pipeline (normal flow considered as 3500 m³/hr for 20 hours $\geq$ 70 MLD), i.e., transmission main laid up to inlet chamber at WTP for further treatment.

The plinth level of all buildings shall be 600 mm above FGL (FGL is considered same as HFL).

Since the existing ground level is lower to HFL or FGL of approx. 5.0 m lot of earth filling need to be considered and in these regard PHE Dept must give the guidelines to contractor for collection of earth filling. However, compactness of soil may not be available within a short time and accordingly contractor shall be informed of taking the command in the existing ground level for stability where the soil SBC and sub-soil water consideration is better/acceptable.

All the units of water treatment plant shall be designed for an input flow of 70 MLD in 20 hours, i.e. 3500 m³/hr to achieve an output of approx. 66.5 MLD in 20 hrs. i.e. 3325 m³/hr. However pipes, channels, gates, valves etc. shall be capable of taking 20% overloading (i.e. 4200 m³/hr) including units and also much adverse result should be eliminated.

Plant layout shall be drawn to eliminate wastage of land and operators friendly manner. Approach to various units for maintenance personnel shall be taken care of.

11.6. Broad design consideration for Civil works:

11.6.1. *The entire Water Treatment Plant shall be resting on RCC cast-in-situ driven piles. The minimum thickness of walls of water retaining structure shall not be less than 150 mm.*

11.6.2. *All design shall be carried out as per latest IS codes of practice and considering all combination of loads as suggested in relevant IS codes of practice.*

11.6.3. *The inlet collecting chamber, open channel with parshall flume, flash mixtures, channels clarifloculator Rapid Gravity filters etc. shall be in reinforced concrete, whereas the chemical house, and chlorine house, filter annex building, covered pipe gallery portion of filter house and other utility building shall be in reinforced concrete framework with 250 mm thick non-load bearing brick walls with plastering.*

11.6.4. *The site of the proposed water treatment plant is a low lying area and shall be developed and raised to an acceptable finished ground level (FGL).*

11.6.5. *The foundation system shall consist of deep cast-in-situ RCC driven piles of adequate size and number of piles under the structures are to be designed in such a way that these piles are capable of carrying full downward load at normal operating condition taking no relief from sub-soil pressure as well as capable of taking full upward tension due to sub-soil water pressure assuming structures are in empty condition.*

11.6.6. *The concrete mix of piles shall be of M30 grade having cement content not less than 400 kg/m³. The reinforcement in piles shall be in conformity with the specifications given in IS-2911 and shall be provided for the full length of piles.*

11.6.7.

11.6.8.

11.6.9. IS specifications to be referred for civil works.

A list of some Indian Standards is given below which is by no means exhaustive.

The standards shall be of the latest version (may be revised) and shall be followed for design and construction of different structures.

1. IS 456 : Code of practice for plain and reinforced concrete
2. IS 875 : Code of practice for loading standards
3. IS 3370 : Code of practice for concrete structures for the storage of liquids
4. IS 2911 : Cast-in-situ driving piles
5. IS 1893 : Earthquake design
6. IS 800 : Code of practice for the use of structural Steel
7. IS 226 : Structural Steel
8. IS 1542 : Sand for plaster
9. IS 1235 : Flooring tiles cement concrete
10. IS 1443 : Cement concrete flooring tiles
11. IS 10262 : Mix design
12. IS 269 : Ordinary rapid hardening and low heat Portland cement
13. IS 515 : Aggregate for use in mass concrete natural and manufactured
14. IS codes further specified in CPHEEO manual.
15. National Building codes of India.

11.6.10. Functional and Hydraulic design:

Based on the analytical reports of the raw water of river Rupnarayan at Chatinda, Kolaghat and from our experience as per CPHEEO manual, it is recommended to adopt the following lines of treatment to achieve the treated water quality as in IS-10500.

SL NO.	PROCESS	FUNCTION
1	Pre-chlorination	Biological control (removal of organic matters, Algae, etc.)
2	Alum and polyelectrolyte dosing and mixing	Coagulation of fine suspended impurities for a better settlement.
3	Flocculation	Promotion of floc sizes.
4	Clarification/ Sedimentation	Removal of flocs of Suspended matter in Clariflocculators.
5	Filtration	Final clarification of arresting carries over of Clariflocculator. for achieving clear water in Rapid Gravity Filters.
6	Disinfection by post chlorination	To eliminate the last trace of organic matter, bacteria.
7	backwash wastewater recycling	Recycling of settled backwash wastewater (max. of 5% of input capacity) to avoid wastage as far as possible.
8	Sludge handling	Collection of sludges developed/ during operation, thereafter settlement in Lagoons for further disposal of solids by truck, etc.

11.6.12. Throughput to Water Treatment Plant (WTP).

The output of the WTP is considered 66.5 MLD (3325 m³/hr) as per the demand of 55 lpcd calculated by & consumers at the end of 30 years, i.e. approx. the year 2052 (considered and of construction and installation by 2025). It is mandatory to consider 5% additional raw water over and above 66.5 MLD which is the plant wastage in desludging of sedimentation units and backwash wastewater of R.G. Filters and therefore the input will be $66.5 \div 0.95 = 70$ MLD (3500 m³/hr). The plant as per the norms of the PHE Dept. is to run for 20 hours a day the hourly input will thus be 3500 m³/hr.

11.6.13. Overload of treatment units.

All endeavors are to be made by overloading the entire plant to the tune of 20% without much affecting the quality of treated water. However, this overloading shall be restricted for a few hours (say half a day) of operation and during this period no units shall be overflowed.

11.6.14. Tentative Layout of the WTP.

A tentative layout of WTP has been prepared and produced in enclosed Drg. No. This layout has been prepared based on the availability of earmarked dedicated land provided by PHE Dte.

11.6.15. Head Loss.

A tentative Hydraulic Flow Diagram (HFD) showing the head losses from the inlet collecting chamber to Clear Water Reservoir (CWR) for normal design flow is presented in Drg No. Since the WTP is to be constructed on a filled-up soil, we have indicated the CWR resting on the existing ground level as a Ground-level reservoir (GLR). During detail engineering the successful vendor/contractor will be called for elaboration with detailed hydraulic calculations to satisfy the HFD (to be approved. by the consultant as well as the Client) before going ahead with the Constructional activities.

11.6.16. Chemical Administering Points/location.

The location of coagulates and other chemical mixing points are appended below;

SL NO.	POINT OF APPLICATION	CHEMICAL TO BE USED
1	pre-chlorination at inlet collecting chamber	Chlorine
2	At hydraulic jump of Parshall flume	Alum (Coagulant)
3	At the exit of water from the inlet shalt of clariflocculator	Poly-electrolyte (PE) (Coagulant)
4	Post chlorination at the exit of clear water of R.G. filters leading to clear water reservoir (CWR)	Chlorine

Quality of Chemicals.

- 1. Alum** - Solid Alum (Ferric) shall be procured which should contain 13 to 17% of Alumina (Al₂O₃).
- 2. P.E.** - Available in 98 to 100% purity in the liquid condition which shall be free from toxicity and suitable for potable water (human consumption).
- 3. Chlorine** - Available in 100% purity in liquid condition in cylinders or ton containers.

Notes on Chemicals:

(A) Chlorine is less soluble in water and hence every precaution needs to be taken to dose chlorine solution (prepared under pressure) in submerged conditions through UPVC diffusers. This is at the Inlet collecting chamber and clear water channel leading to CWR.

Chlorine is hazardous and hence gas mask/oxygen mask, hand globes, etc. shall be worn by Operators while Raddling chlorin.

(B) Liquid Alum or PAC (Poly Aluminium Chloride) may be used if available easily in place of Solid Ferric Alum.

11.7. Broad Design consideration for Electro-Mechanical Works -

- 11.7.1.** Material of Construction (MOC) of various equipment/materials shall be considered suitable for the different operating conditions to avoid any damage within no time.
- 11.7.2.** All equipment, materials, Stirrer- agitator, fabricated items, etc. shall be robust in nature.
- 11.7.3.** Filter sand and gravel/grit shall be graded as per IS Code.
- 11.7.4.** All reduction gears used in WTP along with an electric motor shall be sturdy in construction.
- 11.7.5.** All clear water pumps at the clear water pump house and elsewhere shall be of horizontal Split casing (HSC) pump.
- 11.7.6.** All pumps handling Sludge water or backwash wastewater shall be the horizontal or vertical non-clog pump, there may be or submersible type of submersible non-clog pump.
- 11.7.7.** The delivery header of clear water pumps at clear water pumps house shall be provided with an electromagnetic type flow meter, turbidity meter, etc. With indicator, digital recorder, etc.
- 11.7.8.** All ultrasonic flow meters state has local indicator plus remote panel-mounted totalizer, indicator, etc. and the accuracy Should be $\pm 2\%$.
- 11.7.9.** A list of some Indian Standards is appended below. To be followed while doing procurement:
 - a)** IS-14846 - Sluice Valve for waterworks purposes (50 to 1200 mm size)
 - b)** IS - 13095//IS -5155 - Butterfly Valves for General purposes
 - c)** IS- 5312// IS-12334 - Swing Cheek type Reflux (Non-return) valves for Waterworks proposes.
 - d)** IS- 10553 - Part 1 and 2 Requirements for Chlorination Equipment.
 - e)** IS-15310 - Hydraulic Design of pump Sumps and Intakes-Guidelines.
 - f)** IS- 13349- Measurement of liquid flow in the open channel - Parshall Flume.
 - g)** IS-13349//IS-3042 - C. I. Sing lad faced thimble mounted sluice Gate.
 - h)** IS-4985 - unplasticized Pvc pipe for Potable water System.
 - i)** IS-1710 - Specifications for Vertical Turbine Pumps for clear, cold, freshwater.
 - j)** IS-8329 – Centrifugally Cast (Spun) Ductile Iron pressure pipes for water, gas Sewage.
 - k)** IS-9523 - Ductile Iron fittings for pressure pipes for water, gas, and sewage
 - l)** IS-4484S – Tempered proof kinetic air valve.
 - m)** IS – 3589 – M.S. Pipe, spirally welded ERW, Fe410.
 - n)** IS-1239 - Specification of G.I. Pipe, and M.S. Steel tubes, and fittings.
 - o)** IS-1520 - Horizontal centrifugal pumps for clear, cold, freshwater.
 - p)** IS-325 - Three-phase induction motor.
 - q)** IS-3025 – Material of sand filling and test (physical and chemical) water and wastewater (37 parts).

11.7.10. The following items shall be considered while preparing Tender Documents to be included.

- a) Laboratory Furniture.
- b) Laboratory Equipment.
- c) Laboratory chemicals.
- d) Sampling Table.
- e) Tools and Tackles.
- f) Office cum office furniture
- g) Surveillance camera for cc tv.
- h) 30 MT Capacity Weigh Bridge.
- i) Portable type fire extinguisher
- j) Portable type dewatering / dredging Pump sets.
- k) Scaled Model of WTP with lights.
- l) Illumination in WTP as well as yard lighting.
- m) Lightning arrestor (protection system).
- n) Emergency. lighting during power. dis-connection.
- o) Telecommunication system.
- p) SCADA (supervisory control and Data Acquisition) system.

11.8. Unit-wise Plant Features & Design criteria. The following features are suggested to be taken into consideration for a better operation of WTP:

11.8.1. Inlet collection chamber

No. of unit	1 (One)
Flow considered	3500 m ³ /hr (70MLD in 20 hrs)
Retortion time	60 sec. (min)

11.8.2. Open channel with Parshall flume

No. of unit	1 (One)
Flow-through channel	3500 m ³ /hr
Design of Parshall flume	As per IS-14371-1996

11.8.3. Distribution Chamber

No. of unit	1 (One)
Distribution to	4 (Four) Nos. flash mixers and Clariflocculators
Type of equal distribution	Through RCC weirs

11.8.4. Flash Mixer

No. of unit	4 (Four)
Flow/unit	3500/4=875 m ³ /hr
Desertion time	60 sec. (min)
Velocity Gradient (G)	More than 300 Sec -1 as per the CPHEEO manual
Agitator	Turbine type impeller
MOC of Agitator	SS-304
Other Item	As per the CPHEEO manual

11.8.5. Clarifocculator:

Sl. No.	Particulars
1	No. of Unit = 4 (Four)
2	Type of Clarifocculator = Conventional
3	Flow considered = $3500 \div 4 = 875 \text{ m}^3/\text{hr}$ (Each Flash Mixer will deliver coagulated & mixed raw water into a dedicated clarifocculator)
4	Detention time = (i) Minimum 30 minutes in flocculation zone, & (ii) Minimum 2.5 Hrs (150min) in clarification zone. <u>Note:</u> The bottom conical portion shall not be considered while calculating volume.
5	Surface rating/ loading = Maximum $32 \text{ m}^3/\text{hr}/\text{m}^2$ (With 20% overload this will be $38.4 \text{ m}^3/\text{day}/\text{m}^2$)
6	Weir loading = Nothing beyond $300 \text{ m}^3/\text{d}/\text{m}$ even during 20% overloading. (Weir may be of V-notch or orifices around the periphery of clariflocculator)
7	Floor Slope = 8.33 % (1 in 12)
8	Sde water depth = 3 to 4m
9	Velocity gradient (G) in Focculator = 10 Sec -1 to 75 Sec-1
10	Range of GT = 10^4 to 10^5
11	Free board = 0.5 m
12	Telescopic bleed = 100 mm dia minimum
13	Desludge pipe = DI-K7 and not less than 300mm dia
14	The total area of Focculator paddles = 10 to 25% of the cross-sectional area of the Flocculator portion. 4 Nos. paddles are to be provided in each Flocculator
15	MOC of Flocculator Paddle and rotating bridge = MS with epoxy coating after sandblasting for surface preparation. Primer & epoxy each of 2 coats
16	The bottom fit of Scraper = Rubber squeezers
17	Location of collecting launder = Outside or inside (if inside, surface loading shall not be calculated for such area)
18	Walkway around Clarifocculator = 900 to 1000 mm wide RCC walkway with double row minimum 25mm dia GI handrailing with approach ladder 750 mm minimum wide from the ground floor (FGL)
19	Rotating bridge with a walkway = Min. 10m wide rotating bridge spanning one end of Clarification zone and suitable on Flocculation zone (to be approved by Client) with MS Grilled or chequered plate of 6 mm thick with toe guard for entire length either on Side.
20	Velocity through launder = Not more than 0.4m/sec

21	<i>Electrical Arrangements for Bridge and Flocculator paddle drive motors</i>	= Kiosk type located on Rotating bridge with incomer, bus bar & outgoing suitable with suitably drawn power cable as per regular practice.
22	<i>Lights on Rotating bridge</i>	= To be provided.

11.8.6. Rapid Gravity Filter Beds

Sl. No.	Particulars	
1	<i>No filter bed</i>	= 12 (10 W + 2S)
2	<i>Type of filter bed</i>	= Conventional twin-section open gravity type.
3	<i>Flow-through each filter bed</i>	= $3500 \div 10 = 350 \text{ m}^3/\text{hr}$. Note: All beds shall be suitable for 20% overload without affecting the quality output of clear water.
4	<i>The normal rate of filtration</i>	= $4.8 \text{ m}^3/\text{hr}/\text{m}^2$ with 20% Overload not exceeding $6.0 \text{ m}^3/\text{hr}/\text{m}^2$
5	<i>Rate of Air Scouring during backwash</i>	= 700 to 900 lpm/m ²
6	<i>Rate flow of water during backwashing</i>	= 450 to 600 lpm/m ²
7	<i>Depth of filter media:</i> <i>(a) Sand</i> <i>(b) Gravel</i>	= Not less than 650mm deep. = Not less than 500 mm deep of /in 4-layers (150 mm, 100mm, 100 mm, and bottom 150mm deep)
8	<i>The total depth of water in a Filter bed</i>	= Min. 2.5m inclusive of filter media.
9	<i>Quality of filter water</i>	= Turbidity is not more than 1.0 NTU and others generally as per IS-10500.
10	<i>Underdrain System</i>	= UPVC perforated lateral pipes of 80 mm ID approximately fixed on Rcc Tees or false bottom with PVC nozzles, etc. This part may be left to the vendor/contractor to decide underdrain system as they are to satisfy quality.
11	<i>Operating Valves & Gates</i>	= All valves and gates shall be complete with Electrical Actuator operated from a console one in each bed with PLC based. BFV or SV or Gates may be used for Inlet, Cutlet, Wash, waste, and Air isolations. Preferable sizes: a) Inlet : 400 x 400 Gate or 450 mm dia Gate/BFV/SV b) Outlet: 350 mm dia BFV c) Wash: 500 mm dia BFV d) Waste: 600 mm dia BFV/SV or 600 x 600 Gate

		e) Air:	250 mm dia BFV.
12	Velocity in inlet channel of filter House	=	Not above $0.6\text{m}^3/\text{Sec}$
13	Velocity in outlet channel	=	Not more than $1.00\text{ m}^3/\text{sec}$
14	Control System	=	Though double beat control Valve (1 No / filter bed) wither accessories which are suitable for slow start arrangement. The same size of outlet valve shall be provided in Control Valve.
15	Interconnecting pipes & fittings	=	DI or MS or CI
16	Other parameters	=	As per CPHEEO Manual

Notes On Filter Beds

- a)** All Sluice gates or valves or BFV (Butterfly valves) shall be operated through coupled electrical actuator and operations shall be semi-automatic through a console (One for each filter) based on pre-set PLC (Program Logic Control) operation.

