



MONITORING OF ENVIRONMENTAL PLAN FOR JN PORT

Performance Evaluation of Sewage Treatment Plant at JNP Township

REPORT NO.	:	UT/ELS/REPORT/EMR-39/2016
Month	:	November 2015 to January, 2016
Issue No	:	01
Revision No	:	00
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Monitoring of Performance of Sewage Treatment Plant

1. INTRODUCTION

As per the Environmental Monitoring Plan of Jawaharlal Nehru Port (JNP), the study of performance of the Sewage Treatment Plant (STP) at Township is carried out by collecting samples of the influent and effluent once in every month. The Flow Diagram of STP at JNP Township is shown in **Figure 1**. The description of various units at STP is given in **Table 1**.

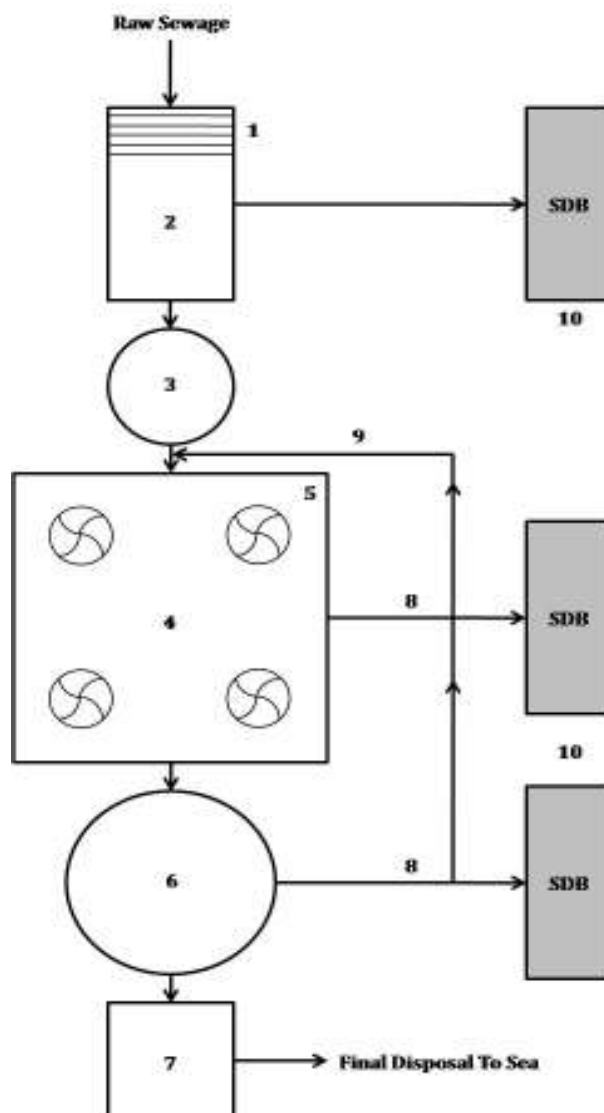


Figure 1: Flow Diagram of Sewage Treatment Plant at JNPT

The treatment system adopted activated sludge process in extended aeration mode. Aeration is done with help of four sets of turbine type aerators.

Table 1: Description of STP units as mentioned in Figure 1

Unit No.	Unit Description	Unit Size	
1.	INLET SEWAGE SUMP	7.00 X 3.00 X 2.00 M SWD	1
2.	SCREEN CHAMBER	0.40 X 1.00 X 0.25 M SWD	2
3.	GRIT CHAMBER	18.00 X 0.80 X 0.80 M SWD	2
4.	AERATION TANK	30.65 X 30.64 X 4.00 M SWD	1
5.	CLARIFIER WITH SKIMMER	18.00 DIA X 2.50 M SWD	1
6.	SLUDGE SUMP	4.00 X 4.00 X 1.5 M SWD	1
7.	SLUDGE DRYING BEDS	6.50 X 13.50 M	12
8.	PUMP HOUSE MCC ROOM & PUMP PIT	10.00 X 7.00 X 3.50 M HT	1
9.	TREATED EFFLUENT CHAMBER	4.00 X 4.00 X 2.40 M	1
10.	DRY PIT AND PUMP HOUSE FOR SLUDGE PUMP	4.00 X 4.00 X 3.50 M ABOVE GL	1

