# I.　WWTP 容量計算書

表 I.1　C1 処理場 容量計算書（1/16）

## 1 BASIC CONDITIONS

### 1-1 Basic Items

(1) Name : **C1 WWTP**

(2) Land Area : Approximately xxxx ha

(3) Ground Level (Elevatio : + 4.50 m

(4) Inlet Pipe Invert Level : - 6.80 m

(5) Pipe Diameter : 1,500 mm

(6) Land Use : —

(7) Collection System : ~~Combined System~~ Separate System

(8) Treatment Process : Conventional Activated Sludge Process

(9) Effluent Point : Yangon River

(10) Water Level at the Effluent Poir :
High water leve = 3.70 m
Low water leve = — m

(11) Target Year : 2020 (F/S Stage)
2040 (M/P Stage)

### 1-2 Service Area and Design Population

(1) Service Area : 499 ha

(2) Design Population

| Item | | Year 2020 | Year 2040 |
|---|---|---|---|
| Design Population | person | - | 178,000 |

# 表 I.1　C1 処理場 容量計算書 (2/16)

## 1-3 Design Sewage Flow

**(Year 2020)**

| Item | $m^3$/day | $m^3$/hr | $m^3$/min | $m^3$/sec |
|---|---|---|---|---|
| Maximum Daily Flow | | 0.0 | 0.00 | 0.000 |
| Maximum Hourly Flow | 0 | 0.0 | 0.00 | 0.000 |

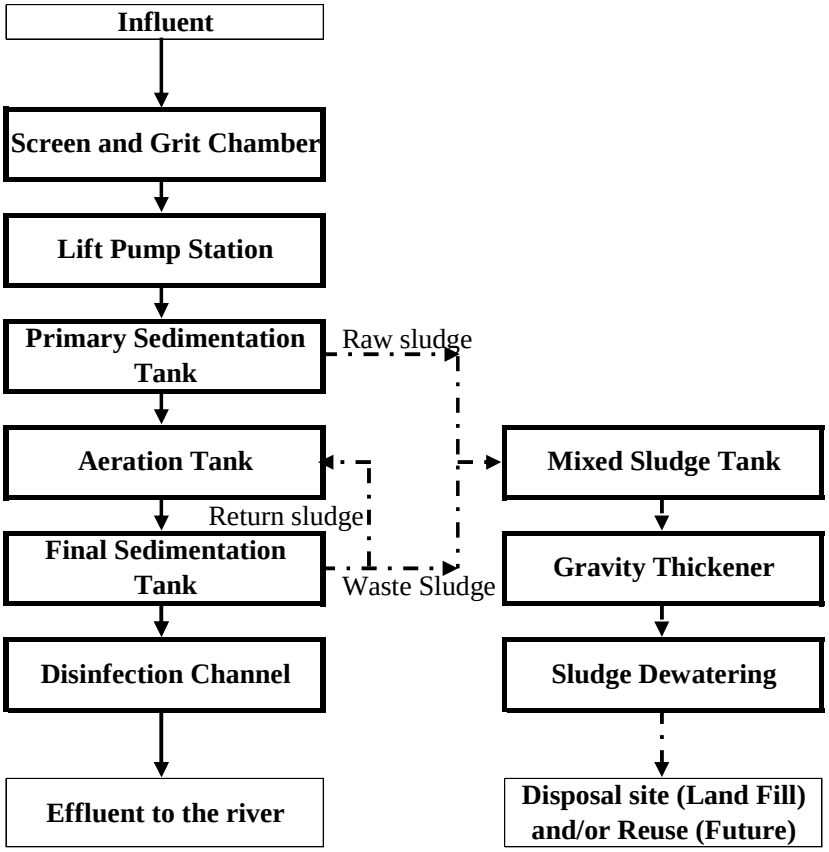
**(Year 2040)**

| Item | $m^3$/day | $m^3$/hr | $m^3$/min | $m^3$/sec |
|---|---|---|---|---|
| Maximum Daily Flow | 70,200 | 2,925.0 | 48.75 | 0.813 |
| Maximum Hourly Flow | 102,900 | 4,287.5 | 71.46 | 1.191 |

## 1-4 Design Sewage Quality

| Item | BOD | SS | T-N | Coli-group | Oil&Greese |
|---|---|---|---|---|---|
| | (mg/l) | (mg/l) | (mg/l) | (MPN/$cm^3$) | (mg/l) |
| Influent | 200 | 180 | - | - | - |
| Effluent | 20 | 30 | - | 3,000 | 5 |

