INTERIM DRAFT DPR
FOR
SEWAGE TREATMENT PLANT AND DISPOSAL WORK

1. Back Ground:-

National River Conservation Directorate, New Delhi has launched the program of pollution abatement of River Krishna in the year 1993 under Krishna River Action Plan by Government of India.

2. Introduction:-

The pre-feasibility Report (PFR) for abatement of pollution of river Krishna has been approved by Director , NRCD(New Delhi). The amount sanctioned for the project is Rs. 1559 lacks. The additional cost shall be borne by the Sangli-Miraj-Kupwad Muncipal Corporation.

3) Population:-

Decade wise population of Sangli city is as under

TABLE - I

Year	Population
1941	34781
1951	50287
1961	73838
1971	1,15,138
1981	1,52,389
1991	1,93,038

Based on the population of 1991 census & previous census. Population forecast has been done by different methods, Details are as per given in I&D report.

4) Quantity of sewage:-

Sewage of Sangli Town flows to the river Krishna through different nallas. All these nallas combine together to form two major nallas viz. i) Sherinalla ii) Haripurnalla

The actual measurement of flow has been done at these two nallas . The Data is given in the report of I&D.

The calculation of interception factor is done based on this data and is also given in the report of I&D.

The sewage flow rate has been calculated on the basis of water supply at the rate of 147 lpcd & interception factor of 0.65, which comes to be 95.5 lpcd .

The entire sewage of the city shall be collected at Sheri Nalla Sump and shall be pumped to Dhulgaon S.T.P. site at 17.142 Kms. away from the city.

The following table shows population & total sewage flow quantity reaching Sherinalla Pumping Station (SNPS) from the entire city including Sangliwadi, Kolhapur road and JJ Maruti Zones.

TABLE - II

Zones	Population &waste water flow(mld)			
	2001	2006	2011	2016
i) Population	251002	288654	326304	375250
ii) Waste Water Flow	24.65	28.36	32.05	36.85

5) Characteristics of Sewage:

Composite samples were taken and analyzed in the laboratory of Environmental Protection Research Foundation, Sangli, and Walchand College of Engineering, Sangli and MPCB Laboratory, Sangli.

5.1) The following tables gives the characteristics of Sangli City Sewage

TABLE - III
CHARACTERISTICS OF SEWAGE

Sr. No.	Parameter	Unit	Range	
			Haripur nalla	Sheri nalla
1	pH	--	7.25 - 7.42	7.50 – 7.69
2	COD	mg/l	300 – 415	175 - 277
3	BOD	mg/l	95 – 151	65 – 129
4	Suspended Solids	mg/l	100 – 200	40 – 50
5	Chlorides	mg/l	180 – 245	200 – 250
6	Sulphates	mg/l	140 – 257	160 – 210
7	Oil & Grease	mg/l	2 – 5	2 – 4

In order to highlight the health problems related to the discharge of waste water, following statements are of some relevance.

5.2) The pathogenic bacterial concentration are summarized as below :

TABLE - IV

Possible Levels of Pathogens in Domestic Wastewater

Type of pathogen		Possible concentration per litre in municipal wastewater[1]
Viruses:	*Enteroviruses*[2]	5000
Bacteria:	Pathogenic *E. coli*[3] *Salmonella* spp. *Shigella* spp. *Vibrio cholerae*	? 7000 7000 1000
Protozoa:	*Entamoeba histolytica*	4500
Helminths:	*Ascaris Lumbricoides* Hookworms[4] *Schistosoma mansoni* *Taenia saginata* *Trichuris trichiura*	600 32 1 10 120

? Uncertain

1 Based on 100 lpcd of municipal sewage and 90% inactivation of excreted pathogens

2 Includes polio-, echo- and coxsackieviruses

3 Includes enterotoxigenic, enteroinvasive and enteropathogenic *E.coli*

4 *Anglostoma duedenale* and *Necator americanus*

5.3) The survival rate of above pathogens is indicated below:

TABLE - V

Survival of Excreted Pathogens (at 20-30^0 C)