2. METHOD OF MONITORING OF STP

The objective behind monitoring of STP at JNP Township is to determine the treatment efficiency. Sewage samples were collected before treatment at STP inlet and after treatment from final outlet once in a month. The sampling and analysis of sewage samples were carried out as per CPCB guidelines as mentioned in Annexure 1. The STP samples were characterized for pH, Suspended Solids (SS), Oil and Grease (O&G), Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand at 27°C, 3 days (BOD) as per standard methods of wastewater analysis. Performance evaluation of STP was carried out based on the removal efficiency of TSS, O&G, COD and BOD. The wastewater samples collected once in a month during November, 2015 to January, 2016.

3. STP INLET AND TREATED WATER CHARACTERIZATION

Physiochemical characteristics of sewage samples before and after treatment are given in **Table 2** to **Table 4** and the characteristics of treated water are compared with CPCB discharge standards for effluent discharge to Marine Coastal Waters. The graphical representation of various characteristics of sewage samples are presented in **Figures 2 to 5** respectively for TSS, O&G, COD and BOD.

It is seen from **Tables 2 to 4** that raw sewage (Influent) characteristics were below the design values while the treated sewage (Effluent) characteristics are well within the prescribed discharge standards. Bioassay test was conducted for the effluent sample. It is seen that 100% survival was seen for 96 hours for 100 % effluent sample.

Table 2: Wastewater Characteristics of STP samples before and after treatment
[Sampling: 6th November, 2015]

Parameter	Unit	Influent	Effluent	Standard*
Colour	-	Colourless	Colourless	Colourless
Odour	-	Slight Odour	Odourless	Odourless
pH	-	7.3	7.1	5.5 to 9.0
Total Suspended Solids	mg/l	96	6	100
Chemical Oxygen Demand	mg/l	448	16	250
Biochemical Oxygen Demand	mg/l	135	5	100
Oil and Grease	mg/l	10	<2	20
Bio-assay test	-	-	100 % Survival	90% survival after 96 hours in 100% Effluent

*: Schedule VI of Environment (Protection) Third Amendment Rules, 1993 for Marine Coastal Areas

Table 3: Wastewater Characteristics of STP samples before and after treatment
[Sampling: 18th December, 2015]

Parameter	Unit	Influent	Effluent	Standard*
Colour	-	Colourless	Colourless	Colourless
Odour	-	Slight Odour	Odourless	Odourless
pH	-	7.4	7.2	5.5 to 9.0
Total Suspended Solids	mg/l	48	8	100
Chemical Oxygen Demand	mg/l	432	12	250
Biochemical Oxygen Demand	mg/l	128	4	100
Oil and Grease	mg/l	8	<2	20
Bio-assay test	-	-	100 % Survival	90% survival after 96 hours in 100% Effluent

*: Schedule VI of Environment (Protection) Third Amendment Rules, 1993 for Marine Coastal Areas

Table 4: Wastewater Characteristics of STP samples before and after treatment
[Sampling: 15th January, 2016]

Parameter	Unit	Influent	Effluent	Standard*
Colour	-	Colourless	Colourless	Colourless
Odour	-	Slight Odour	Odourless	Odourless
pH	-	7.4	7.2	5.5 to 9.0
Total Suspended Solids	mg/l	54	6	100
Chemical Oxygen Demand	mg/l	424	16	250
Biochemical Oxygen Demand	mg/l	120	5	100
Oil and Grease	mg/l	10	<2	20
Bio-assay test	-	-	100 % Survival	90% survival after 96 hours in 100% Effluent

*: Schedule VI of Environment (Protection) Third Amendment Rules, 1993 for Marine Coastal Areas

4. PERFORMANCE EVALUATION OF THE STP

A] TSS Removal in the STP: TSS of the wastewater in the inlet and final outlet varied from 54 to 96 mg/l in inlet and 6 to 8 mg/l in the outlet. TSS removal in STP at inlet and final outlet are represented in **Figure 2**. TSS of the domestic wastewater in STP showed an average reduction from 7 to 66 mg/l during the study period. A maximum removal efficiency of 94% was observed during November, 2015. The standard limit for the discharge of effluent is 100 mg/l.