If SCADA is introduced in WTP, all indicators shall be repeated in a Panel located in a control room, preferably in the Filter House Annexe Building. Even filter operations may be carried out from the control room also.

- b)** Filter media, both sand, and gravel shall be graveled and conforming to IS:8419(Part-III)
- c)** Special care shall be taken while backwashing of filter bed to check so that it delivers less than 1.0 NTU turbidity quantity as well as no loss of filter sand. However, it is recommended to scrap 100mm to 150mm of the sand layer from all beds once every 2 years of operation and replenish it with fresh sand. This will increase the operation of the filter bed very smoothly.
- d)** The operating arrangement of Air Blowers shall be made available in each console with Switches and indicating lamps.
- e)** ROF (Rate of Flow) and LOH (Loss of Head) indicators shall be displayed in each Filter console along with other operating switches and indicating lamps.
- f)** UPVC pipe provided in underdrain system shall withstand a pressure of Kg/cm² and shall be conforming to IS- 4985

- g)** Gravel and sand sizes shall be as follows:

<u>Particulars</u>	<u>Size</u>
150 mm deep gravel at the bottom layer	: 50 mm X 25 mm
100 mm deep gravel at the next upper layer	: 25 mm X 13 mm
100 mm deep gravel at the next upper layer	: 13 mm X 6 mm
150 mm deep grit at the top layer below the sand layer	: 6 mm X 3 mm
650 mm deep sand layer at the top	: 0.45 mm X 0.7 mm

- h)** The duration of operation of filters shall be min. 24 Hours run with max LOH of 1.8 m with less than 1 NTU Turbidity and in such case the output of Clariflocculators shall not exceed 15 NTU (Preferably with 10NTU)
- i)** Control valves may be the doubled-beat open type or as preferred by the vendor or closed venturi type. However, vendor/contractor shall authentication having used in 2 or 3 installations where running satisfactorily.

- j) Filters shall be provided with automatic slow start arrangement equipment so that normal designed flow is slowly obtained in 15 minutes approx. A rewash manually operated sluice valve may be provided in the control inspection chamber to dewater excess water into the drain during this 15 minutes.*
- k) The discharge pressure of Air Blowers shall be 0.4 Kg/cm² (4000mmWG). There shall be a minimum of 2 Sets of Air-Blower with (1W+1S) concept.*
- l) The OHR (Over Head Reservoir) for backwashing of filter and other utilities shall have a capacity of 700 cum. Filling pumps shall be suitable to fill in 1.5 Hrs. of time, i.e capacity shall be 470 m³/hr. 2nos. Pumpsets (1W+1S) shall be provided for filling OHR. This OHR shall have a separate identity and be constructed near the filter house suitably. The pumps shall be of HSC(Horizontal Split casing type and located in the clear water pump house or elsewhere in the filter house or in the filter Annexe building as preferred by both vendor and client (PHE Dte.). OHR shall have the usual features of approach stair. From ground with walkway, overflow and delivery cum drawing arrangement, Air Release, Lightning arrestor, etc. A visible level Indicator shall also be provided (Visible from OHR).*
- m) The mainline for backwashing shall have an electrical flowmeter (magnetic type) inside the filter house with an indicator for the benefit of operators to check the flow as well as repeat indication, totalizer, etc. into the control panel in the control room. Pipeline from OHR for other utilities shall be drawn from OHR separately and no topping on the backwash line is acceptable. A dedicated line separately may be drawn for operating Booster pumps to operate vacuum gravity feed chlorinators.*
- n) Filter waste generated during backwashing shall be taken into a reservoir of approx. 400 m³ capacity from the clear supernatant will be recirculated into the system. The cap. Is approx. the volume is 10 min backwashing. Suitable non-clog type pumps (vertical /Horizontal /submersible) to be in a pump house adjacent to a waste water reservoir is the (1W+1S) or (2W+1S) concept. While calculating volume, the channel collecting backwash wastewater on either side of filter beds may be taken into account.*
- o) The 12 nos. filter beds (Twin type) shall be located in 2 rows, i.e. 6nos. in each row with a distance between filters as 8 m (2.8 m for each pipe gallery, 1.8 m for clear water channel, and balanced as wall thickness).*
- p) Others not specified above but required in the system shall follow the CPHEEO manual.*

11.8.7. Clearwater Ground level reservoir at WTP:

No. of GLR	: 01(One)
No. of Compartment	: 02(Two)
No. of Common Sump adjacent to clear water pump house	: 01(One)
Volume Required	: 1 Hour cap. With 20% OL, i.e 4200 m ³
Volume Comprises	: 2 Nos. comp. + 1 no. Common sump, total 4200m ³
Depth of water	: 3.5 to 4.0 m
Inlet of Reservoir	: 1 Nos. Sluice Gate for each Compartment (Square)
The outlet of Reservoir to common Sump	: 1Nos. Sluice Gate (Square or Circular) for Each Compartment
Overflow of Bath compartment	: To be Provided as per requirement
Comp. & Common Sump	: 6nos. Total manhole to be provided (2nos. In each comp.)
Air Release arrangement with net etc	: As per IS Code

11.9. Chemical House & Dosing System:

A 2-storied chemical house building has been selected, each floor of approx. 350 m² area.

Ground Floor:

- Chemical Storage Space for 3 months operation of normal design flow.
- Platform Dial type 1.0 MT capacity weighing machine.
- Stair case.
- Toilet.
- Corridor for movement.
- Area Required (approx.)-

Alum Store	-	200 m ²
Stair Case	-	20 m ²
Toilet	-	10 m ²
PE Store	-	70 m ²
Corridor, etc	-	50 m ²

**Note: - Area for Alum & PE one suitable for 3 months of operation.*

First Floor:

- 3 Nos. (Three) Alum solution preparation RCC Tank with internal lining by FRP/ acid proof tiles or epoxy coated suitable for dosing max. 50 ppm dose @ 10% strength of the solution, 8 hrs. duration.
- 2 (Two) or 3 (Three) nos. Polyelectrolyte Solution preparation tanks of RCC or ML with lining as FRP on RCC or MSRL suitable for dosing max. 1.5 ppm dose @1% strength and 8 or 12 hours volume.
- 2 (Two) nos. Metering Pumps for Alum Solution delivery to Parshall Flume.
- 2 (Two) nos. Metering Pumps for PE Solution delivery to exit of Flash Mixers or in Distribution Chamber.
- 2 (Two) nos. MSRL constant head tank, one each for Alum Solution & PE Solution for dosing desired quantity by gravity in case of failure of Metering Pumps.
- 1 (One) no. Electrically operated hoist (CPB) for lifting chemicals from the ground floor.

- Area Required (approx.)-

i) Stair Case	-	20 m ²
ii) Toilet	-	10 m ²
iii) Solution preparation & dosing area	-	150 m ²
iv) MCC room	-	30 m ²
v) Operator's room	-	30 m ²
vi) Laboratory	-	50 m ²
vii) Corridor & Passage	-	50 m ²

Few more information are appended below:

Sl. No.	Particulars	Alum Dosing Device	PE Dosing Device
1.	No. of Preparation Tanks	3 (Three)	2 (Two) or 3 (Three)
2.	MOC of Preparation Tanks	RCC	RCC or MS
3.	Internal lining of Preparation Tank	FRP/Epoxy/Acid proof tiles for RCC.	FRP/Epoxy/Acid proof tiles for RCC Or Rubber lining for MS.
4.	MOC of Agitator	AISI-316 turbine type impeller	AISI-316 turbine type impeller
5.	Metering Pumps		
	(a) No. of Pump	2 (1W+1S)	2 (1W+1S)
	(b) Type of Pump	Diaphragm Type	Plunger Type
	(c) Discharge Capacity	2500 LPH	650 LPH
	(d) Discharge Pressure	As per system requirement but not less than 20m (2 kg/cm ²) head.	As per system requirement but not less than 20m (2 kg/cm ²) head.
6.	Rotational Speed of Agitator	20 to 40 rpm	20 to 40 rpm
7.	Type of Valves		
	(a) Feed Water	GI	GI
	(b) Chemical Solution	Diaphragm/Ball	Diaphragm/Ball
	(c) MOC	SS-316/pp	PP/PVC/SS-316
8.	MOC of Pipe Materials	SS/UPVC/MSRL/FRP	SS/UPVC/MSRL/FRP
9.	Level Indicator in Preparation Tank	Capacitance Type with Digital Indicator.	Capacitance Type with Digital Indicator.
10.	Hoist	1 MT Electrically operated monorail hoist (CPB). 1 no. manually operated in addition to above in case of failure of electrically driven hoist.	
11.	Bottom level of Preparation tanks	1.5 m above from the top of Parshall Flume to permit gravity flow in case of failure of Metering Pump.	1.5 m above from the distribution chamber to facilitate gravity flow in case of failure of Metering Pump.
12.	Head Room from top of Preparation Tank	1.8 m from bottom of beam.	1.8 m from bottom of beam.

11.10. Chlorine House & Dosing System:

Chlorination (Pre & Post)

From our experience, we have proposed 5 ppm dose for pre-chlorination and 2 ppm dose for post chlorination shall satisfy disinfection accordingly-

Sl. No.	Particulars	Pre	Post
1.	No. of Chlorinator	2 (1W+1S)	2 (1W+1S)
2.	Capacity of each Chlorinator	20 Kg/hr	7.5 Kg/hr
3.	No. of Booster Pump sets (Pump + Motor)	2 (1W+1S)	2 (1W+1S)

4.	Point of application of chlorine solution	At the bottom of Inlet collecting chamber sub-merged from top and discharge through PVC diffuser.	At the outlet of clear water reservoir under sub-merged condition and discharge through PVC diffuser.
5.	No. of Chlorine Tonner (Approx. 900 Kg)	Min. 14 Nos. <i>Note:</i> Vendor to conform for 2 months operation with 3500 m ³ /hr flow.	Min. 6 Nos.
6.	Type of Chlorinator	Vacuum gravity Feed Type	Vacuum gravity Feed Type
7.	Discharge capacity and pressure of Booster Pump	To be decided by vendor (as per Manufacturer)	To be decided by vendor (as per Manufacturer)
8.	Pressure Indicator/ gauge	Min. 100 mm dial size, bourden type for each pump.	Min. 100 mm dial size, bourden type for each pump.
9.	Type of Booster Pump	Horizontal Centrifugal	Horizontal Centrifugal
10.	Valves of Booster Pump	Sluice/Gate Valve (PN rating as per discharge pressure)	Sluice/Gate Valve (PN rating as per discharge pressure)
11.	Type of valves & fittings including pipes handling chlorine gas and chlorine water	As per Chlorinator Manufacturer's recommendation.	As recommended by Chlorinator Manufacturer.
12.	Chlorine Solution Delivery Pipes	UPVC with dosing through PVC diffuser	UPVC with dosing through PVC diffuser

Other information on Chlorination:

- a) The chlorination system shall be as per IS-10553.
- b) 1-No. 3 MT capacity gantry girder crane shall be in Chlorine Tonner room for handling Tonne container.
- c) 20 Nos. Tonne container shall be placed in 2 rows.
- d) The size of rooms are-
 - Tonner Room– Area shall be minimum 150 m² (15m X 10m)
 - Chlorinator & Booster Pump Room– Area shall be minimum 100 m² (10m X 10m)
- e) A Chlorine Absorption System shall be provided for neutralization of leaked gas, if any. This consists of an Absorption Tower on top of a Caustic Soda (NaOH) solution chamber of approx. 20 m³ volume along with 2 sets of Air Blower (1W+1S) for drawing leaked chlorine gas from Tonner room to the tower and 2 sets (1W+1S) of Caustic Soda recirculation pump. This system is available with the Chlorinator Manufacturer. The open area of 50m² (10m X 5m) will be required for locating all equipment.
- f) Dynamometer shall be provided and fixed to the hook of hoist which shall indicate the weight of a chlorine Tonner of 3.0MT.
- g) A Yoke for holding chlorine Tonner shall be required and to be procured.
- h) The following safety equipment shall be must in Chlorination Handling System:
 - Emergency Repair Kit --- 1 Set

- Cannister Type gas mask --- 4 Sets
 - Air Breathing Apparatus --- 2 Sets
 - Aprons, Goggles, Hand Gloves, etc. --- 4 Sets
 - Tools and Tackles provided by chlorinator manufacturer --- 1 Set
 - A glass cabinet storing above and located just by the side of room --- 1 Set
- i) Chlorine gas is hazardous and cause injuries to human in breathing and even cause death. Hence every equipment and system shall be handled very carefully.
- j) An eye wash fountain shall be placed near to chlorine handling area.
- k) Entire chlorination system shall be procured and installed as per rules laid down by Indian Explosive Act.

11.11. Sludge Water and Backwash Waste Water Handling:

Sludge or waste water generated need to be handled properly otherwise more settlement, choking, etc. will happen. This is a problem in any WTP. Accordingly, we give below some alternative for client's approval:

Proposal #1

Since the proposed WTP area is lower than the HFL, which is an occasional feature, the entire sludge and waste water may be collected alternately in 2 Nos. (1W+1S) Lagoon each suitable for holding solids in waste water for 3 months. Every 3 months one which is functioning will be taken out for manual cleaning and the other will be a sump cum pump house which will receive the decanted water from lagoon. 5% of this water will be recirculated, which is approx. 175 m³/hr, into the Parshall Flume for treatment again. In this system both waste water from Clarifocculators and Filters will either gravitate directly into lagoon through waste pits or collected into a reservoir and pumped into Lagoons. If the Lagoons are located on the existing ground levels, every likelihood that entire water will gravitate into Lagoons but during flood condition it will be submerged.

Proposal #2

Considering HFL all the collecting reservoirs, pump houses, Lagoons, etc will rest on filled up soil (suitably considering FGL), during flood these will not sub-merged but functionally will obstruct for flood water everywhere including all units of WTP.

In this case separate reservoir are to be constructed for collecting sludge water of Clarifocculators and backwash waste water and pump house/houses shall be constructed adjacent to the reservoirs for pumping waste water to Lagoons. The entire quantity of supernatant will be drained towards river and recycling will be done only from the supernatant of backwash waste water. Here also only 5%, i.e., to the tune of 175 m³/hr will be recirculated because the WTP is already loaded by an additional 5% as stated above. Here also each Lagoon will hold 3 months solid and supernatant discharged to drain/ nallah, etc. 2 Nos. (1W+1S) Lagoon will be provided.

Proposal #3

(Modern method of Sludge Handling)

Entire Clarifocculators Sludge water and Filters backwash waste water will be collected into a reservoir and will be pumped into Thickener (s) along with a dose of Poly-electrolyte and sludge water. The thickened sludge will be collected from the bottom of the Thickener (s) and pumped to belt press Filter (s) or centrifuge for proper solid liquid separation. The solids are used for manufacturing bricks or filling of low-lying areas. The liquid coming out of centrifuges and supernatant of thickness are collected into a reservoir from where 5%, i.e., 175 m³/hr will be recirculated and balance may be drained. This is no doubt is costly and operators' attention of operation is necessary.