Type of pathogen	Survival time in days			
	In faeces, night soil and sludge	In fresh water and sewage	In the soil	On crops
Viruses *Enteroviruses*	<100 (<20)	<120 (<50)	<100 (<20)	<60 (<15)*
Bacteria Faecal Coliforms *Salmonella* spp. *Shigella* spp. *Vibrio cholerae*	 <90 (<50) <60 (<30) <30 (<10) <30 (<5)	 <60 (<30) <60 (<30) <30 (<10) <30 (<10)	 <70 (<20) <70 (<20) -- <20 (<10)	 <30 (<15) <30 (<15) <10 (<2) < 5 (<2)
Protozoa *Entamoeba histolytica cysts*	<30 (<15) <30 (<15)	<30 (<15) <30 (<15)	<20 (<10) <20 (<10)	<10 (< 2) <10 (< 2)
Helminths *Ascaris lunbricoides eggs*	Many Months	Many Months	Many Months	<60 (<30)

* Figures in brackets show the usual survival time.

Source - M.B. Pescod, FAO of UN; Irrigation and Drainage Paper 47

It is seen from the above table that the waste water discharge into river can create unsafe, unhygenic conditions for the downstream users.

Sangli city experiences frequent occurrence of epidemics like Jaundice (Viral), Dysentry, Cholera etc. Especially on two occasions i.e. in 1974 and 1976 the mortality rate increased substantially due to out-break of Typhoid and Jaundice. Even today the situation is still more or less the same.

The recent observations of Ganga River Quality after implementation of Ganga River Action Plan have also indicated that the faecal contamination is maximum of 15 lakhs per 100 ml and minimum of 70,000 per 100 ml, whereas the permissible limit is only 500 per 100 ml. The discharge of domestic waste water has created irreparable health damages and as such the NRCD has issued directives to utilize the treated effluents for irrigation purpose only as the die away of the pathogens of sewage is much faster and also there is no direct contact of faecal pollution to the human health unlike in water bodies. The directives are applicable to all river abatement and pollution control programs .

6) Sewage Treatment Plant:

6.1) Selection of Alternative Treatment System:

It has been observed that present treatment plant based on aeration principles does not give desired efficiency, as there is a tendency of non-operation of the plant because of high energy costs. The UASB technologies also may not be suitable for municipal waste having low BOD and high sulphate concentration.

The characteristics of sewage indicates the BOD and Sulphate concentration of 100-150 mg/l and 200-250 mg/l respectively. These values indicate suitability of simple treatment method of anaerobic pond followed by facultative lagoon. It is expected to get 50% to 60% reduction in BOD in anaerobic pond and 70% to 80 % B.O.D reduction in the facultative lagoon. The treated effluent B.O.D shall be less than 100 mg/l. In fact, observations made by Mr. Duncan Mara of UK indicates that Waste Stabilization Ponds (WSP) are the most cost effective and efficient treatment systems for Indian conditions. Further, he has observed that in most of the Indian cities, the sewage is highly dilute and requires very simple treatment. Thus, it was decided to follow anaerobic pond and facultative lagoon treatment having one day and four days hydraulic retention time respectively.

In the meeting convened by NRCD on 2nd July 1999 it is suggested that the sewage treatment plant may be designed to achieve BOD of 100 mg/l, if the treated sewage is to be used for irrigation. In the present case the sewage shall be used only for irrigation purpose and the anaerobic pond itself can give the desired irrigation standards. However, to remove anaerobiossity a polishing pond of 2 days capacity may be incorporated.

6.2) DESIGN OF SEWAGE TREATMENT PLANT:

a) Process

As discussed earlier the low cost treatment option selected for this scheme is Waste Stabilization Ponds (WSP). In WSP, Anaerobic pond followed by polishing pond has been selected for this design.

The advantages of this scheme are:

- Simple to construct
- Cost effective - Anaerobic pond followed by Facultative pond are cheaper than other conventional treatment system as no aeration is required and huge cost of electricity can be saved.
- High efficiency of >60 % is usually obtained
- Easy operation & Maintenance
- Treated sewage can readily be used for pisci- culture , irrigation etc. without any tertiary treatment.

This alternative requires large area, hence it is not generally adopted in city Sewage treatment Plant (STP). However, in this case the STP site is selected at Dhulgaon , which is situated at a distance of 17.142 km from Sangli where sufficient land is available and also there is a shortage of irrigation water. Thus there is a good scope for utilisation of treated sewage for irrigation rather than disposing it in any water body.

b) Capacity

The entire scheme is divided into four Phases. The population forecast has been made for the selected years of the scheme observing the trend of population increase in past. Based on the forecasted population the sewage flow has been estimated as mentioned in Table III.

c) Layout of Treatment Plant:-

As stated earlier, the STP site is selected at Dhulgaon, 17.142 Km away from Sangli., in Gat No. 16. The area available is of irregular shape and divided centrally by the road . hence the anaerobic pond is located on southern side of road and polishing pond is located on the northern side .