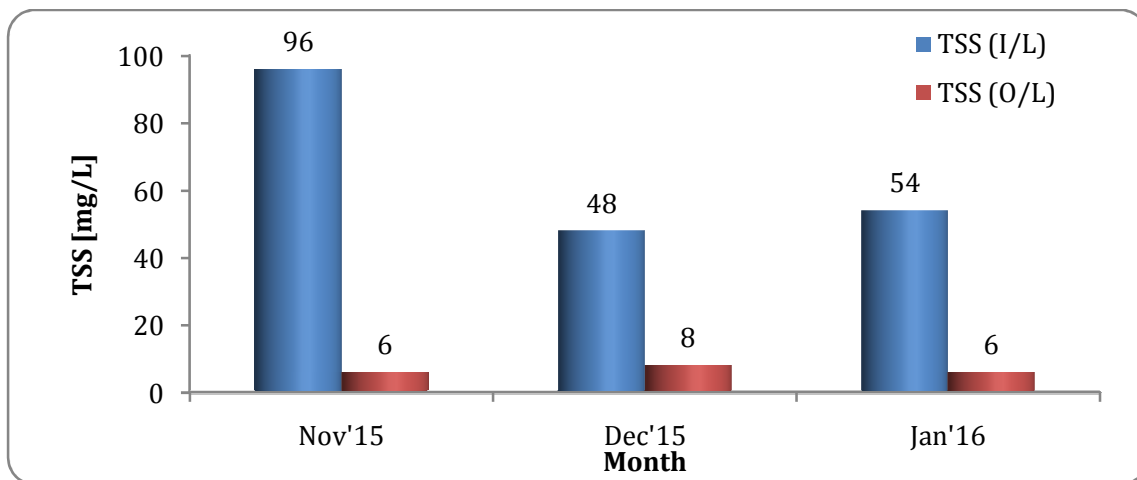


Figure 2: TSS concentration for STP Inlet and Final Outlet [Period- November, 2015 to January, 2016]

B] O&G Removal in the STP: O&G of the wastewater in the inlet and final outlet varied from 8 to 10 mg/l in inlet and <2 mg/l in outlet. O&G removal in STP at inlet and final outlet are represented in **Figure 3**. O&G of the domestic wastewater in STP showed an average reduction from 9 to <2 mg/l during the study period. During all the months O&G values were below <2 mg/l. The standard limit for the discharge of effluent is 20 mg/l.

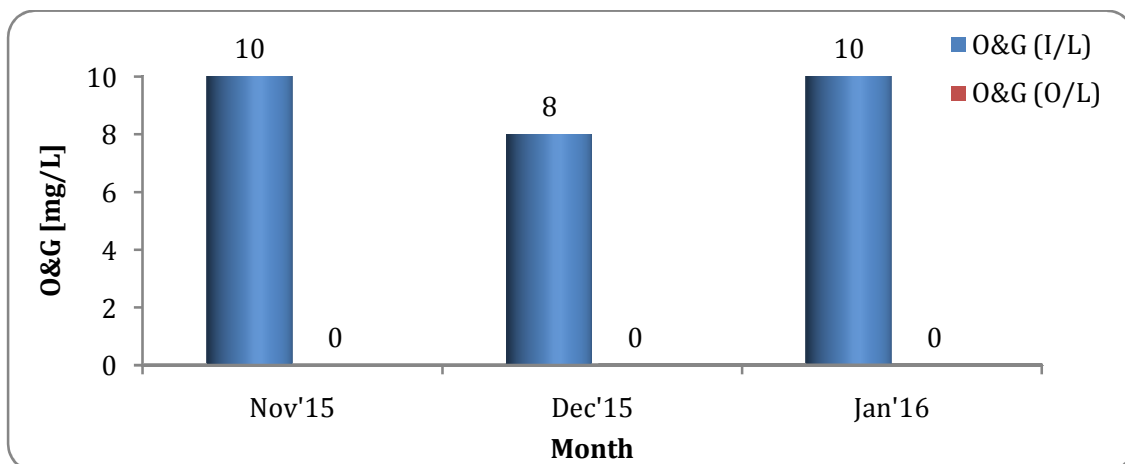


Figure 3: O&G concentration for STP Inlet and Final Outlet [Period- November, 2015 to January, 2016]

C] COD and BOD Removal in the STP: COD and BOD of the domestic wastewater at inlet and final outlet are represented in **Figures 4 and 5**. COD values of wastewater in the inlet varied from 424 to 448 mg/l and final outlet 12 to 16 mg/l. The average COD reduction observed from 15 to 435 mg/l during study. A maximum of 97% removal efficiency was observed during December, 2015. The standard limit for discharge of effluent is 250 mg/l.