## 1-5 Process Flow Diagram



# 表 I.1　C1 処理場 容量計算書 (3/16)

## 1.6 Design Criteria

| ITEMS | UNIT | Formula or Value | Application |
|---|---|---|---|
| **1** Grit Chamber (For Maximum Hourly Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 1,800 | 1,800 |
| (2) Average Velocity | m/sec | 0.3 | 0.3 |
| **2** Primary Sedimentation Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 35.0-70.0 | 50 |
| (2) Settling Time (Ref.) | hour | 1.5 | 1.5 |
| (3) Water Depth | m | 2.5-4.0 | 3.5 |
| (4) Weir Loading | $m^3/m/day$ | 250 | 250 |
| **3** Aeration Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Retention Time (HRT) | hour | 6 - 8 | 6.0 |
| (2) MLSS Concentration | mg/l | 1,500 -2,000 | 2,000 |
| (3) BOD-SS Load (Reference only) | kg/kg/day | 0.2 - 0.4 | - |
| **4** Final Sedimentation Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 20.0-30.0 | 25 |
| (2) Settling Time (Ref.) | hour | 3.0-4.0 | - |
| (3) Water Depth | m | 2.5-4.0 | 3.5 |
| (4) Weir Loading | $m^3/m/day$ | 150 | 150 |
| **5** Disinfection Tank (For Maximum Daily Flow) | | | |
| (1) Retention (Chlorination) Time | min | 15 | 15 |
| **6** Gravity Thickener (For Maximum Daily Flow) | | | |
| (1) Solids Loading | $kg/m^2/day$ | 60-90 | 75 |
| (2) Water Depth | m | | 4.0 |
| | | | |

# 表 I.1　C1 処理場 容量計算書 (4/16)

## 2　CAPACITY CALCULATION

### 2-1 Grit Chamber

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 102,900 |
| (Maximum Hourly Flow) | Q2 | $m^3$/sec | | | 1.191 |
| Water Surface Load | WSL | $m^3/m^2$/day | | | 1,800 |
| Required Surface Area | RSA | $m^2$ | Q1/WSL | | 57.17 |
| Basin Number | BN | basin | | | 4 |
| Average Velocity | AV | m/sec | | | 0.3 |
| Depth | H | m | | | 0.9 |
| Width | W1 | m | Q2/(AV×H×BN) | | 1.10 |
| *Therefore* | W2 | m | | | 1.1 |
| Length | L1 | m | RSA/(W2×BN) | | 12.99 |
| *Therefore* | L2 | m | | | 13.0 |
| **Dimension (Width)** | W | m | | | **1.1** |
| **(Jength)** | L | m | L2 | | **13.0** |
| **(Depth)** | H | m | H | | **0.90** |
| **(Basin Number)** | N | basin | | | **4** |
| **(Check)** | | | | | |
| Water Surface Load | | $m^3/m^2$/day | Q1/(W×L×N) | | 1,799 |
| Average Velocity | | m/sec | Q2/(W×H×N) | | 0.301 |
| | | | | | |

### 2-2 Lift Pump Station

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Vertical shaft Volute type mixed flow pump | | |
| Design Sewage Flow | Q1 | $m^3$/min | Peak Flow | | 71.46 |
| | | | | | |
| Pump Unit -1 Number | UN1 | unit | including 1 stand-by | | 4 |
| Discharge per Unit | DU1 | $m^3$/min | Q1/UN1 | | 23.82 |
| Pump Diameter(V=1.5~3.0m/s | D1 | mm | $146\times(DU1/1.5\sim3.0)^{0.5}$ | | 411 ～582 |
| *Therefore* | D1 | mm | | | 500 |
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## 表 I.1　C1 処理場 容量計算書 (5/16)

**2-3 Primary Sedimentation Tank**

**(1) Existing**

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 20,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 833.3 |
| Basin Number | BN | basin | | | 2 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 50.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 400 |
| | A2 | $m^2$/basin | A1/BN | | 200 |
| Width | W1 | m | 3.0m~4.0m, Max5.0m | | 7.3 |
| Length | L1 | m | A2/W1 | | 27.40 |
| *Therefore* | L2 | m | | | 27.4 |
| Water Depth | WD | m | | | 3.7 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 250 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 40.00 |
| *Therefore* | WL2 | m/basin | | | 40.0 |
| | | | | | |
| **Dimension (Width)** | W | m | | | **7.3** |
| **(Depth)** | D | m | | | **3.7** |
| **(Length)** | L | m | | | **27.4** |
| **(Basin Number)** | N | basin | | | **2** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 50.00 |
| Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 1.75 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 250.00 |