Details will be carried out by the vendors/contractors and PHE Dte. selects one of the proposals.

11.12. Plant Analytical Laboratory:

A small area in chemical house has been provided for immediate tests like pH, Turbidity, Residual Chlorine, etc, with a Jar Test apparatus.

The main laboratory may be located in Filter Annexe Building equipped with various equipment, apparatus, instruments, reagents, etc for carrying out physical & chemical test as far as practicable or required in WTP laboratory. Bacteriological Test may be conducted in the plant laboratory if desires by PHE Dte. Otherwise, weekly sample may be sent to nearest full-fledged laboratory to ascertain the presence of bacteria, coliform, etc.

A Chemist room also may be located adjacent to laboratory in the first floor of Filter Annexe building. Laboratory analyst/technician may sit in the laboratory.

Air Conditioner shall be provided as required. As per desired decision of PHE Dte., a list of equipment, apparatus, furniture, etc. may be recommended.

Glass wares and reagents shall be arranged once in 3 months interval.

11.13. Sampling Table:

One sampling Table with sun mica/granite top is required which have 3 Nos. clarity bowl (for raw, clarified and filtered water samples), one ss sink with required no. goose-neck faucets. Small pumps will be required for drawing samples into sampling Table. This may be located in Plant Laboratory.

11.13.1. Scaled Model of WTP - 1 No. of total WTP, 1 No. for Clarifocculator and 1 No. for RG Filter.

11.14. Power Distribution System of WTP

11.14.1. One 33 KV Power Supply from WBSEDCL shall be located in a sub-station for WTP. H.T switch Gear with Meter arranged by WBSEDCL shall be located in a room and this arrangement shall be made by PHE Dte. At their cost. The further arrangement shall be arranged by the bidder/contractor within their cost of WTP including cabling, etc.

11.14.2. Contractor/vendor has to arrange 1 no. 33 KV H.T switch gear in a room in Sub-station nest to WBSEDCL's room. This shall have 33KV VCB panel which shall have 3nos. outgoing VCB panel feeders as described below:

- 2 nos. (1W+1S) 33KV/0.415 oil-immersed naturally air cooled (ONAN) transformer. Transformers shall be provided with off-circuit Tap charger of tapping range ($\pm 2*2.5\%$). Transformers shall be either Indoor or Outdoor type.
- 1 no. Spear feeder.

11.14.3. L.T Switch Gear

There will be 2 nos. Incommer, one each from each Transformer and all outgoing Feeders shall be staggered on either side with a Bus-Coupler so as to receive power under all circumstances.

Tentative outgoing switches/feeders in the PCC is given below:

1. 2 nos Feeder : To incomer of Chemical House MCC including Flash Mixers.
2. 2 nos Feeder : To incomer of Chlorine House MCC

3. 2 nos Feeder : To incomer of Filter House MCC located in Annexure building. Clarifloculator operating Kisosk will receive from this MCC.
4. 2 nos Feeder : To incomer of MCC located in sludge Pump House. In case of thickener MCC for sludge handling will be located in Centrifuge Building.
5. 2 nos Feeder : To incomer of Clear water pump House MCC

The following items as also to be considered:

- a) APFC Panel.
- b) Capacitor Bank.
- c) Illumination within building as well as yard lighting /street Lighting.
- d) Battery & Battery Charger.
- e) UPS (Uninterrupted Power Supply).
- f) Closed Circuit VIDEO Monitoring (CCTV) system.
- g) Telecommunication System.
- h) Earthing of Entire plant.
- i) Lightning Protection System.
- j) Automation + SCADA System.

11.15. LIST OF INSTRUMENTS AT WTP

<u>SL No.</u>	<u>Location</u>	<u>Particulars of Instruments</u>	<u>Quantity</u>
1	<i>Inlet pipe of Stilling/Inlet Collecting Chamber</i>	a) On-Line Turbiditymeter- Nephelometric Measurement System (0 to 2000 NTU)	1 No.
		b) On-line pH-Meter (0 to 14)	1 No.
2	<i>Parshall Flum on Open Channel</i>	Ultrasonic type Flowmeter (0 - 4500/5000 m ³ /hr)	1 No.
3	<i>Rapid gravity filter beds (12 nos. Twin Section) (10W+2S)</i>	a) Rate of flow (ROF) indicator	12 Nos.
		b) Loss of head (LOH) indicator	12 Nos.
		c) Pressure gauge at air blower delivery	2 Nos.
		d) Flow Indicator of Backwash Inlet Pipe (Display at Filter gallery) plus remote Indicator & totalizer in control Room)	1 Set
4	<i>Alum Solution Dosing Device & metering Pump</i>	a) Capacitance type digital level indicator (0 to 2.5m)	3 Nos.
		b) Diaphragm type Pressure gauge on delivery of both Metering pumps.	2 Sets
5	<i>Poly-electrolyte (PE) Dosing Device & Metering Pump</i>	a) Capacitance type digital level indicator (0 to 2.5m)	2 Nos.
		b) Bourden type Pressure gauge/indicator on both delivery of both Metering pumps.	2 Sets
6	<i>Clear water Reservoir at Common Sump</i>	Capacitance or Suitable level indicator in CW sump	1 No.
7	<i>Clear water Pump House</i>	a) Compound Gauge	

		b) Bourden type Pressure gauge/indicator	
		c) On-Line pH Meter	
		d) On-Line Turbidity meter	
		e) Residual Chlorin Analyzer	
		f) Electromagnetic Type On-Line Flowmeter	
8	Sludge Handling Pumps	a) Diaphragm Type Pressure gauge	6 Nos.
9	Booster Pump for Chlorinator Operation	a) Bourden type Pressure gauge with isolation cock	4 Sets
10	Backwash OHR filling Pump	a) Bourden type Pressure gauge/indicator with isolation cock	2 Sets
11	OHR (Overhead Reservoir)	a) Level Indicator - Float & Counterweight or capacitance type-scale visible from ground level	3 Sets

CHAPTER 12 : CIVIL COMPONENTS OF WORKS

12.1 Intake

The location for the construction of an Intake arrangement has been selected as per the bathymetric survey report. The location is at Chhatinda Mouza (JL-285) of Panskura-II Block (22.45875° N, 87.87713889° E) for drawl of water from the river Roopnarayan. However, the actual pin-pointed Intake site for the withdrawal of 70.00 MLD water from the river has been finalized after proper investigation and with the concurrence of the competent authority.

The intake is a fixed type Jetty of 360 m² area, to be constructed on river Roopnarayan at the above-mentioned location with arrangement for housing Raw Water pipe and connected by carriageway (of about 120 m length x 4.0 m width) with the river bank.

12.2 Raw water main

Raw water main will be laid to supply raw water to WTP with the help of raw water pumping machinery. The raw water main is proposed to follow the shortest possible route, keeping in view the velocity considerations to avoid silting and other physical considerations. Provision has been made for embankment crossing by the Jack-Push method where required, restoration of roads, restoration of service connections, etc.

Ductile Iron (DI K9) pipe of adequate diameter and thickness has been proposed to use for raw water pumping main, for which all protective measures are to be adopted. For bends, road crossings, etc. MS pipe has been considered. A necessary resistivity survey along the pipeline route shall be undertaken for finalizing the degree of protective measures to be adopted for DI pipes.

12.3 Water Treatment Plant (WTP)

About 70 MLD (15.40 MGD) of raw water will be treated at the proposed conventional Water Treatment Plant to produce about 65 MLD of Clear Water. The location of WTP has been proposed in Laskardighi Mouza JL. No. 63 of Panskura-I block (22.41469163° N, 87.70564471° E). In the present scheme, the conventional process of treatment has been proposed to be adopted.

The WTP will consist of the following units:

- I. Inlet Well
- II. Inlet Channel with Parshall flume

- III. Flash Mixer with agitator
- IV. Clari-flocculator with a scrapper, bridge, flocculating paddles, etc.
- V. Rapid Gravity Filters with backwashing arrangement
- VI. Filter House, Laboratory, Office, SCADA Room, etc.
- VII. Chemical House
- VIII. Back Wash Tank (OHR)
- IX. Clear Water Reservoir (CWR)
- X. Clear Water Pump House
- XI. Sludge Pond and Pump House with sludge pumping and disposal arrangement
- XII. Sludge Pond for holding Sludge
- XIII. Sub-Station Building
- XIV. Transformer & H.T room
- XV. Pumps & Machinery & Electrical works
- XVI. SCADA and Instrumentation works
- XVII. Inspection Bungalow
- XVIII. Staff Quarters, Guard Rooms
- XIX. Administrative Building, Store and Stack Yard, etc.

Necessary provisions for the above items have been included in the DPR estimate. Provisions have also been made for Land Development, Retaining walls, Internal Roads and Pathways, and Boundary Walls. Beautification and Arboriculture etc. at Intake. Water Works and Zonal Head Worksites.

12.3.1 SCADA

As per the present norms of NRDWP and the latest circular of MDWS, Govt. of India's provision of SCADA is mandatory for schemes. Moreover, for minimizing dependence on manual operation and to achieve the best performance, good data acquisition, readily available of all records, and ultimate cost reduction in operation; the provision of SCADA has been kept in the DPR. The SCADA facility would operate, monitor, control, and regulate the running of WTP and all other water supply infrastructures.

12.3.2 Clear Water Reservoirs (CWR)

A Clearwater reservoir (CWR) has been proposed at the Water Treatment Plant site for the dead stock of treated water to accomplish the contact period required for disinfection and fluctuation of pumping input and output. Clear Water Pumping is 20 hours and a minimum of one hour of detention time is considered during the calculation of the size of CWR at WTP. Water from CWR will be pumped simultaneously to 21 nos. Zones at Panskura and 2 (to) nos Boosting Stations (BS) at Pingla and Kharagpur-II.

The capacity of the CWR at the WTP site comes to 3500 m³ considering 1-hour detention.

12.4 Boosting Stations (BS)

The command area of the proposed PWSS is very large and divided suitably into 45 zones with at least 1 (one) OHR in each zone. It is not techno-economically feasible to supply clear water directly to all the OHRs from the WTP itself. It is therefore decided to provide 1 (one) Boosting Stations with 1 (one) Ground level reservoir (GLR) at the BS. The BS is proposed to be located at Abdulla Mouza (JL-211) under the Pingla block. Pumping is 20 hours and a minimum of one hour of detention time is considered during the calculation of the size of GLR at both the BS. Water from BS will be pumped simultaneously to 24.

BS will comprise the following:

a) Ground Level Reservoirs (GLR)

The capacity of the GLR at BS comes to 1000 m³.

b) Pump House

The size of the pump house will be 540 m² for BS.

c) Sub-station Building

The size of the Sub-station building will be 450m² for BS.

Other items like Boundary walls, Internal pathways, Campus lighting, etc. will also be provided at BS as necessary.

A separate Chlorination unit will be provided at each BS.

12.5 Clear Water Mains (CWMs)

12.5.1 Selection of Pipes for Clear Water Mains

This DPR has been prepared after getting the actual Clear Water Rising main route. **DI pipes and bends have been considered in this DPR.**

12.5.2 Design of Clear Water Mains

Different dia DI K9 pipe has been chosen for CWMs. The dia of the DI K9 pipe varies from 150 mm to 1000 mm.

Parameters are given below:

Period of pumping	: 20 Hours
Design year	: 2052
Pipe material	: DI-K9 (IS 1729: 2002)
Pipe Dia.	: 150 mm to 1000 mm (OD)

12.6 Zonal Overhead Reservoirs (OHRs)

Treated water will be supplied to individual RCC OHRs acting as a service reservoir for the zone and water will then be supplied to the consumers through an adequately designed distribution network. Storage capacities, therefore, were calculated as per mass curve analysis for all zones considering pump operation time of 20 hours and distribution through reservoir for 8 hours.

However, the nearest available rounded departmental designed size OHRs have been adopted. Considering zonal demand, some of the existing OHRs of the existing PWSS does not meet the capacity requirement of the zone and hence additional OHRs are proposed.

In this scheme, in addition to the existing 16 OHRs, 32 new OHRs are proposed (totalling 48 OHRs) in 45 zones.

12.7 Fire Fighting

No separate provision has been kept in the DPR for firefighting arrangements. Water stored at the proposed and existing OHRs and GLRs will be utilized for firefighting emergencies.

CHAPTER 13 : ELECTRICAL- MECHANICAL INSTRUMENTATION COMPONENTS OF WORKS

The detail of Electro-mechanical components is given in Further.

13.1 Availability of Electrical Power

For the timely implementation of the Project, the ready availability of electrical power at various locations such as raw water Intake, treatment Plant site, and other Head work sites is essential. Connections of WBSEB will be available within an average distance of 500 m from all the pumping stations.

13.2 Mechanical / Electrical Installations

Mechanical/Electrical components of a water supply scheme constitute a key part of the overall project. These units require smooth functioning for the overall performance of the whole water supply scheme.

13.3 Pumps and motors

Suitable numbers of pumps would be provided as per design.

13.3.1 Raw Water pumps

Working hours	: 20 hrs
Free delivery head	: 48 m minimum
No. of Pumps	: 6 (4 workings + 2 stand by)
Pump Type	: VT Pump (200 KW)

13.3.2 Clear Water pumps at WTP (for feeding PANSKURA OHRs, PINGLA GLR & KHARAGPUR-II GLR)

Working hours	: 20 hrs
Free delivery head	: 100 m
No. of Pumps	: 9 (6 workings + 3 stand by)
Pump Type	: HCF Pump (250 KW)

13.3.3 Wash Water Pumps

Working hours	: 7 minutes
Free delivery head	: 24 m
No. of Pumps	: 2 (1 working + 1 stand by)
Pump Type	: HCF Pump (75 KW)

13.3.4 Clear Water pumps at PINGLA Pumping Station

Working hours	: 20 hrs
Free delivery head	: 100 m
No. of Pumps	: 4 (2 workings + 2 stand by)
Pump Type	: HCF Pump (225 KW)

13.3.5 Clear Water pumps at Kharagpur – II Pumping Station

Working hours	: Not Considered
Free delivery head	: Not Considered
No. of Pumps	: Not Considered

5. CHAPTER 14 : ALLIED WORKS

14.1 Investigation & Statutory Permission

Provisions have been made for statutory permission for drawl of water, a one-time license fee to be given to PWD for laying a pipeline on PWD roads, and a one-time impact assessment fee for drawl of Roopnarayan river water, and supervision charges to be given to Indian Railway for railway crossing.

14.2 Sub-Station

Provision has been made for the construction of Sub-stations at Intake, W.T.P site, and 1 no. boosting stations.

14.3 Staff Quarter

Provision for staff quarters for operational staff has been made at the WTP site. It is a three-storied building with a 600 sqm area on each floor including the ground floor. Some of the O&M personnel who would directly be involved in day and night service are to be provided with accommodation. In places, it shall be necessary to provide Guard sheds and camp accommodation for security/Police personnel. Details of all these have not been worked out at this stage.

14.4 Office, Go-down, Stack-Yard

Provision for Office, Go-down, Stackyard, etc. has also been kept in the summary of the capital cost estimate of the proposed scheme.

14.5 River Bank Protection

The Intake site has been selected considering the least possible erosion of River Banks along with other necessary points. However necessary provision has been kept in the estimate for Riverbank protection around the Intake point. The extent of work would be decided before the execution of the schemes.

14.6 Road/Railway/Canal crossing

They are a good number of major roads within the command area including state highways and PMGSY. Necessary permission to lay pipes along and across the roads needs to be obtained from the respective authority. Getting the permission of laying pipelines along and across National Highways and State highways will take considerable time and effort. As such, the process should be initiated immediately after the sanction of the project. Permission for laying pipelines along and across other roads from state-level or District level authorities may not pose a serious problem. But the process of obtaining permission for laying the pipeline along and across these roads should also be initiated side by side. However, the initial layout for the pipeline has been selected to avail the underpass/culvert/bridge as far as possible to avoid road crossing.

Also, a Broad gauge Railway track passes through the command area. The pipelines are to be taken across the Railway track to transport and distribute the water to the zones located on either side of it for which the suitable technology and necessary permission from the appropriate authority have to be arranged well in advance. However, permission for crossing, in this case, may not be a major problem if the crossing is done by the Trenchless method.