It is proposed to provide pre-treatment consists of Coarse Bar Screen and Grit Removal facilities at the collection sump only. It is proposed to provide pre-treatment units consisting of Fine Screen, Grit Channel, Oil & Grease Trap and Parshall Flume at STP site. Adequate facilities will be provided for storage of oil and grit collected in these units.

It is proposed to treat the sewage in Anaerobic Pond followed by Polishing Ponds in series. The inlet and outlet of the ponds will be provided in opposite directions and opposite corners to ensure plug flow in the ponds.

The layout of plant is given in the drawing No. STP/1

d) DESIGN PARAMETERS ADOPTED FOR STP:

" Design Manual for Waste Stabilization Ponds" by Duncan Mara has been followed for design of WSP system.

Mean winter Temperature	-	22° C
Longitude	-	74°42' E
Latitude	-	16°15' N
Elevation	-	598m above Mean Sea Level
Evaporation Rate	-	5mm/m^2/d
Sky clearance Factor	-	75%

f) PRIMARY TREATMENT PLANT :

Primary treatment plant comprising of Screen chamber, Grit channel, Oil& Grease trap & partial flume shall be provided on modular basis. The initial units shall be for the flow of 2006. Subsequently additional units shall be provided for every 5 years module.

Hydraulic flow diagram is given in drawing S.T.P /2

g) SECONDARY TREATMENT:

Anaerobic Pond followed by Polishing Pond
Phase- I (Year 2006)

PARAMETER		ANAEROBIC POND	POLISHING POND
Avg. flow	-	28,360 m^3\d	28,360
Inlet BOD	-	150 mg/l	67.5 mg/l
No. of units	-	2	1
Designed flow/unit	-	14180 m^3	28360 m^3
Detention time	-	1 day	2 days
Liquid depth	-	4 m	1.75 m
Free board	-	1 m	0.75 m
BOD removal efficiency	-	55%	30%
Out let BOD	-	67.5 mg\l	42.25 mg/l
The surface area required	-	1.2 ha.	4.54 ha.
Total area required		6.66 ha (with 10% area for roads)	

The hydraulic flow diagram is given in drawing no. STP/3

PHASE-II (YEAR 2011)

DESIGN DATA

Avg. flow	-	32.05 MLD i.e. 32,050 m^3/d
Inlet BOD	-	150 mg/l
Additional Flow	-	32,050 – 28,360
	=	3,700 m^3 /d
The additional flow /unit	=	1,850 m^3/d

DESIGN OF ANAEROBIC POND

If additional flow of 3,767 m^3 is added to the existing units of Anaerobic ponds and Polishing pond s provided for the Phase-I

Avg. flow / unit - 14426 + 1,850 = 16,276 m^3/d

The Anaerobic ponds are expected to take up this additional loading with same BOD removal efficiency of 55%

Hence BOD at the outlet of AP - 67.5 mg/l

DESIGN OF POLISHING POND

Flow - 32,050 m3/d

Inlet BOD - 67.5 mg/l

The BOD removal efficiency of Polishing pond is expected to decrease slightly and will be @ 20%

Thus BOD at the outlet of PP =67.5 * 0.8 =54 mg/l

It is within the prescribed limit of 100 mg/l

Thus the additional flow of the II phase can be treated in the existing AP and PP of the phase-I and the treated effluent will have BOD @ 54 mg/l, which is within the limit of 100 mg/l . Thus there is no need of additional secondary treatment facilities for the phase-II. The additional units for primary treatment i.e. Screen, Oil & grease Trap and Grit chamber will be provided.

Phase- III (Year 2016)
DESIGN DATA

Avg .Flow	-	36.85 MLD i.e. 36,850 m^3/d
Inlet BOD	-	150 mg/l
Additional flow	-	36.85-32.05 = 4.80 MLD i.e. 4,800 m^3/d

To treat this sewage, one more unit of Anaerobic pond followed by a Polishing pond will be required. Additional units of primary treatment also will be provided.