# 表 I.1　C1 処理場 容量計算書 (6/16)

***Continuing Primary Sedimentation Tank***
**(2) Proposed-1**

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 25,400 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 1,058.3 |
| Basin Number | BN | basin | | | 6 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 50.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 508 |
| | A2 | $m^2$/basin | A1/BN | | 85 |
| Width | W1 | m | 3.0m~4.0m, Max5.0m | | 3.5 |
| Length | L1 | m | A2/W1 | | 24.19 |
| *Therefore* | L2 | m | | | 24.0 |
| Water Depth | WD | m | | | 3.0 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 250 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 16.93 |
| *Therefore* | WL2 | m/basin | | | 17.0 |
| | | | | | |
| **Dimension (Width)** | W | m | | | **3.5** |
| **(Depth)** | D | m | | | **3.0** |
| **(Length)** | L | m | | | **24.0** |
| **(Basin Number)** | N | basin | | | **6** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 50.40 |
| Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 1.43 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 249.02 |

# 表 I.1　C1 処理場 容量計算書（7/16）

***Continuing Primary Sedimentation Tank***
**(3) Proposed-2**

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 24,800 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 1,033.3 |
| Basin Number | BN | basin | | | 4 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 50.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 496 |
| | A2 | $m^2$/basin | A1/BN | | 124 |
| Width | W1 | m | 3.0m~4.0m, Max5.0m | | 5.8 |
| Length | L1 | m | A2/W1 | | 21.38 |
| *Therefore* | L2 | m | | | 21.5 |
| Water Depth | WD | m | | | 3.0 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 250 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 24.80 |
| *Therefore* | WL2 | m/basin | | | 25.0 |
| | | | | | |
| **Dimension (Width)** | W | m | | | **5.8** |
| **(Depth)** | D | m | | | **3.0** |
| **(Length)** | L | m | | | **21.5** |
| **(Basin Number)** | N | basin | | | **4** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 49.72 |
| Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 1.45 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 248.00 |
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## 表 I.1　C1 処理場 容量計算書 (8/16)

### 2-4 Aeration Tank

**(1) Existing**

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Multi-tank Complete mixing Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 45,400 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 1,891.7 |
| Hydraulic Retention Time | HRT | hr | | | 6.0 |
| Basin Number | BN | basin | | | 2 |
| Required Volume per basin | RV | $m^3$/basin | Q2×RT/BN | | 5,675 |
| Width | W | m | 1~2H | | 18.6 |
| Water Depth | H | m | 4.0m~6.0m | | 4.1 |
| Length | L1 | m | RV/(W×H) | | 74.4 |
| *Therefore* | L2 | m | | | 74.4 |
| **Dimension (Width)** | W | m | | | **18.6** |
| **(Depth)** | H | m | | | **4.1** |
| **(Length)** | L | m | | | **74.4** |
| **(Basin Number)** | N | basin | | | **2** |
| | | | | | |
| **(Check)** | | | | | |
| Hydraulic Retention Time | HRT | hour | W×H×L×N/Q2 | | 6.0 |
| BOD-SS load | $BSS_L$ | kgBOD/kgSS/d | (Q1×BODin)/(W×H×L×N×Xa) | | 0.24 |
| $BOD_{in}$ : Inflow BOD Concentration | | | 120 mg/L | (Removal Rate in PST : 40%) | |
| Xa : MLSS Concentration | | | 2,000 mg/L | | |
| Aerobic Sludge Retention Time | ASRT | day | HRT/24×Xa / (a×S-BODin + b×SSin - c×HRT/24×Xa) = | | 4.738 |
| $S\text{-}BOD_{in}$ : Inflow S-BOD Concentration | | | 80 mg/L | (S-BOD[Solved BOD]=BODin×0.6 | |
| $SS_{in}$ : Inflow SS Concentration | | | 90 mg/L | (Removal Rate in PST : 50%) | |
| a : Sludge converting ratio of solved BOI | | | 0.5 mgMLSS/mgBOD | (0.4~0.6) | |
| b : Sludge converting ratio of SS | | | 0.95 mgMLSS/mgSS | (0.9~1.0) | |
| c : Sludge reduction ratio caused by endogenous respiration | | | 0.04 | (1/day)(0.03~0.05) | |
| Effluent Quality (C-BOD) | EQ | mg/L | $10.42\times A\text{-}SRT^{(-0.519)}$ (15~20℃) | | 4.648 |
| Water Temperature | | | 20 ℃ | | |
| Effluent Water Quality (C=BOD Maximum) | | | EQ×3 20mg/l > | | 14 |
| | | | | | -OK- |