14.7 SCADA

For smooth operation. supervision, monitoring, and control of entire water supply infrastructure, Network for SCADA hall be implemented at WTP, CWR, and zonal OHR sites. The entire WTP site shall be controlled centrally tight from raw water intake to clear water pump including backwash of filter beds. Parameters like turbidity, pH, and residual chlorine shall be monitored in real-time. The central control panel shall be capable of remote operation of the entire plant equipment like substation, pumps, filter bed consoles, etc. The system shall be controlled through optical fibre networking on suitable available SCADA Platforms.

The valves of the WTP, CWR, and OHR sites shall be opened and closed in a predefined logic provided in the system, which can be, of course, alterable. The flow, residual chlorine, and OHR water level shall be monitored in real-time.

The range shall consist of instrumentation like online pH & Turbidity Meters, Flow Meters, Level Sensors, Residual Chlorine analyzers, dosing of chemicals, etc., as will be required in the system. This also includes actuator-operated Butterfly /Sluice valves with power back up if and where necessary and Water Flow Meters on the delivery pipe of OHRs.

14.8 Inspection Bungalow

Due to the proximity of Panskura-I Block to Kolkata and Howrah construction of an Inspection Bungalow is necessary to facilitate a regular inspection by PHED officials. As experienced from South 24 Parganas and North 24 Parganas Surface Water Supply Schemes that visitors from other states, Central Government officials, Institutions, Universities, and international organizations frequently visit WTP and its O&M activities for sharing knowledge and skill development. Accommodation of such visitors with meeting and conferencing facilities is very much necessary. Considering the above aspects, it is proposed to construct a two-storied Inspection Bungalow with all modern gadgets and amenities at the WTP site with a meeting room facility. The cost for such an inspection bungalow has been covered in this DPR.

14.9 Land

The different locations of all proposed OHR will be finalised at the time of execution. These lands have been finalized at the local level by the concerned division in discussion with the district authority. The lands for new OHRs are also been procured.

- **INTAKE SITE:** 4.34 Katha land is available for the construction of Intake & the Sub-station building will be constructed at the existing WTP site.
- **WTP SITE:** 1029 Katha of land is available for the construction of WTP.
- **ZONAL OHR SITE:** Total land has been procured for 32 nos of OHR site.

The quantum of land required for the proposed project is given below.

Description	Location	Procured	Remarks
Intake site	Chhatinda (JL-285), Block: Panskura-I 22.45875° N 87.87713889° E	4.34 Katha	Location finalized
WTP site	Laskardighi (JL-63), Block: Panskura-I 22.41469163° N 87.70564471° E	1029 Katha	Location finalized
Boosting Stations- Pingla	Abdulla (JL-211), Block: Pingla 22.29973568° N 87.69883386° E	48.4 Katha	Location finalized
OHRs 32 (Pingla-14 & Panskura-18)		1800 Katha	Location finalized
Total =		2881Katha	

CHAPTER 15 : OPERATION AND MAINTENANCE

PHED to carry out O&M for five years at source, treatment, and transmission of bulk water to overhead reservoir sites.

Then PHED will decide on the concerned department that will take care of the O&M for the rest of the period.

15.1 Operation & Maintenance cost of Civil Works

Provisions have been made for statutory permission for drawl of water, a one-time license fee to be given to PWD for laying a pipeline on PWD roads, and a one-time impact assessment fee for drawl of Roopnarayan river water, and supervision charges to be given to Indian Railway for railway crossing.

Tentative O & M Cost of Civil work are given below :

TENTATIVE COST OF O&M (OPERATION & MAINTENANCE CIVIL) EXPENSES PROJ: 70 MLD Cap INTAKES, WTP AND ALL PIPELINE (20 Hrs/Day OPERATION)

1. Intake :

i) 2 operators/shift + Reliever 2 x 4 = 8 Persons @20,000/- p.m.		=Rs.160000	
ii) 1 Watchman/Shift + Reliever 1x4=4+1=5 person @ 12,000/- Pm		=Rs.60000	
		<u>Rs.220000</u>	
Therefore, Rs. 2,20,000/- x 12	= Rs.	26,40,000.00	/- per year
iii) Lubricant, Stationaries Tea/Coffee, etc. Rs. 400/- per day Therefore, Rs. 400 x 365	= Rs.	1,46,000.00	/- per year
iv) Conveyance, Medical, Mobile, Leave encash mont = Rs. 70,000/- per month Therefore, Rs. 70,000 x 12	= Rs.	8,40,000.00	/- per year
v) Electricity Cost- To be bourne by PHED directly			
	Sub total		
	(A)=	36,26,000.00	/- per year

2. Raw Water Rising Main :

20 Km. Approx. length & hence taken			
(i) 3 person/day + 1 reliever =	4 Persons		
Therefore, 4 x Rs. 10,000/- p.m. x 12			
= Rs.	4,80,000.00	/- per year.	
(ii) Medical, Mobile, etc. @ 5000 pm x12			
= Rs.	60,000.00	/- per year.	
Sub Total(B) = Rs.	5,40,000.00	/- per year.	

3. Water Treatment Plant :

3.1 Manpower

(a) Plant Supervisor 1 Person(Gen Shift) @40,000/- p.m	= Rs.	40,000.00
(b) Plant Manager		

3 Person (3 Shift) + 1 Reliever = 4 Nos.		
@ 25,000/- p.m. x 4	= Rs.	1,00,000.00
(c) Operator		
5/Shift + Reliver, Therefore, 5x4=20 Nos.		
@ 15,000/- p.m. x 20	= Rs.	3,00,000.00
(d) Fitter/Helper		
5/Shift + Reliver, Therefore, 5x4=20 Nos.		
@ 12,000/- p.m. x 20	= Rs.	2,40,000.00
(e) Khalasi		
3/Shift + Reliver, Therefore 3x4=12 Nos.		
@ 10,000/- p.m. x 12	= Rs.	1,20,000.00
(f) Watchman		
4/Shift + Reliver, Therefore 4x4=16 nos.		
@ 10,000/- p.m. x 16	= Rs.	1,60,000.00
(g) Chemist		
1 Person (Gen Shift)		
@ 25,000/- x 1	= Rs.	25,000.00
(h) Lab Tech.		
1/Shift + Reliver, Therefore 1 x 4 = 4 Nos.		
@ 15,000 x 4	= Rs.	60,000.00
(i) Lab Helper		
1/Shift + Reliver, Therefore 1 x 4 = 4 Nos.		
@ 12,000 x 4	= Rs.	48,000.00
(j) Electrician		
1 Person(Gen Shift) @25,000/- x 1	= Rs.	25,000.00
(k) Elec. Tech.		
1/Shift + Reliver, Therefore 1 x 4 = 4 Nos.		
@ 15,000 x 4	= Rs.	60,000.00
	Rs.	11,78,000.00
Sub Total = (C)Rs.	1,41,36,000.00	/- Per year

3.2 Electricity Cost : To be borne by PHED directly

3.3 Consumables :

(a) Alum : (3500x30x20x365)/1000 = 7,66,500 kg.		
766.5 MT @ Rs. 20,000/-	= Rs.	1,53,30,000.00
(b) P E : (3500x1x20x365)/1000= 25,550 kg.		
25.55 MT @ Rs. 2,50,000/-	= Rs.	63,87,500.00
(c) Lubricant : Rs. 10,000/- p.m. x 12	= Rs.	1,20,000.00
(d) Chlorine : (3500x4x20x365)/1000 = 102,200 kg.		

102.2 MT @ Rs. 15,000/-	= Rs.	15,33,000.00	
(e) Stationeries waste : Rs. 1000/- p.m x 12	= Rs.	12,000.00	
(f) Tea/Coffee : Rs. 300/- per day x 30 x 12	= Rs.	1,08,000.00	
(g) Truck : Approx 900 MT / 9 = 100 Nos.			
100 x 25,000 /-	= Rs.	25,00,000.00	
(Transport of Chemicals)			
(h) Misc. like Lab reagents etc. Rs. 2000/- per month x 12	= Rs.	24,000.00	
	Sub Total		
	(D)= Rs.	2,60,14,500.00	/- per year

3.4 O & M Expenses of Staff :

(a) Conveyance for staff = 2 Nos. Vehicle @ 30,000/- Per month	= Rs.	60,000.00	
(b) Medical for Staff : Rs. 1,00,000 per month x12	= Rs.	12,00,000.00	
(c) Accomodation cost etc. : Rs. 3,00,000 per month x 12	= Rs.	36,00,000.00	
(d) Leave Encashment of Staff : 8% of Manpower (Rs. 1,40,40,000/-)	= Rs.	11,23,200.00	
(e) Mobile expenses : (79 persons x 400 x 12)	= Rs.	3,79,200.00	
	Sub Total		
	(F)= Rs.	63,62,400.00	/- per year

4.0 At 40 Nos. OHR

(i) 2 Persons per day = 80 persons @10,000/- p.m. Therefore, 80 x 10,000/-	= Rs.	8,00,000.00	/- per month
Therefore, 8,00,000 x 12	= Rs.	96,00,000.00	/- per year
(ii) Medical, Mobile, Leave encashment etc. = Rs. 8,000/- per person/year Therefore, Rs. 8000/- x 80	= Rs.	6,40,000.00	/- per year
	Sub Total		
	(G)= Rs.	1,10,40,000.00	/- per year
Grand Total[(A)+(B)+(C)+(D)+(E)+(F)+(G)],Rs.		6,17,18,900.00	/- per year
TOTAL OPERATIONAL ELECTRIC COST OF WTP FOR 5 YEARS INCLUDING 15% PRICE HIKE)		34,56,25,840.00	

NOTE

: 10 to 15% rise shall be applicable from 2nd year Upto Fifth year.

15.2 Electrical, Instrumentation & Automation Required for WTP

Provision has been made for the construction of Sub-stations at Intake, W.T.P site, and 1 no. boosting stations.

ELECTRICAL, INSTRUMENTATION & AUTOMATION REQUIRED FOR RUN THE WATER TREATMENT PLANT

ITEM	DESCRIPTION OF ITEM	UNIT	QTY	PREFERRED MAKE
SUPPLY & INSTALLATION OF FOLLOWING ITEMS				
1.0	HT SWITCH BOARD			
1.1	33KV,1600A, 25kA for 3 sec, 9 Circuit VCB panel with all metering and protection,Vaccum Circuit breaker, Numerical relay,auxiliary relay,CTs,PTs ,indication lamp, switches along with Weather proof double compression Ni plated brass cable gland and crimping type cable lugs for all incoming and outgoing cables	No.	1	SIEMENS / AREAVA / ABB/ SCHNEIDER
1.2	6.6KV,800A, 26.3kA for 3 sec, 7 Circuit VCB panel with all metering and protection,Vaccum Circuit breaker, Numerical relay,auxiliary relay,CTs,PTs ,indication lamp, switches along with Weather proof double compression Ni plated brass cable gland and crimping type cable lugs for all incoming and outgoing cables	No	1	SIEMENS / AREAVA / ABB / SCHNEIDER
2.0	POWER TRANSFORMER & LIGHTING TRANSFORMER			
2.1	2000KVA, 33KV/6.6KV, Outdoor, ONAN Type Power Transformer along Bucholtz Relay, OTI, WTI,1st filled oil, Marshelling Cabinetcomplete with weather proof double compression Ni plated brass cable glands and cable lugs for all incoming and outgoing cables and all other accessories	No.	2	AREAVA / CROMPTON / EMCO / VOLTAMP
	630KVA, 33KV/0.433KV,Outdoor, ONAN Type Power Transformer along Bucholtz Relay, OTI, WTI,1st filled oil, Marshelling Cabinetcomplete with weather proof double compression Ni plated brass cable glands and cable lugs for all incoming and outgoing cables and all other accessories	No.	2	AREAVA / CROMPTON / EMCO / VOLTAMP
2.2	100KVA, 0.433/0.415KV,Indoor Dry type Lighting Transformer along with Weather proof double compression Ni plated brass cable gland and cable lugs for all incoming and outgoing cables and.	No.	1	AREAVA / CROMPTON / EMCO / VOLTAMP
3.0	ON LINE UPS			
3.1	30 KVA, 415/230V, 3ph Input & 1 Ph Output, Redundant On line UPS with Ni-Cd battery bank .UPS shall complete with Ac Distribution Board for feeding 230V AC power to Emergency lighting distribution board and HT switch board for operation of tripping ,closing coil and indication lamp	No.	1	EMERSON / FUJI / HITACHI
4.0	MV & LT SWITCH BOARD (PCC, MCC, LIGHTING BOARDS, AND CAPACITOR PANEL)			
4.1	6.6, 3Ph, 50Hz, 1000A, 26,3KA for 3 Sec. Soft Starter Panel having 2 nos Incoming VCB and 1 no. Bus Coupler Panel with Cu Bus Bars, Metering, Protection and indication for operation of 10 Nos. 275KW (1 No Spare) clear water pump as per SLD complete with necessary protection, CTs, PTs and Weather proof double compression Ni plated brass cable glands and lugs for all incoming and outgoing feeders.	No.	1	SIEMENS / L&T / ABB / SCHNEIDER

4.2	415 Volt, 3Ph-N, 50Hz, 1250A, 35KA for 1 Sec. Al-Bus Bar Single front, Non-drawout type PCC with Metering and protection. PCC shall have 2nos Incoming EDO-ACB and 1 No EDO-ACB Bus Coupler feeder with built in release, required nos of outgoing feeders as per SLD complete with MCCBs, CTs, PTs, indication lamp, switches etc along with Weather proof double compression Ni plated brass cable glands and lugs for all incoming and outgoing feeders.	No.	1	SIEMENS / L&T / ABB / SCHNEIDER
4.3	415 Volt, 3Ph-N, 50Hz, 250A, 35A for 1 Sec. Al-Bus Bar Single front, Non drawout type MCC for CWP with Metering and protection. MCC shall comply with 2 nos incoming feeders and 1 no Bus Coupler feeder with built in release, required nos of outgoing feeders as per SLD complete with MCCBs, MPCBs, Power & Aux. Contactor, O/I relay, CTs, PTs, indication lamp, switches etc along with Weather proof double compression Ni plated brass cable glands and lugs for all incoming and outgoing feeders.	No.	1	SIEMENS / L&T / ABB / SCHNEIDER
4.4	415 Volt, 3Ph-N, 50Hz, 400A, 35A for 1 Sec. Al-Bus Bar Single front, Non drawout type MCC for Filter House with Metering and protection. MCC shall comply with 2 nos incoming feeders and 1 no Bus Coupler feeder with built in release, required nos of outgoing feeders as per SLD complete with MCCBs, MPCBs, Power & Aux. Contactor, O/I relay, CTs, PTs, indication lamp, switches etc along with Weather proof double compression Ni plated brass cable glands and lugs for all incoming and outgoing feeders.	No.	1	SIEMENS / L&T / ABB / SCHNEIDER
4.5	415 Volt, 3Ph-N, 50Hz, 200A, 35A for 1 Sec. Al-Bus Bar Single front, Non drawout type MCC for Sludge Pump House with Metering and protection. MCC shall comply with 2 nos incoming feeders and 1 no Bus Coupler feeder with built in release, required nos of outgoing feeders as per SLD complete with MCCBs, MPCBs, Power & Aux. Contactor, O/I relay, CTs, PTs, indication lamp, switches etc along with Weather proof double compression Ni plated brass cable glands and lugs for all incoming and outgoing feeders.	No.	1	SIEMENS / L&T / ABB / SCHNEIDER
4.6	415 Volt, 3Ph-N, 50Hz, 100A, 35A for 1 Sec. Al-Bus Bar Single front, Non drawout type MCC for Chlorine House with Metering and protection. MCC shall comply with 2 nos incoming feeders and 1 no Bus Coupler feeder with built in release, required nos of outgoing feeders as per SLD complete with MCCBs, MPCBs, Power & Aux. Contactor, O/I relay, CTs, PTs, indication lamp, switches etc along with Weather proof double compression Ni plated brass cable glands and lugs for all incoming and outgoing feeders.	No.	1	SIEMENS / L&T / ABB / SCHNEIDER
4.7	415 Volt, 3Ph-N, 50Hz, 63A, 35A for 1 Sec. Al-Bus Bar Single front, Non drawout type MCC for Chemical House with Metering and protection. MCC shall comply with 2 nos incoming feeders and 1 no Bus Coupler feeder with built in release, required nos of outgoing feeders as per SLD complete with MCCBs, MPCBs, Power & Aux. Contactor, O/I relay, CTs, PTs, indication lamp, switches etc along with Weather proof double compression Ni plated brass cable glands and lugs for all incoming and outgoing feeders.	No.	1	SIEMENS / L&T / ABB / SCHNEIDER
4.8	415 Volt, 3Ph-N, 50Hz, 200A, 25KA for 1 Sec. Al-Busbar, single front, fixed type Main Lighting distribution board with Metering ,Auxiliary relay, contactor CTs, PTs etc as per SLD along with Weather proof double compression Ni plated brass cable glands and lugs for all incoming and outgoing feeders.	No.	1	PECON / POWER INDIA / INCOTECH / ZENITH