PARAMETERS	ANAEROBIC POND	POLISHING POND
Flow	4,800 m^3/d	4,800 m^3/d
No. of units	1	1
Inlet BOD	150 mg/l	67.50 mg/l
Retention time	1 day	2 days
Liquid depth	4 m	1.75 m
BOD removal efficiency	55 %	30%
Out let BOD	67.5 mg/l	47.25mg/l
Area required	0.298 ha	0.86 ha
Total area required	1.16 ha. (with 10% area for roads)	

Phase- IV (Year 2021)
DESIGN DATA

Avg .Flow	-	41.66 MLD i.e.41,660 m^3/d
Inlet BOD	-	150 mg/l
Additional in flow	-	41660-36850= 4810 m^3/d

To treat this sewage, one more unit of Anaerobic pond followed by a Polishing pond of size same as that for phase III will be required. Additional units for primary treatment shall also be provided.

PARAMETER	ANAEROBIC POND	POLISHING POND
Flow	-4810 m^3/d	4810 m^3/d
No. of units	- 1	1
Inlet BOD	-150 mg/l	67.50 mg/l
Retention time	-1 day	2 days
Liquid depth	-4 m	1.5 m
BOD removal efficiency	-55 %	30%
Outlet BOD	-67.5 mg\l	47.25 mg/l
Area required	-0.29 Ha.	0.865Ha
Total area required	1.16 Ha. (with 10% area for roads)	

TABLE - VI

AREA REQUIRED FOR THE STP

Year	Phase	Average Flow of Sewage in MLD	Area required for STP in Ha.			Total area required for STP including. roads etc. in Ha
			AP	PP	Total	
2006	I	28.36	1.2	4.54	6.66	7
2011	II	32.05	1.2	4.54	6.66	7
2016	III	36.85	0.298	0.86	1.16	8
2021	IV	41.66	0.29	0.86	1.16	9.2

7) Disposal system:

In the present proposal the entire city waste shall be treated at Dhulgaon 17.142 kms. away from the city and shall be used on land for irrigation. About 1000 acres of land is available for disposal of treated sewage in the nearby fields.

7.1) Area required for irrigation :

The sewage application rate on land for irrigation is considered as 2 lakh litres per hectare per rotation. With 10 rotations required in a year, the sewage quantity utilised shall be 50 hectares per mld.

The area required for the disposal of sewage for different years is given below:

TABLE - VII

AREA REQUIREMENT FOR IRRIGATOIN:

Sr.No.	Year	Flow (MLD)	Area (Ha)
1	2001	24.65	1230
2	2006	28.36	1418
3	2011	32.05	1602
4	2016	36.85	1843
5	2021	41.66	2083

TABLE - VIII

Cost of STP for Year 2011 :

Sr. No.	Treatment Units	Cost Rs. in Lakhs
1	Primary Treatment	15.0
2	Anaerobic Pond	58.0
3	Polishing Pond	87.0
4	Miscellaneous Works	20.0
	Total	180.0
	14 % Centage Charges	25.20
	Total	**205.20**

Note : The present STP can serve till year 2011. Additional units shall be provided on modular basis of five years each for 2016 and 2021.

TABLE - IX

DETAILS OF OPERATION AND MAINTENANCE COST :

A) Manpower :

Sr. No.	Post	Numbers X Shifts	Rs. / Month	Months	Amount (Rs.)
1	Operators	2 X 3	2500	12	1,80,000
2	Beldar	3 X 3	2000	12	2,16,000
				Total	**3,96,000**

TABLE - X

B) M & R Charges :

Sr. No.	Item	Capital Cost (Rs. in Lakhs)	% of M &R	Amount (Rs. in Lakhs)
1	STP	205.2	1.0	2.05
Other				
2	Sundry Charges	205.2	0.1	0.21

TABLE - XI

XI . D) SUMMARY OF O & M CHARGES:

Sr. No.	Particulars	Amount (Rs. In Lakhs)
1	Staff	3.96
2	Energy charges	2.05
3	M & R Charges	2.05
4	Sundry charges	0.21
	Total	**8.27**

TABLE - XII

ANNUAL BURDEN

Based on Both I & D and STP Cost

Sr. No.	Particulars	**For 2001**
1	O & M Charges (Rs in Lakhs) (162.67 + 8.27)	170.94
2	Area to be irrigated (Ha)	1234.00
3	Rate of irrigation (Rs/Ha)	10000.00
4	Revenue from irrigation (Rs. In Lakhs)	123.40
5	**Annual Burden (Rs. In Lakhs)**	**47.54**

INTERIM DRAFT DPR
FOR
LAND ACQUISITION

1) INTRODUCTION:

National River Conservation Directorate, New Delhi, has launched the programme of abatement of pollution of River Krishna in the year 1993 under Krishna River Action Plan by Government of India. The principal objective of this programme is to improve the quality of water to desired river category.