BOD of wastewater in the inlet varied from 120 to 135 mg/l and final outlet 4 to 5 mg/l. Average BOD removal during the study varied from 128 to 5mg/l and the treatment system was able to achieve a maximum BOD removal of 97% during December, 2015. BOD removal can be attributed to the decomposition and mineralization of organic compounds. The standard limit for discharge of effluent is 100 mg/l.

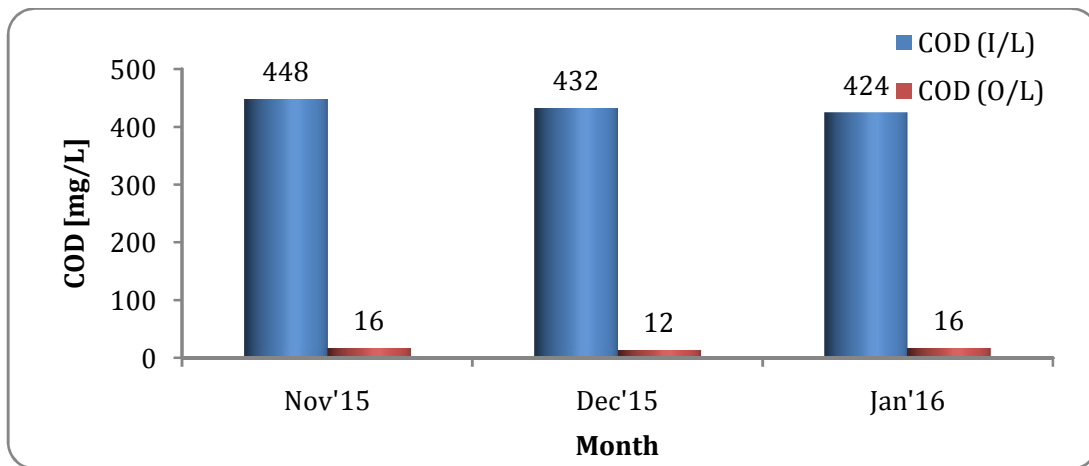


Figure 4: COD concentration for STP Inlet and Final Outlet [Period- November, 2015 to January, 2016]

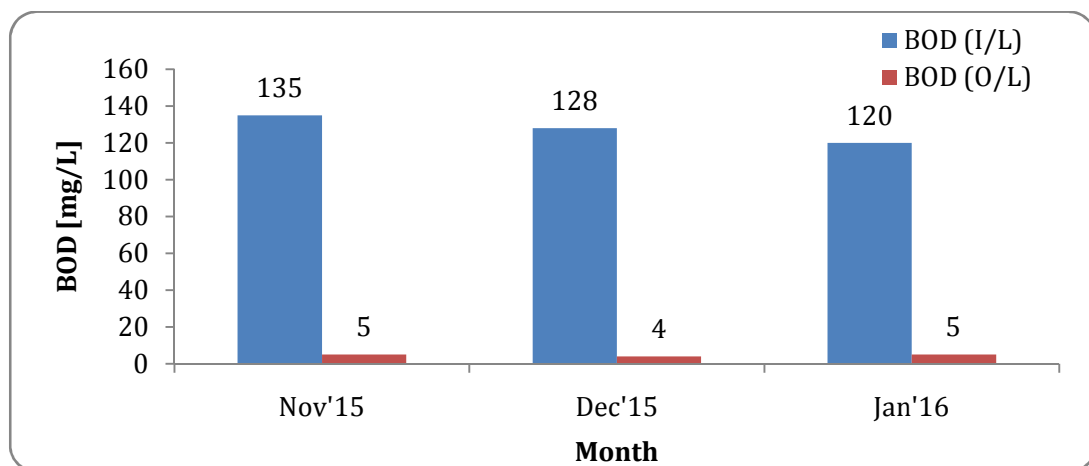


Figure 5: BOD concentration for STP Inlet and Final Outlet [Period- November, 2015 to January, 2016]

The influent wastewater of STP exhibited a COD to BOD ratio ranging from 3.13 to 3.41 and the values are comparable to those presented by Metcalf and Eddy Inc., "Wastewater Engineering – Treatment, Disposal and Reuse", 4th Edition (2003). The

typical COD/BOD ratio of domestic wastewaters is usually in the range of 1.25 to 2.5. However, for treated effluents, it ranges from 3.24 to 4.94. This indicates relatively higher proportion of the non-biodegradable content in treated effluent rather than raw wastewater. Hence, the BOD removal efficiency is slightly higher than that of COD.