4.5	415 Volt, 630A,3Ph&N, 50Hz, Al-Busbar, 350KVAR APFC panel consisting of small unit of (4X50KVAR, 4x25KVAR, 4X10KVAR, 2X KVAR) fixed type single front capacitor Bank Panel consisting of ACB incomer, MCCB & capacitor duty contactor, Metering and protection as per SLD along with APFC Realy	No.	1	PECON / POWER INDIA / INCOTECH /ZENITH
4.7	415 Volt, 3Ph-N, 50Hz, 32A, 25KA for 1 Sec. Al-Busbar, single front, Emergency Lighting Distribution Board with Metering ,Auxiliary relay, contactor CTs, PTs etc as per SLD along with Weather proof double compression Ni plated brass cable glands and lugs for all incoming and outgoing feeders.	No.	1	PECON / POWER INDIA / INCOTECH /ZENITH
5.0	POLE/PEDESTAL/STRUCTURE MOUNTING EQUIPMENT			
5.1	415 Volt, 3Ph-N, 50Hz, 32A, 25KA for 1 Sec. Al-Busbar, Outdoor Type Local Control Panel with Metering ,Auxiliary relay, contactor CTs, PTs etc as per SLD along with Weather proof double compression Ni plated brass cable glands and lugs for all incoming and outgoing feeders.	Lot	1	MDS / SIEMENS / HAVELS /SCHNEID ER
5.2	415 V, 3Ph-N, 32A,50 Hz, MCB/ Lighting distribution board having sheet enclosure suitable for 1No, 415V, 32A, 3Phase & neutral MCB incomer & 12 Nos. 240V, 6A SPN MCB Out going feeders	Lot	1	MDS / SIEMENS / HAVELS /SCHNEID ER
5.3	Switch Socket Outlet with plug and looping facility, double compression Ni-plated brass cable gland along with crimping type(Cu) lugs for all incoming and outgoing cables.	Lot	1	MDS / SIEMENS / HAVELS /SCHNEID ER
5.4	240 Volt AC,150W/72W/42W/25W LED lighting fixtures with,lamp ,Double compression Ni plated brass cable glands ,Lugs and all other accessories.	Lot	1	PHILIPS / WIPRO / HAVELS / CROMPTO N
5.5	Design & Supply of 30 Mtr. height Telescopic High Mast complete with 16 Nos. 350W LED flood light luminaries, motor with reversable starter, EPR insulated trailing Cable and necessary accessories.	Nos.	4	PHILIPS / WIPRO / HAVELS / CROMPTO N
5.6	Supply of 9.0 meter height M.S Lighting Pole with earthing arrangement with single arm (bracket) complete with 90W weatherproof LED street lighting fixture. Lighting pole shall be supplied along with all required hardwares.	Lot	1	PHILIPS / WIPRO / HAVELS / CROMPTO N
6.0	Supply of 33KV/6.6KV/1.1 KV XLPE, FRLS Power and Control Cable			
6.1	33 KV Grade (E),3CX 150Sqmm(AL), XLPE, Screened,Armoured , FRLS Power cables with termination kit	Lot	1	POLYCAB / KEI / GLOSTER / KEC /FINOLEX
6.2	6.6 KV Grade (UE),3CX240Sqmm(AL), XLPE, Screened,Armoured , FRLS Power cables with termination kit	Lot	1	POLYCAB / KEI / GLOSTER / KEC /FINOLEX

6.3	1.1 KV Grade XLPE,Armoured, FRLS power cable per tender specification with necessary Gland and Socket	Lot	1	POLYCAB / KEI / GLOSTER / KEC /FINOLEX
7.0	EARTHING, LIGHTNING & OTHER STEEL MATERIAL			
7.1	Supply of hot dip GI earth electrode 3.8 m long 80 dia NB heavy duty as per IS 1239 complete with all parts including necessary civil works and required S.S. hardware for earth pit. Earth electrodes shall be hot dip galvanised (Min 120 Micron coating) after drilling / welding.	Nos.	40	LOCAL
7.2	Supply of Hot Dip Galvanized G.I. earth strips with min 120 micron coating and Earthing wire of following sizes.	Lot	1	LOCAL
7.3	Steel Channel, Angle, Flat and Sheet of various size as pre requirement as for the purpose of Erection of Equipment	Lot	1	LOCAL
8.0	ERECTION HARDWARE			
8.1	Supply of Erection Hardwares like PVC rigid and Flexible conduit, Cable Trays and General Safety Equipment	Lot	1	LOCAL

15.3 Operation & Maintenance cost of Electrical & Mechanical Works

Provision has been made for the construction of Sub-stations at Intake, W.T.P site, and 1 no. boosting stations.

Tentative O & M Cost of Civil work are given below :

<u>TENTATIVE COST OF O&M (OPERATION & MAINTENANCE ELEC. & MECH.) EXPENSES PROJ: 70 MLD Cap INTAKES, WTP AND ALL HEAD WORK SITES (20 Hrs/Day OPERATION)</u>		
<u>Cost of electricity Consumption</u>	365.00	days
<u>1. Raw Water Intake Pump House</u>		
A. Raw Water Pump Sets(4W+2S)		
Power consumption for one pump	200.00	KW-h
Number of working pumps	4.00	nos.
Pumping hour	20.00	hrs.
Total power consumption in one year	5840000.00	KW-h
B. Other item like electrical actuator,Lighting ,Instrument ,EOT crane etc.		
Let assume total power consumption for all activities is	50.00	KW-h
Running time	20.00	hrs.
Total power consumption in one year	365000.00	KW-h
Sub Total,	6205000.00	KW-h
(consider cost of unit KW-h is 7 rupees)	8.00	Rs.
Total Cost for one year,Rs.(A)	49640000.00	
<u>2. Water Treatment Plant</u>		
A. Inlet Valve to Flash Mixer (4 Nos.)		

Power consumption for one Flash Mixer	3.70	KW-h
Number of Flash Mixer	4.00	nos
Running time	20.00	hrs.
Total power consumption in one year	108040.00	KW-h
B. Clarifloculator (4 nos)		
Power consumption for one Flash Mixer	6.60	KW-h
Number of Flash Mixer	4.00	nos
Running time	20.00	hrs.
Total power consumption in one year	192720.00	KW-h
C. Rapid Sand Filter (12 Nos)		
1. Electrical Actuator		
Power consumption for one actuator	8.50	KW-h
Number of actuator	12.00	nos
Running time	20.00	hrs.
Total power consumption in one year	744600.00	KW-h
2. Air Blower		
Power consumption for one Air Blower	55.00	KW-h
Number of Air Blower	1.00	nos
Running time	11.00	hrs.
Total power consumption in one year	220825.00	KW-h
3. Misc. on console ,PLC,EMFM,etc.		
Let assume total power consumption for all activities is	60.00	KW-h
Total power consumption in one year	21900.00	KW-h
D.Clear Water Pump House		
1.High Lift Pumps (6W+3S)		
Power consumption for one pump	275.00	KW-h
Number of pum working	6.00	nos
Running time	20.00	hrs.
Total power consumption in one year	12045000.00	KW-h
2. OHR (backwash + utilities) Filling pupmp(1W+1S)		
Power consumption for one pump	55.00	KW-h
Number of pum working	1.00	nos

Running time	20.00	hrs.
Total power consumption in one year	401500.00	KW-h
3. Elec. Actuator,Dewatering Pumps,EOT Crane,Instrument ,etc.		
Let assume total power consumption for all activities is	20.00	KW-h
Running time	20.00	hrs.
Total power consumption in one year	146000.00	KW-h
E. Chemical house		
1.Agitator of Alum & PE		
Total power consumption in one year	77088.00	KW-h
2. Metering Pumps		
Power consumption for one pump	3.70	KW-h
Number of pump working	1.00	nos
Running time	20.00	hrs.
Total power consumption in one year	27010.00	KW-h
3.Hoist,etc.		
Power consumption for one pump	3.70	KW-h
Number of pump working	1.00	nos
Running time	20.00	hrs.
Total power consumption in one year	27010.00	KW-h
F. Chlorine Building		
1. Booster Pumps		
Power consumption for one pump	3.70	KW-h
Number of pump working	2.00	nos
Running time	20.00	hrs.
Total power consumption in one year	54020.00	KW-h
2. EOT crane, air blower ,NaOH pump etc.		
Let assume total power consumption for all activities is	30.00	KW-h
Total power consumption in one year	109500.00	KW-h
G. Sludge Pump House		
1. Sludge pump,175 m ³ /hr (2W+2S)		
Power consumption for one pump	22.00	KW-h

<i>Number of pum working</i>	<i>2.00</i>	<i>nos</i>
<i>Running time</i>	<i>20.00</i>	<i>hrs.</i>
<i>Total power consumption in one year</i>	321200.00	KW-h
2. Sludge pump,125 m3/hr (1W+1S)		
<i>Power consumption for one pump</i>	<i>15.00</i>	<i>KW-h</i>
<i>Number of pum working</i>	<i>1.00</i>	<i>nos</i>
<i>Running time</i>	<i>20.00</i>	<i>hrs.</i>
<i>Total power consumption in one year</i>	109500.00	KW-h
3. EOT Hoist ,agitators(6 nos)		
<i>Let assume total power consumption for all activities is</i>	<i>30.00</i>	<i>KW-h</i>
<i>Running time</i>	<i>20.00</i>	<i>hrs.</i>
<i>Total power consumption in one year</i>	219000.00	KW-h
H. Lighting for entire WTP ,AC machine ,instrument,etc.		
<i>Let assume total power consumption for all activities is</i>	<i>60.00</i>	<i>KW-h</i>
<i>Running time</i>	<i>20.00</i>	<i>hrs.</i>
<i>Total power consumption in one year</i>	438000.00	KW-h
I. Street light		
<i>Total power consumption in one year</i>	54750.00	KW-h
<i>Sub Total of WTP</i>	<i>15317663.00</i>	<i>KW-h</i>
Total Cost for one year,Rs.(B)	12,25,41,304.00	
3. Pingla Pump house		
A. High lift Pumps(2W+2S)		
<i>Power consumption for one pump</i>	<i>225.00</i>	<i>KW-h</i>
<i>Number of pump working</i>	<i>2.00</i>	<i>nos</i>
<i>Running time</i>	<i>20.00</i>	<i>hrs.</i>
<i>Total power consumption in one year</i>	3285000.00	KW-h
B. Actuator,Eot Hoist ,Instrument,etc		
<i>Let assume total power consumption for all activities is</i>	<i>20.00</i>	<i>KW-h</i>
<i>Running time</i>	<i>20.00</i>	<i>hrs.</i>
<i>Total power consumption in one year</i>	146000.00	KW-h
<i>Sub Total of WTP</i>	<i>3431000.00</i>	<i>KW-h</i>

Total Cost for one year, Rs. (C)	2,74,48,000.00	
4. Head Work Site		
Power consumption for one pump	80.00	KW-h
Number of H/W Site	49.00	nos
Running time	1.00	day
Total power consumption in one year	1430800.00	KW-h
Total Cost for one year, Rs. (D)	1,14,46,400.00	
TOTAL OPERATIONAL ELECTRIC COST OF WTP[(A) +(B) +(C)+(D)],Rs.	21,10,75,704.00	
TOTAL OPERATIONAL ELECTRIC COST OF WTP FOR 5 YEARS INCLUDING 15% PRICE HIKE	1,18,20,23,942.40	
NOTE: 10 to 15% rise shall be applicable from 2nd year Upto Fifth year.		

CONCLUSION

This project has been conceived as instructed by the Honorable Minister In-charge of Public Health Engineering Department and the Department of Environment of Govt. of West Bengal, and further approved by the Principal Secretary, Public Health Engineering Department, Govt. of West Bengal.

The proposed project will be executed in three blocks namely Pingla, Kharagpur-II and Panskura-I. Pingla & Kharagpur-II comes in Paschim Midnapur District and Panskura-I comes in Purba Midnapur District. In This is project report population of Pingla & Panskura-I is being considered. Only Kharagpur-II block's water demand is being considered here for Intake and WTP.

Ater completion of the WTP, it will cover of 411 nos. rural Mouzas 707 nos. Habitations in 24 nos. GPs with a total population of 6,61,552 according to the 2011 Census (out of which about 10.54% belong to SC & 11.90% ST population) and this population will be benefited by potable drinking water @55 lpcd. The proposed water supply command area by the proposed WTP is fairly large covering an approximate area of 73703 Ha. The total no of households are being benefited under this scheme is 1,11,171 (Pingla 46,964 & Panskura-I- 64,207).

The present water supply to part of the command area depends on 23 nos. PWSS consisting of 183 Mouzas (157 commissioned). The PWSS is maintained by Public Health Engineering Directorate. However, spot sources are sunk and maintained by Zilla Parishad.

Total raw water capacity of the WTP is about 70 MLD (15.40 MGD) considering 55 LPCD as per JJM guidelines and 10 % distribution, 5 % institutional, 2 % rising main transmission & 5 % treatment loss. The water demand, at Intake & WTP, is calculated considering three blocks i.e., Pingla, Panskura-I and Kharagpur-II. Kharagpur-II block's demand has been considered for future reference.

The present project has been proposed in accordance with the existing NRDWP Norms & Guidelines, JJM Guidelines, CPHEEO Manual, and prevailing Schedule & Guidelines of the Planning wing of PHE Directorate.