The first phase of this programme comprises of two towns viz. Sangli and Karad in the Krishna River Basin for pollution abatement in the state of Maharashtra. Under the programme, it is envisaged to intercept, divert and treat about 24 million litres per day (MLD) of the wastewater of Sangli town. As per PFR, the Krishna River Action Plan in Phase-I is estimated to cost Rs. 1560 lakhs for Sangli and Rs. 1400 lakhs for Karad town.

The pre-feasibility report for abatement of pollution for River Krishna at Sangli in Maharashtra under National River Conservation Plan (NRCP) has been approved by the Director, NRCD, New Delhi vide letter No. J-39013 / 122 / 96-NRCD-II dated 20-04-1999. The Detailed Project Report Preparation is in progress, keeping in view, the following guidelines given by NRCD.

1. Sewage is to be taken away from town most economically.
2. Treated sewage is to be used for irrigation.
3. Treatment plant is to be based on Waste Stabilization Pond Process.

2) SALIENT FEATURES OF THE SCHEME :

- An Intercepting weir shall be constructed on Sherinalla to collect wastewater from North East region of Sangli city. An intake pipe shall lead the sewage to Sheri Nalla Pumping Station (SNPS) to be constructed in C.S. No.13.
- Entire waste from Kolhapur Road Pumping Station (KRPS), JJ Maruti Pumping Station (JJMPS) and Sangliwadi Pumping Station (Sangliwadi PS) shall be pumped to Sherinalla sump.
- Entire Sangli city waste water shall be pumped in two stages viz from Sherinalla Pumping Station (SNPS) to Kavalapur & from Kavalapur to Dhulgaon.
- Construction of Sewage Treatment Plant comprising of Anaerobic lagoon followed by Polishing pond at Dhulgaon.
- Disposal of treated sewage on land for irrigation.

3) LAND REQUIRED FOR THE SCHEME :

i) **For Pumping stations :** In the present scheme three new pumping stations are to be constructed viz.

a) At JJ Maruti near Irwin Bridge - 25 m X 25 m (C. S. No. 1118)
b) At Sheri Nalla. - 60 m X 60 m (R.S. No. 13)
c) At Kavalapur - 40 m X 40 m (Gat No. 2230)

The layout map of the above pumping stations are enclosed as Annexure - I, Annexure – II and Annexure – III respectively.

ii) For Sewage Treatment Plant at Dhulgaon Village : Capacity of STP is designed for the flow of 28.36 mld in the year 2006 and the same will be sufficient to cater the sewage flow for the year 2011. The area required for this flow is 7.0 Hectares. This area is located in Gat No. 16

At Dhulgaon 15.0 hectares of Gayran land is available and Dhulgaon Grampanchayat has given a consent letter for handing over the land for STP.

For the flow of 2021 and 2031 additional land of 13.0 Hectares is required which shall be procured at later stage.

4) ESTIMATED COST OF LAND ACQUISITION :

Basis :

1) **JJMPS :** As the Pumping Station is located in the town proper, the rate of land acquisition is considered as Rs. 2000.00/Sq.m.
2) **SNPS :** This area is coming under agricultural zone and frequent flooding occurs during mansoon hence a rate of Rs. 100 / Sqm is proposed for this pumping station.
3) **KVPS :** This pumping station is located in the area owned by Kavalapur Grampanchayat. Hence the rate of Rs. 50.0 / Sqm.
4) **Dhulgaon STP :** The present requirement of land of STP is 7.0 Hectares and the Gayran area available is 15.0 hectares. Hence no cost is considered for land acquisition.

Total Cost of Land Acquisition :

Sr. No.	Item	Area	Rate	Amount (Rs. in Lakhs)
1	JJMPS	625	2000.0	12.50
2	SNPS	3600	100.0	3.60
3	KVPS	1600	50.0	0.80
4	Dhulgaon STP	150000	---	----
			Total	16.90