

## APPENDIX 6.4 – SETTLEMENT LAGOON EFFICIENCY

It is to provide additional settlement capacity within the MBT it is proposed to construct additional settlement pond to the north of the facility.

The revised settlement system will consist of the following

- 7,882 m<sup>3</sup> new settlement lagoons
- Existing lagoons/ponds

The calculated retention time will be approximately 3.8 days or **91 hours**.

Table 1 below, from the CIRIA publication c532 shows the percentage suspended solids (SS) removal over time, whilst this is a generalised graph for a range of particle sizes it does demonstrate that 100% removal of SS is not achievable in a practical time span. From this assessment it is concluded that the dimensions of the sumps and proposed ponds are such that the water to be discharged can be treated and can achieve an emission limit value for suspended solids of 35 mg/l.

From experience, as the MBT will drain the hardstanding areas it is unlikely that the influent to the MBT lagoon will be greater than 35 mg/l.

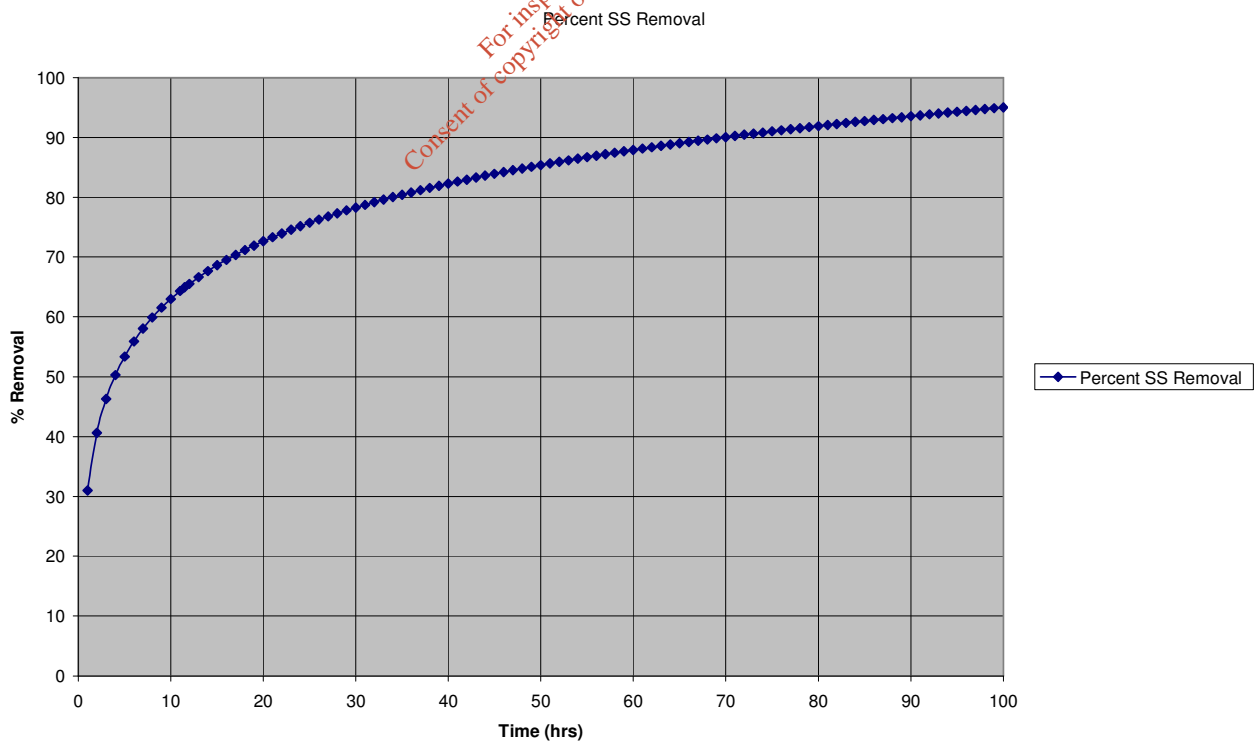


Figure 1 Suspended Solids removal from CIRIA c532

## Settlement Lagoons

It is proposed to construct additional settlement lagoons for the Proposed MBT. The proposed settlement lagoons is designed to allow for an addition >600 hours of settlement under normal (average) conditions and 16 hours under 2 year flood conditions.

Details of the settlement lagoons are included in Drawing 6301-2016 and the layout is shown on 6301-2013. The proposed to construct 2 No. settlement lagoons of 100m x 20m x 2m. The calculations below are outlined below for a 2 year flood event.

### Mean Hydraulic Residence Time

Residence Time,  $tr = V/Q$

where  $V$  = Volume of the ponds  $2 \times (100\text{m} \times 20\text{m} \times 2\text{m}) = 7,882 \text{ m}^3$   
and  $Q$  = Quantity pumped per second  $(505 \text{ m}^3/\text{hour} / 60 / 60) = 0.140 \text{ m}^3/\text{s}$   
therefore  $tr = 56,169 \text{ seconds} = 16 \text{ hours}$

### Pond Efficiency

From the following equation taken from the CIRIA (Construction Industry Research Information Association) publication 'Design of Flood Storage Reservoirs' (ISBN: 978-0-86017-393-9) the efficiency of the settlement pond can be calculated.

Pond Efficiency,  $n = Vt \cdot tr / dl$

where  $Vt$  = Settlement velocity (as above)  
and  $tr$  = Mean hydraulic residence time = 56,159 seconds  
and  $dl$  = Flowing Layer Depth = 2 m

#### **Coarse Silt -**

settlement velocity  $Vt = 2.74 \times 10^{-3} \text{ m/s}$

efficiency  $n = 69 > 100\% \text{ efficient (690\%)} - \text{all coarse silt settled out within the first few metres of settlement lagoon}$

#### **Medium Silt -**

settlement velocity  $Vt = 6.18 \times 10^{-4} \text{ m/s}$

efficiency  $n = 1.23 > 100\% \text{ efficient (123\%)} - \text{all medium silt settled out within the first 80m of settlement lagoon}$

***Fine Silt -***

settlement velocity  $V_t = 2.47 \times 10^{-5}$  m/s

efficiency  $n = 0.69$  **69% efficient removal of fine silt**

It is proposed to monitor the water quality of the discharge on a monthly basis and submit results to the relevant authorities.

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## Extreme Rainfall Return Periods

Location: Lulymore, Co. Kildare  
 Average Annual Rainfall: 834

Maximum rainfall (mm) of indicated duration expected in the indicated return period.

Duration	Return Period (years)							
	1/2	1	2	5	10	20	50	100
1 min				1.8	2.1	2.5	3.1	3.6
2 min				3.1	3.6	4.3	5.4	6.2
5 min				5.5	6.5	7.8	9.8	11.3
10 min				7.9	9.3	11.3	14.5	16.7
15 min	4.8	6.1	6.8	9.5	11.8	14.4	18.6	22
30 min	6.3	8.0	8.9	12.4	15.2	18.5	24	28
60 min	8.2	10.2	11.4	15.6	19.1	23	29	34
2 hour	10.6	13.1	14.7	19.5	23	28	35	40
4 hour	14.3	17.5	19.2	25	29	34	42	48
6 hour	16.8	20.4	22	29	34	39	48	55
12 hour	21.5	26	28	36	42	49	59	67
24 hour	26	31	34	43	50	57	69	78
48 hour	32	38	42	52	60	68	81	91
96 hour								

Notes: Larger margins of error for 1, 2, 5 and 10 minute values and for 100 year return periods  
 M560: 15.6      M52d: 49      M560/m52d: 0.32

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