The some important features of proposed project in tabular form given below:

PROJECT AT A GLANCE		
DESIGN OF CONVENTIONAL TYPE FLOCULATOR BASED WATER TREATMENT PLANT FOR PINGLA & PANSKURA BLOCK IN WEST BENGAL		
A. GENERAL FEATURES		
SL NO	ITEM	DETAIL
1	NAME OF PROJECT	DESIGN OF CONVENTIONAL TYPE FLOCULATOR BASED WATER TREATMENT PLANT FOR PINGLA & PANSKURA BLOCK IN WEST BENGAL
2	LOCATION	PINGLA & PANSKURA -I BLOCK PASCHIM MEDINIPUR & PURBA MEDINIPUR
3	NAME OF THE BLOCK/MUNICIPALITY	PINGLA & PANSKURA -I BLOCK
4	NAME OF DISTRICT	PASCHIM MEDINIPUR & PURBA MEDINIPUR
5	TYPE OF SOURCE (GROUND WATER / SURFACE WATER/SUB-SURFACE WATER, ETC.)	Surface water of river Roopnarayan
6	NO. OF MOUZAS/WARDS TO BE COVERED	182 nos. of Mouzas in Pingla Block and 229 nos. of Mouzas in Panskura -I Block

7	NO. OF HABITATIONS TO BE COVERED	419 nos. Habitation in Pingla Block and 288 nos. Habitation in Panskura Block
8	CENSUS POPULATION (2011)	661552
9	PRESENT POPULATION	769375
10	DESIGN POPULATION	1015576
11	COMMAND AREA	47140 Ha (For Kharagpur 26563 Ha Extra)
12	NUMBER OF ZONES	45
13	PER CAPITA DEMAND	55 LPCD
14	LOSSES	5% INSTITUTIONAL/Industrial + 10% DISTRIBUTION + 2% RISING MAIN TRANSMISSION + 5 % TREATMENT
15	DAILY WATER DEMAND (PRESENT)	Raw Water: 51.63 MLD Clear water: 49.51 MLD
16	DAILY WATER DEMAND (INTERMEDIATE)	Raw Water: 60.93 MLD Clear water: 58.43 MLD
17	DAILY WATER DEMAND (DESIGN)	Raw Water: 70.00 MLD Clear water: 65.36 MLD
18	QUANTITY ASPECT OF SOURCE	Sufficient to meet future demand.
19	LOCATION OF INTAKE	Chhatinda Mouza (JL No 285), Panskura - II Block
20	LOCATION OF WTP SITE	Laskardighi mouza (JL No 63), Panskura - I Block
21	PUMPING HOURS	Raw Water Main: 20 Hours
		Clearwater Main From Wtp: 20 Hours
22	SUPPLY HOURS	8 hours
23	METHOD OF TREATMENT	Conventional water treatment plant with two-stage disinfection.
24	NO. OF CWR PROPOSED FOR WTP AREA	1 No. CWR of 3500 m ³ capacity for WTP & 1 No. GLR of 1000 m ³ at BS Pingla.
25	TOTAL LENGTH OF PIPELINE	
	I) RISING MAIN (RAW + CLEAR)	Its depends on the command area and distribution design
	II) DISTRIBUTION SYSTEM	Subjected to distribution design
26	RAW WATER MAIN MATERIAL	DI K9 & MS
27	CLEARWATER MAIN MATERIAL	DI K9
28	DISTRIBUTION SYSTEM MATERIAL	HDPE PE 100 PN 6
29	GROUND LEVEL RESERVOIR	1 No.
30	WHETHER QUALITY PROBLEM, IF ANY	NA
31	METHOD OF TREATMENT	Conventional water treatment plant with two-stage disinfection.
32	WHETHER SCOPE OF FUTURE EXTENSION AVAILABLE	Yes, within the command area.
33	EXECUTING AGENCY	PHED, West Bengal
34	STRATEGY OF O&M	PHED to carry out O&M for five years at source, treatment, and transmission of bulk water to overhead reservoir sites.
35	SUSTAINABILITY OF THE SCHEME	The provision of a 100% house connection has been kept. Cost towards annual operation and maintenance of the scheme would mostly be met through the collection of suitable tariff and one-time

		deposit of connection charges against house connection.
36	EXPECTED TIME OF COMPLETION	3 Years approx.

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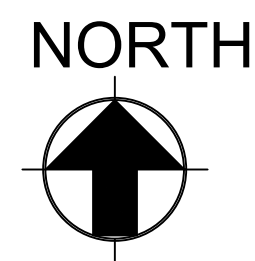
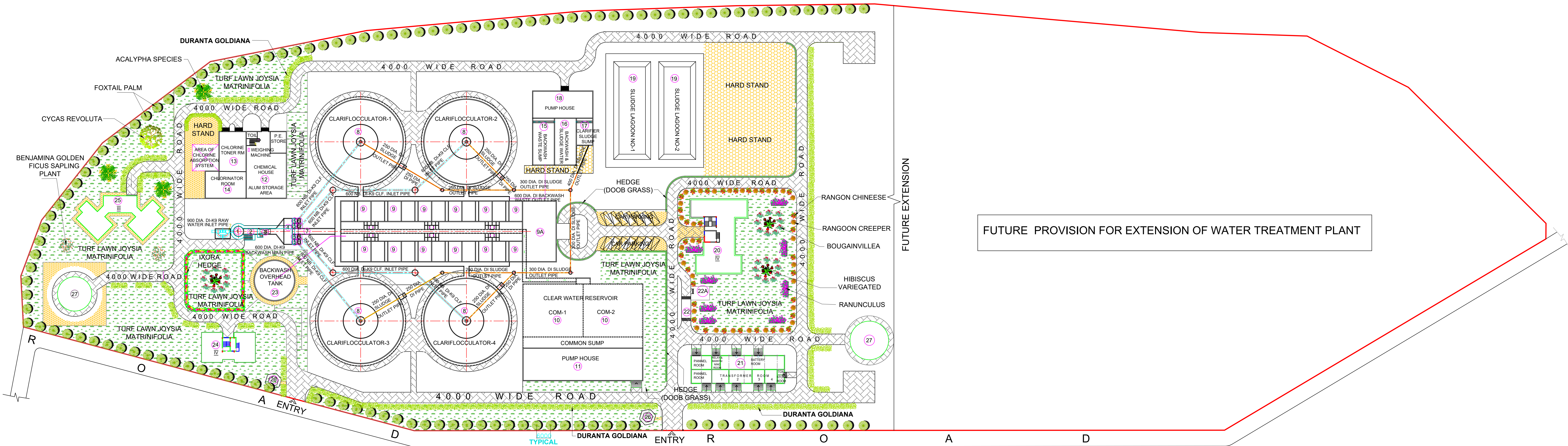
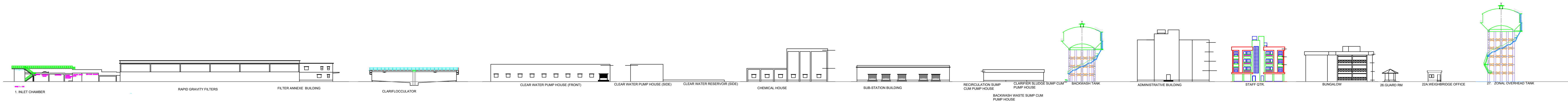
Manual_on_Water_Supply_and_Treatment_CPHEEO_MoUD_1999.pdf.

<http://cpheeo.gov.in>. The readers are advised to refer to for further updates

<https://censusindia.gov.in/census.website/data/handbooks>

ABBREVIATION

- 1.VT :Vertical Turbine
- 2.CWR :Clear Water Reservior
- 3.DI :Ductile Iron
- 4.GLR:Ground Level Reservior
- 5.PH:Pum House
- 6.OHR:Over Head Reservior
- 7.WTP:Water Tratment Plant
- 8.SCADA:Supervisory Control and Data Acquisition
- 9.PWSS:Piped Water Supply Scheme
- 10.H/W:Head Work Site
- 11.SWD:Side Water Depth
- 12.RGF:Rapid Gravity Filter
- 13.HFD:Hydraulic Flow Diagram
- 14.PE:Poly Electrolite
- 15.HSC:Horizontal Split Casing
- 16.BFB: Butterfly Valves
- 17.SV:Sluice Valve
- 18.PLC: Program Logic Control
- 19.CCTV: Closed Circuit Television
- 20.EOT: Electric overhead traveling crane
- 21.BS:Boosting Station
- 22.SLD:Single Line Diagram
- 23.MCC:Monitoring and Control Centre
- 24.MCCB: Moulded Case Circuit Breaker
- 25.MPCB: Motor Protection Circuit Breaker



LANDSCAPED PLAN OF WATER TREATMENT PLANT
SCALE - 1 : 800

LEGEND

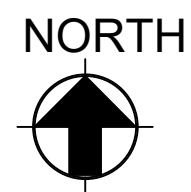
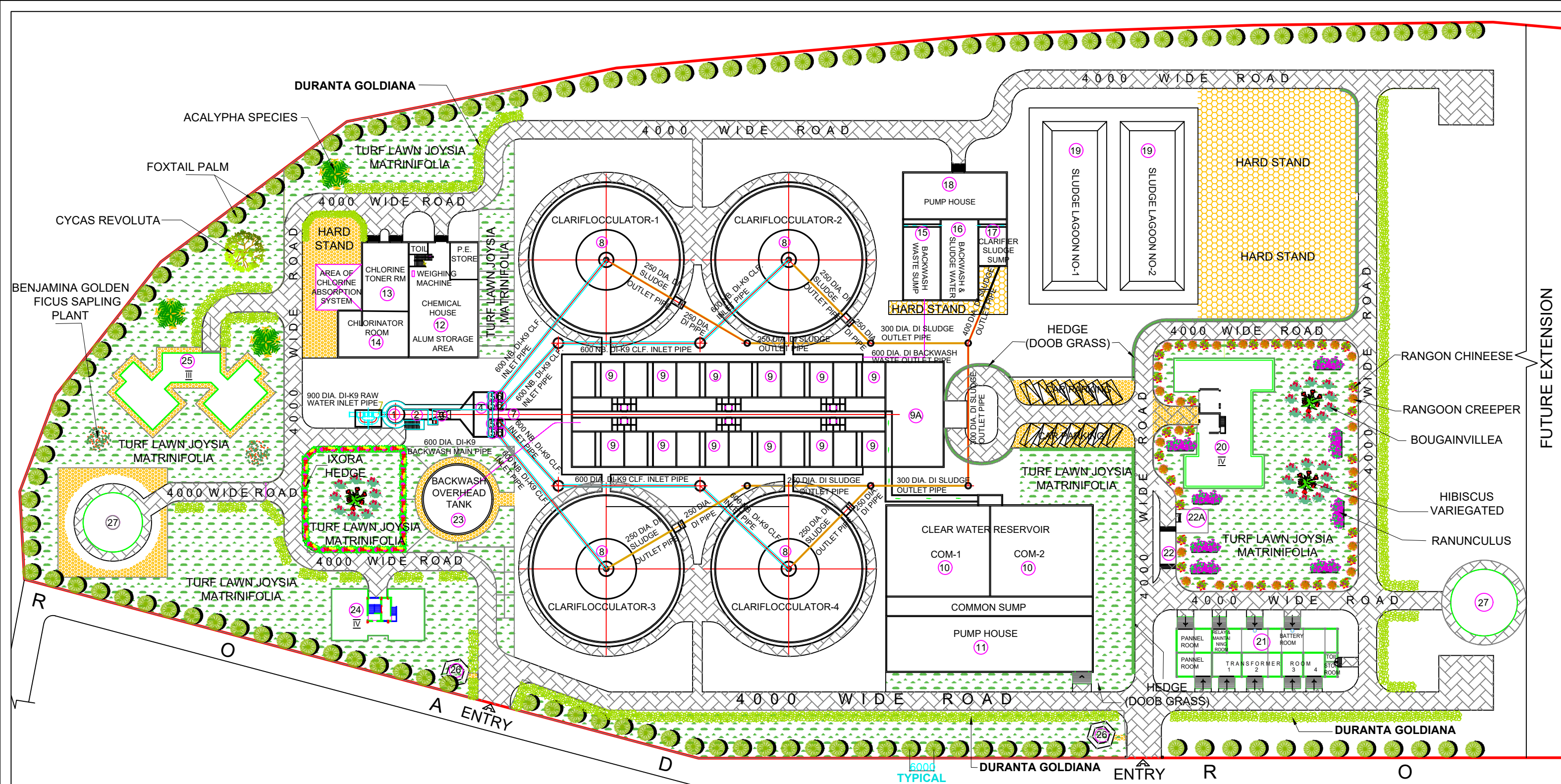
1. INLET WELL (1No.)	3.700x5.50 D
2. CHANNEL (UP STREAM+ DOWN STREAM) (1No.)	12.5x1.23 D.
3. PARSHALL FLUME (THROAT WIDTH) WITHIN ABOVE CHANNEL(1No.)	0.90
4. FLOW DISTRIBUTION CHAMBER (1No.)	3.0x9.60
5. FLASH MIXER (EACH) (4Nos.)	1.7 x 1.7 x 5.1 D
6. OUTLET CHAMBER (4Nos.)	1.0x1.7
7. BYE-PASS CHANNEL (1No.)	2.0 WIDE
8. CLARIFLOCCULATOR (4 NOS) EACH	32.0 Ø
9. FILTER HOUSE (1No.) BED SIZE (TWIN SECTION) EACH OF 12 Nos.	68.50x23.00 11.2x7.5
9A. FILTER ANNEXE BUILDING (1No.)	12.5x22.70
10. CLEAR WATER RESERVOIR (2 COMPT.)	22.5 x 20.0 Each comp.x 4.25 LD
11. PUMP HOUSE (1No.)	45.00x12.0
12. CHEMICAL HOUSE (1No.)	25.0x15.0
13. CHLORINE TONNER ROOM (1No.)	10.0x15.0
14. CHLORINATOR ROOM (1No.)	15.0x10.0
15. BACKWASH WASTE SUMP (1No.)	17.5x8.0x2.5LD
16. BACKWASH DECANTED WATER SUMP (No.-2)	17.5x8.0x2.5LD
17. CLARIFIER SLUDGE SUMP (1No.)	10.0x6.0x2.5LD
18. SLUDGE PUMP HOUSE (1No.)	22.0x10.0
19. SLUDGE LAGOON (2 NOS.) (TOTAL AREA)	37.0x43.0 appx. Each:37.0x14.0
20. ADMINISTRATIVE BUILDING (FOUR STORIED)	413.15 SQM / FL
21. SUB-STATION BUILDING (1No.)	40.0x10.0
22. WEIGHBRIDGE : 30MT CAP.(1No.)	
22A. WEIGHBRIDGE OFFICE	5.0x7.0
23. PROPOSED OHR FOR BACKWASH & UTILITIES (1No.)	700 cum. cap.
24. STAFF QTR. (G+3 STORIED)	200.05 SQM / FL
25. BUNGALOW (THREE STORIED)	300.0 SQM /FL
26. GUARD RM (2 NOS) EACH	10 SQM approx.
27. ZONAL OVERHEAD TANK	250 CUM & 400 CUM

NOTES

- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- UNLOADING PLATFORM AREA TO BE DESIGNED CONSIDERING WHEEL LOAD OF TRUCK AS WELL AS STORING OF PUMP, MOTOR ETC AND PUMP FLOOR TO BE DESIGNED CONSIDERING STORING OF HEAVY EQUIPMENT LIKE PUMP, MOTOR ETC ON THE FLOOR.
- THIS DRAWING IS FOR TENDER PURPOSE ONLY .

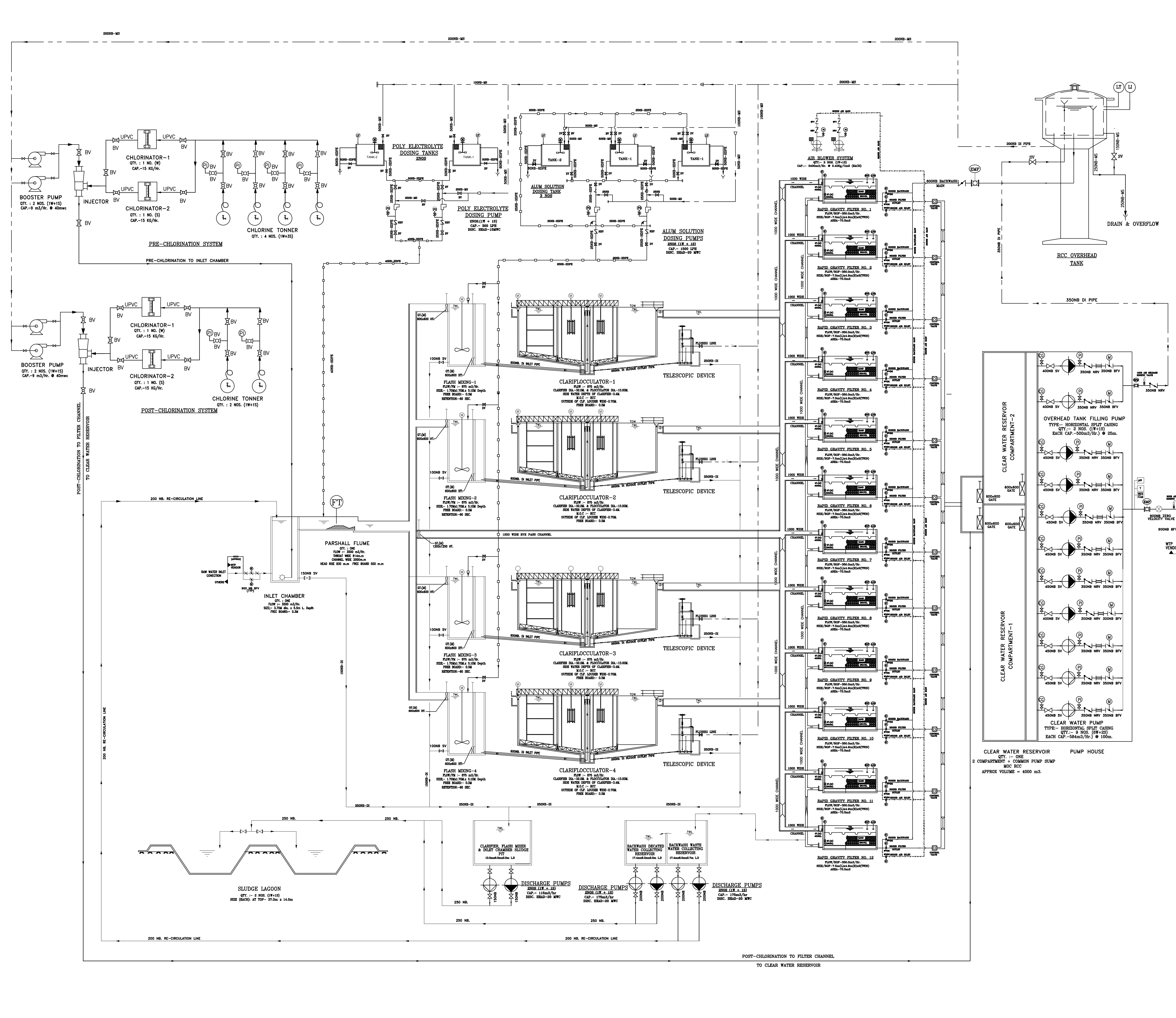
TITLE

TENTATIVE LAYOUT PLAN OF
WATER TREATMENT PLANT SITE
AT PANSKURA-1 CAPACITY: 70 MLD
INPUT IN 20 HRS/DAY RUN, i.e., 3500
M3 /hr.