The data for TSS, O&G, COD and BOD removal efficiency of the sewage treatment plant for the period of November, 2015 to January, 2016 is collected in **Table 5**. The overall removal efficiency is presented in **Figure 6**.

Table 5: Performance of STP – % Removal Efficiency of TSS, O&G, COD & BOD

Parameter	% Removal Efficiency			
	Nov' 2015	Dec' 2015	Jan' 2015	Average
Total Suspended Solids	93.8%	83.3%	88.9%	88.7%
Oil and Grease	-	-	-	-
Chemical Oxygen Demand	96.4%	97.2%	96.2%	96.6%
Biochemical Oxygen Demand	96.3%	96.9%	95.8%	96.3%

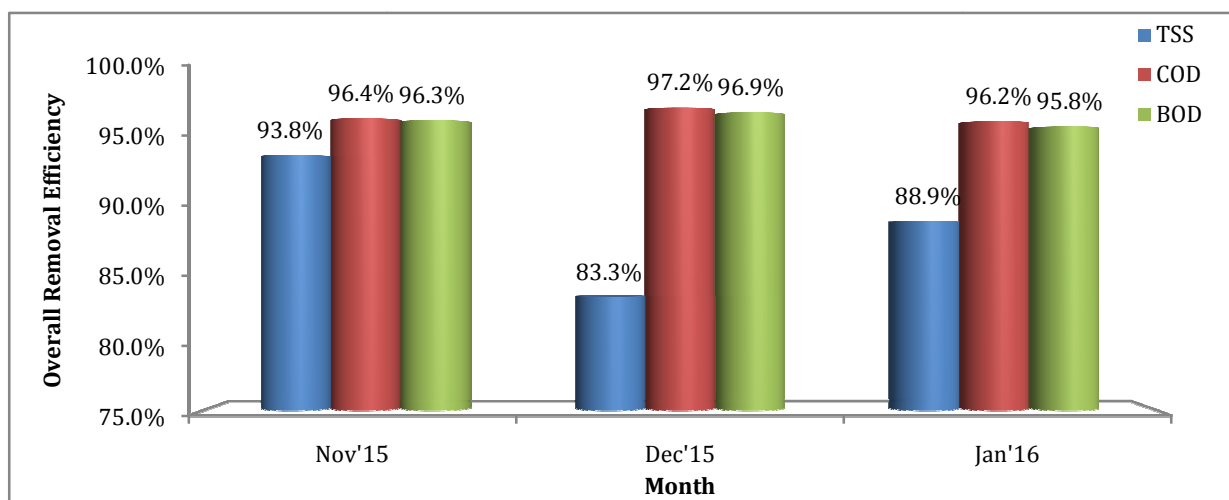


Figure 6: BOD concentration for STP Inlet and Final Outlet [Period- November, 2014 to January, 2015]

5. CONCLUSIONS

Based on above study, it is seen that the performance of STP at JNP Township is satisfactory. The treatment plant was well maintained during November, 2015 to January, 2016 with considerable removal efficiency achieving the standards prescribed for final disposal to coastal waters.

ANNEXURE: Schedule VI of Environment (Protection) Third Amendment Rules, 1993

Sr. No.	Parameter	Standard for Marine Coastal Areas
1	Colour and Odour	All efforts to be made to remove Colour and unpleasant Odour as far as possible
2	Suspended Solids, mg/l	100
3	pH Value	5.5 to 9.0
4	Oil and Grease, mg/l	20
5	Chemical Oxygen Demand, mg/l	250
6	Biochemical Oxygen Demand [3 days at 27°C]	100
7	Bio-assay Test	90% survival of fish after 96 hours in 100% effluent