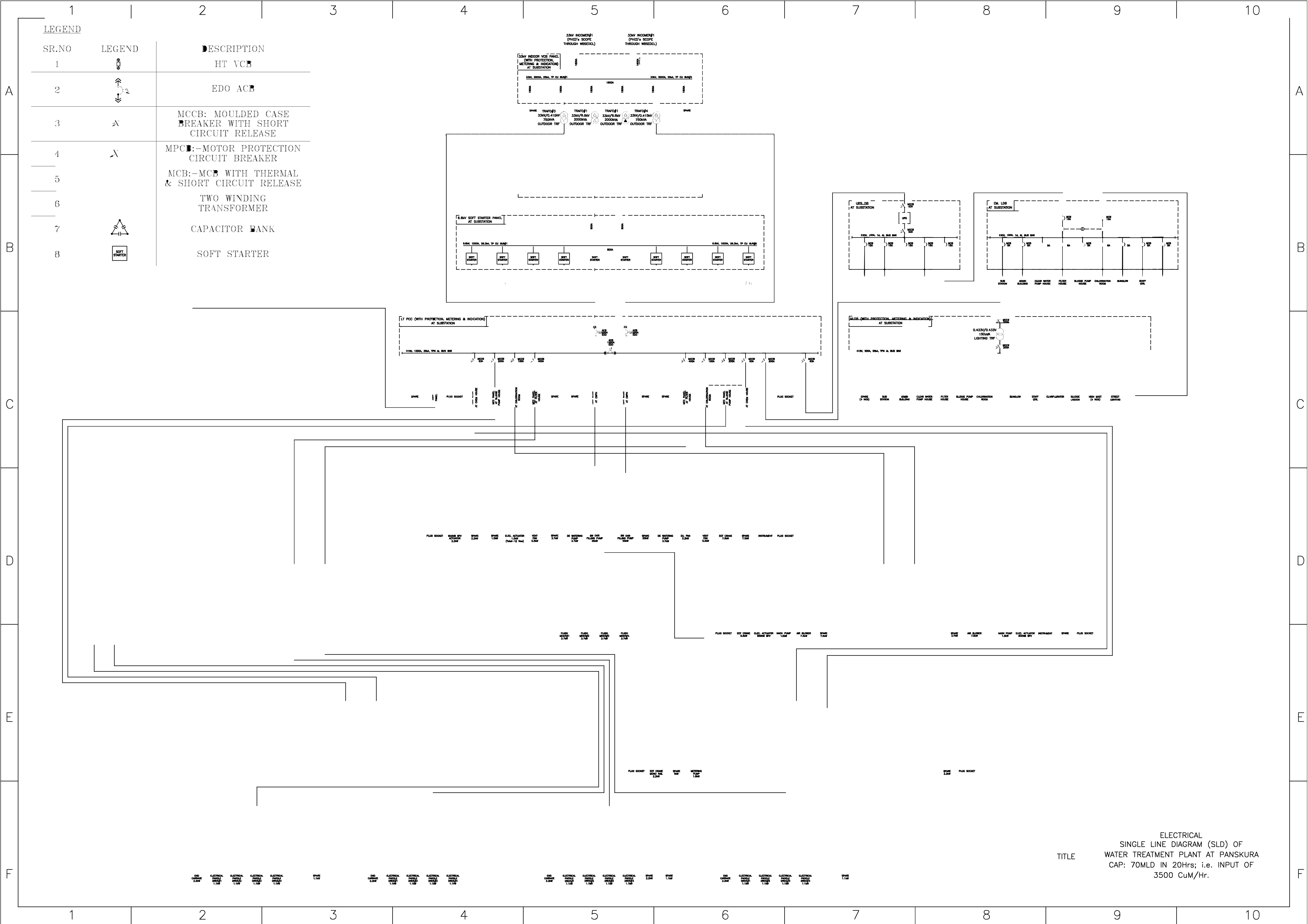


LANDSCAPED PLAN OF WATER TREATMENT PLANT

SCALE - 1 : 800



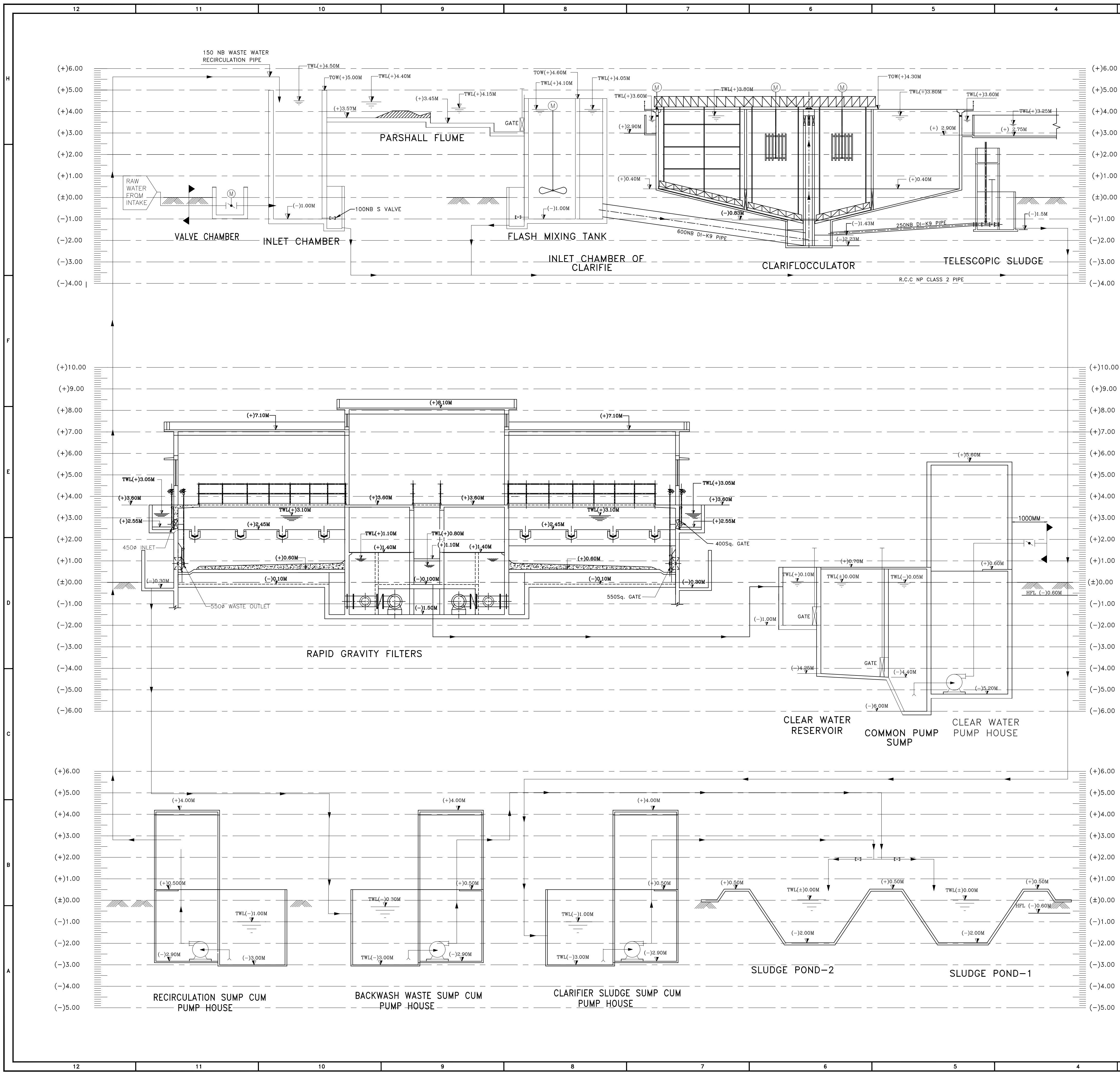
LEGEND		
SL. NO.	PARTICULARS	SYMBOL
1.	BUTTERFLY VALVE (MANUAL)	
2.	BUTTERFLY VALVE (MOTORISED)	
3.	NON RETURN VALVE	
4.	GATE/SLUICE VALVE	
5.	PVC DIAPHRAGM VALVE	
6.	BALL VALVE	
7.	DRAIN	
8.	DISMANTLING JOINT	
9.	AIR BLOWER	
10.	CONTROLLER SLOW START	
11.	MOTOR OPERATED AGITATOR/STIRRER	
12.	MOTOR OPERATED PENSTOCK GATE	
13.	GEAR OPERATED GATE MANUAL OPERATED	
14.	VERTICAL TURBINE- V.T. PUMP	
15.	HORIZONTAL SPLIT CASING (HSC) CENTRIFUGAL PUMP & MOTOR SETS (WORKING)	
16.	HORIZONTAL SPLIT CASING (HSC) CENTRIFUGAL PUMP & MOTOR SETS (STAND BY)	
17.	SUBMERSIBLE TYPE PUMP (NON-CLOG FOR SLUDGE HANDLING)	
18.	METERING PUMP DIAPHRAGM TYPE.	
19.	FLOCCULATOR PADDLE	
20.	AIR FILTER	
21.	EJECTOR	
22.	LEVEL INDICATOR ELECTRICAL DIGITAL TYPE-LOCAL OR MECH FLOAT TYPE	
23.	PRESSURE INDICATOR/GAUGE 100mm DIAL SIZE	
24.	DIAPHRAGM TYPE PRESSURE INDICATOR/GAUGE 100mm DIAL SIZE	
25.	FLOW INDICATOR ULTRASONIC (MECH FLOAT COUNTER WT. TYPE)	
26.	RATE OF FLOW	
27.	LOSE OF HEAD	
28.	OPEN CHANNEL	
29.	COVERED CHANNEL	
30.	AIR LINE	
31.	CHEMICAL SOLN. LINE	
32.	pH METRE	
33.	TOTALIZER	
34.	ELECTROMAGNETIC FLOWMETER	
35.	ZERO VELOCITY VALVE	
TITLE P & I DIAGRAM FOR WATER TREATMENT PLANT SITE AT PANKURA-1S CAPACITY:- 70 MLD INPUT IN 20 Hrs/Day RUN, iec, 3500 m3/hr.		
APPROVED BY		
ASSISTANT ENGINEER	EXECUTIVE ENGINEER	SUPERINTENDING ENGINEER
DRG. NO. - PPK/PHED/ WTP/P&I/003		DATE
SHEET : 1 OF 1		SCALE :- NTS



LEGEND

SR.NO	LEGEND	DESCRIPTION
1		HT VCB
2		EDO ACB
3		MCCB: MOULDED CASE BREAKER WITH SHORT CIRCUIT RELEASE
4		MPCB:-MOTOR PROTECTION CIRCUIT BREAKER
5		MCB:-MCB WITH THERMAL & SHORT CIRCUIT RELEASE
6		TWO WINDING TRANSFORMER
7		CAPACITOR BANK
8		SOFT STARTER

TITLE
ELECTRICAL
SINGLE LINE DIAGRAM (SLD) OF
WATER TREATMENT PLANT AT PANSKURA
CAP: 70MLD IN 20Hrs; i.e. INPUT OF
3500 CuM/Hr.



REFERENCE DRAWINGS

S.NO.	NAME OF DRAWINGS	DRAWING NO.
01	PLANT LAYOUT WATER TREATMENT PLANT	001
02	P & ID DIAGRAM WATER TREATMENT PLANT	

NOTES:

1. ALL LEVELS ARE INDICATED IN METERS.

2. FINISHED GROUND LEVEL (FGL) Mtrs BASED ON SURVEY DRAWING.

ABBREVIATION:

TWL	- TOP WATER LEVEL	TOT	- TOP OF TANK
IL	- INVERT LEVEL	FGL	- FINISHED GROUND LEVEL
LOW	- LIP OF WEIR	EL	- ELEVATION LEVEL
HP	- HIGH POINT	U/S	- UP STREAM
LP	- LOW POINT	D/S	- DOWN STREAM
TOW	- TOP OF WALL		

NOTE:-

1. NEAR BY BITUMINOUS ROAD HAS BEEN CONSIDERED AS 0.00 M LEVEL

2. ALL HYDRAULIC CALCULATION HAS BEEN DONE AS PER PROCESS DESIGN

TITLE

HYDRAULIC FLOW DIAGRAM OF WATER TREATMENT PLANT SITE AT PANSKURA-1

DRG. NO. -02

SHEET : 1 OF 1

SCALE :- NTS

CENTRAL SCADA
AT PHE HQ

CENTRAL MONITORING
& DATA ACQUISITION

LEVEL- 4

PROJECT - I

MASTER SCADA
AT WTP CAMPUS

PROJECT CONTROL,
(SEMI AUTO)
MONITORING & DATA
ACQUISITION

LEVEL- 3

RTU AT LOCAL
FIELD STATION

RTU AT LOCAL
FIELD STATION

SUPERVISORY CONTROL,
(SEMI AUTO & FULLY AUTO
CONTROL), MONITORING
& DATA ACQUISITION

LEVEL- 2

SUB STATION
HT & LT PANELS
& INSTRUMENTS

CHLORINE & OTHER
DOSING
ARRANGEMENT
MASS FLOW METERS

PUMPING STATION
MCC & OTHER
PANELS &
INSTRUMENTS

DIRECT CONTROL
& MONITORING

LEVEL- 1

MACHINERIES & EQUIPMENTS AT LOCAL FIELD
STATION

FIELD LEVEL

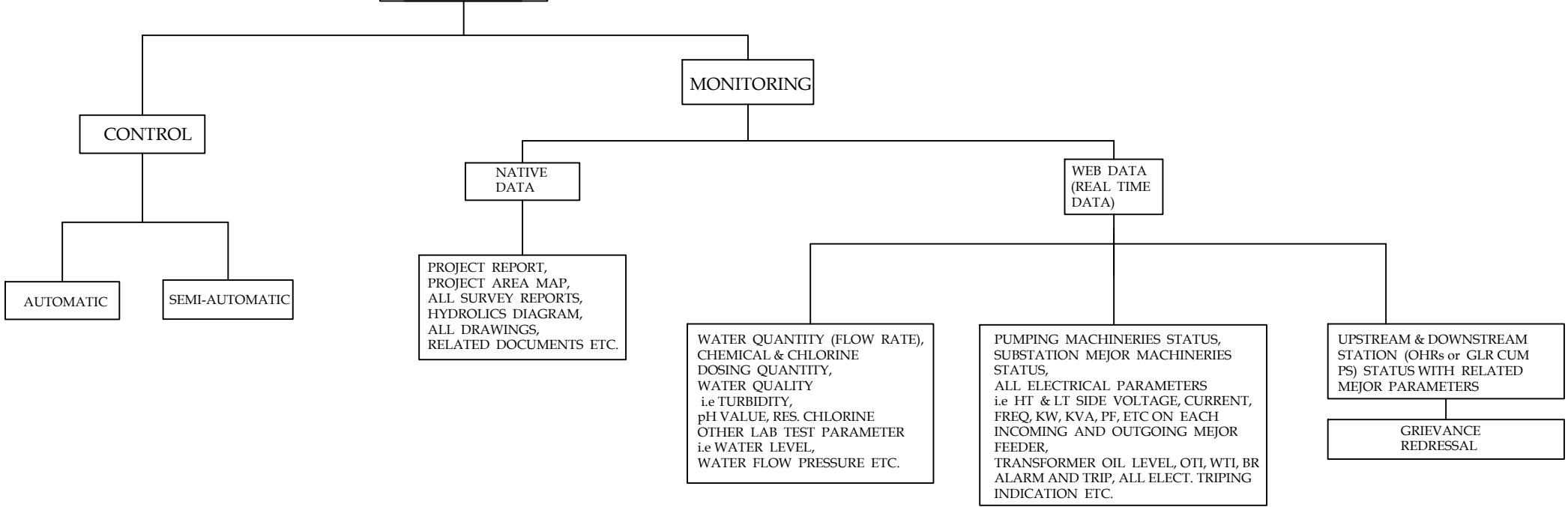
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DATE

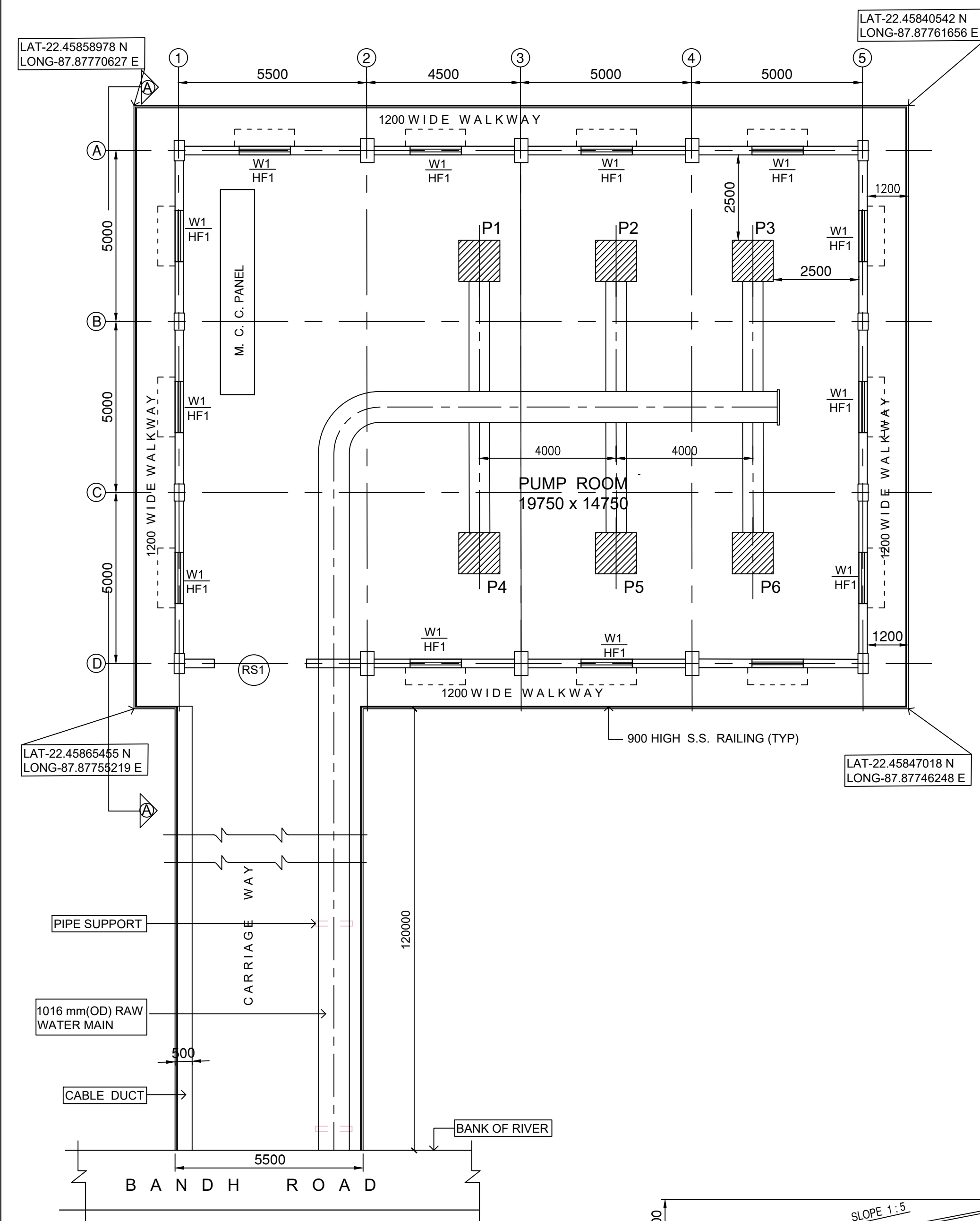
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SCADA PHILOSOPHY DIAGRAM

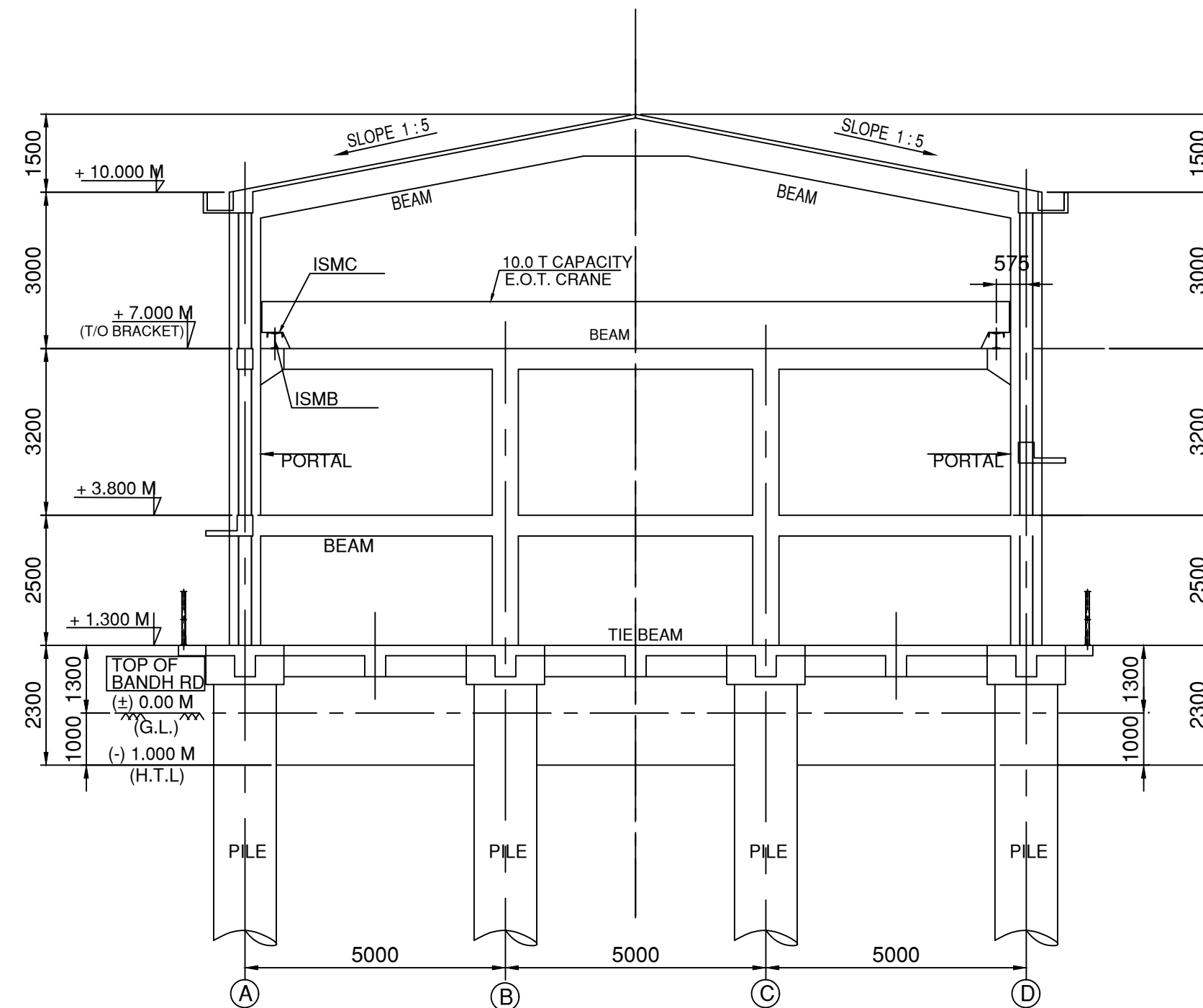
SCADA



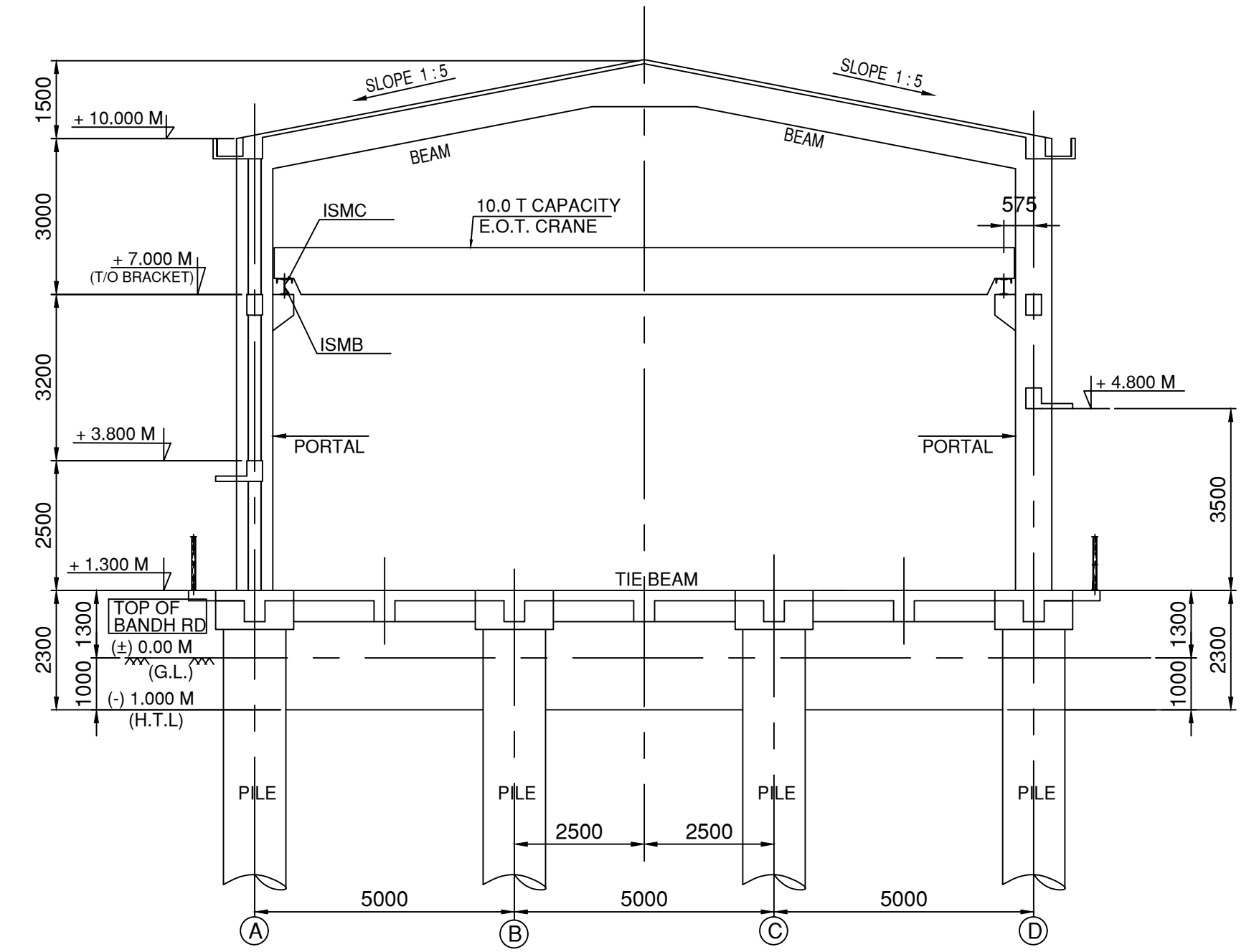
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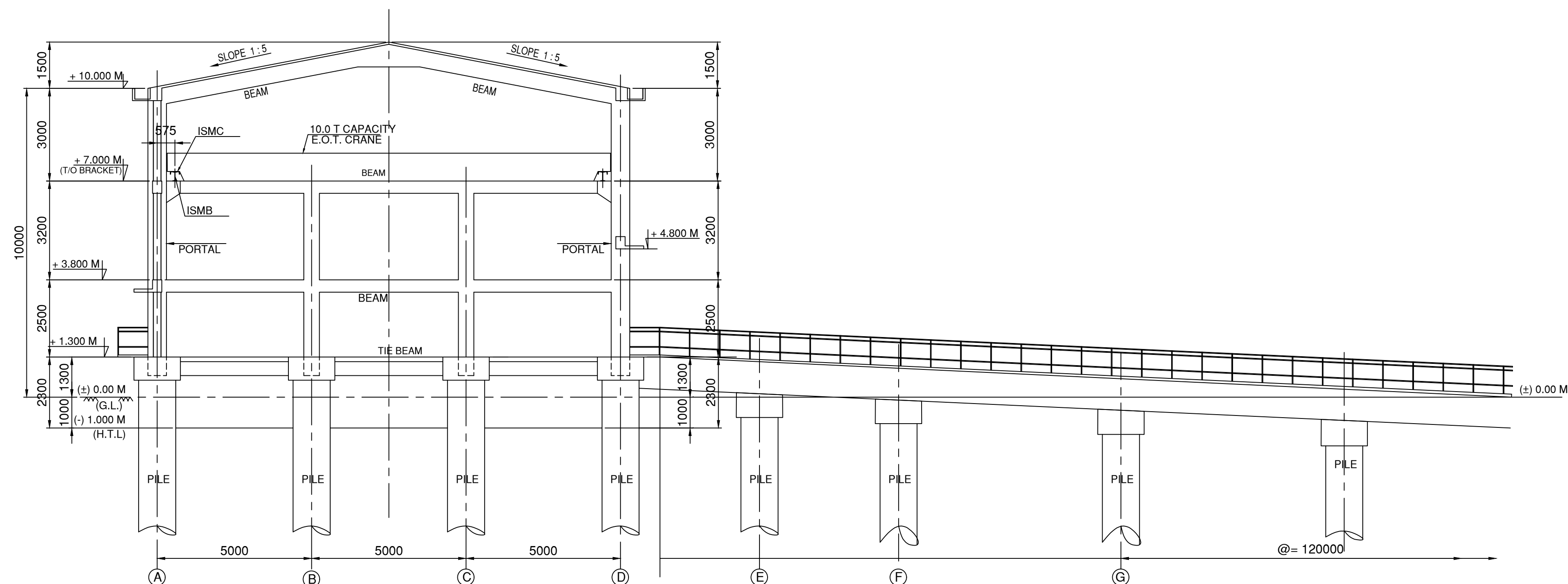
PLAN OF INTAKE PUMP HOUSE WITH JETTY
SCALE - 1 : 100



SECTIONAL ELEVATION ON LINE 1 & LINE 5



SECTIONAL ELEVATION ON LINE 2, 3. & LINE 4



SECTION A-A

NOTES.

1. ALL DIMENSIONS ARE IN MM
2. ALL EXTERNAL WALLS ARE 250 THK.
3. BANK OF RIVER (±0.00) CORRESPONDING TO TOP OF BANDH ROAD

DOOR / WINDOW SCHEDULE

MKD	NO	SIZE	DESCRIPTION
RS1	1	2700 x 3500	ROLLING SHUTTER
W1	9	1500 x 1200	ALUMINIUM OPENABLE WINDOW
HF1	18	1500 x 600	TOP HUNG & FIXED

Title

GA DRAWING FOR INTAKE JETTY WITH PUMP HOUSE FOR SURFACE WATER
PANSKURA BLOCK.