## 表 I.1　C1 処理場 容量計算書 (9/16)

***Continuing Aeration Tank***

**(2) Proposed**

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Multi-tank Complete mixing Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 24,800 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 1,033.3 |
| Hydraulic Retention Time | HRT | hr | | | 6.0 |
| Basin Number | BN | basin | | | 2 |
| Required Volume per basin | RV | $m^3$/basin | Q2×RT/BN | | 3,100 |
| Width | W | m | 1~2H | | 12.0 |
| Water Depth | H | m | 4.0m~6.0m | | 5.5 |
| Length | L1 | m | RV/(W×H) | | 47.0 |
| *Therefore* | L2 | m | | | 48.2 |
| **Dimension (Width)** | W | m | | | **12.0** |
| **(Depth)** | H | m | | | **5.5** |
| **(Length)** | L | m | | | **48.2** |
| **(Basin Number)** | N | basin | | | **2** |
| | | | | | |
| **(Check)** | | | | | |
| Hydraulic Retention Time | HRT | hour | W×H×L×N/Q2 | | 6.2 |
| BOD-SS load | $BSS_L$ | kgBOD/kgSS/d | (Q1×BODin)/(W×H×L×N×Xa) | | 0.23 |
| $BOD_{in}$ : Inflow BOD Concentration | | | 120 mg/L | (Removal Rate in PST : 40%) | |
| Xa : MLSS Concentration | | | 2,000 mg/L | | |
| Aerobic Sludge Retention Time | ASRT | day | HRT/24×Xa / (a×S-BODin + b×SSin - c×HRT/24×Xa) = | | 4.888 |
| $S\text{-}BOD_{in}$ : Inflow S-BOD Concentration | | | 80 mg/L | (S-BOD[Solved BOD]=BODin×0.6 | |
| $SS_{in}$ : Inflow SS Concentration | | | 90 mg/L | (Removal Rate in PST : 50%) | |
| a : Sludge converting ratio of solved BOI | | | 0.5 mgMLSS/mgBOD | (0.4~0.6) | |
| b : Sludge converting ratio of SS | | | 0.95 mgMLSS/mgSS | (0.9~1.0) | |
| c : Sludge reduction ratio caused by endogenous respiration | | | 0.04 | (1/day)(0.03~0.05) | |
| Effluent Quality (C-BOD) | EQ | mg/L | $10.42\times A\text{-}SRT^{(-0.519)}$ (15~20℃) | | 4.573 |
| Water Temperature | | | 20 ℃ | | |
| Effluent Water Quality (C=BOD Maximum) | | | EQ×3　20mg/l > | | 14 |
| | | | | | -OK- |
| | | | | | |
| | | | 1 : 1.5 : 1.5 : 2.25 | | |
| Partition of Aeration Tank | | | No.1 \| No.2 \| No.3 \| No.4 | | |
| | | | | | |
| Total Length of Tank | TL | m | | | 48.2 |
| No.1 Tank Length | L1 | m | TL×1/(1+1.5+1.5+2.25) | | 7.7 |
| No.2 Tank Length | L2 | m | TL×1.5/(1+1.5+1.5+2.25) | | 11.6 |
| No.3 Tank Length | L3 | m | TL×1.5/(1+1.5+1.5+2.25) | | 11.6 |
| No.4 Tank Length | L4 | m | TL×2.25/(1+1.5+1.5+2.25) | | 17.4 |
| | | | **Total** | | **48.3** |
| | | | | | |

7)

## 表 I.1　C1 処理場 容量計算書（10/16）

**2-5 Final Sedimentation Tank**

**(1) Existing**

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Radial flow circular type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 20,600 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 858.3 |
| Basin Number | BN | basin | | | 2 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 25.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 824 |
| | A2 | $m^2$/basin | A1/BN | | 412 |
| Water Depth | WD | m | | | 3.5 |
| Diameter | D1 | m | $(4\times A2/3.14)^{0.5}$ | | 22.91 |
| *Therefore* | D2 | m | | | 22.9 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 150 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 68.67 |
| *Therefore* | WL2 | m/basin | | | 69.0 |
| | | | | | |
| | | | | | |
| | | | | | |
| **Dimension (Diameter)** | D | m | D2 | | **22.9** |
| **(Depth)** | H | m | WD | | **3.5** |
| **(Basin Number)** | N | basin | BN | | **2** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | $4\times Q1/(D^2\times 3.14\times N)$ | | 25.02 |
| 7) Retention(Settling) Time | T | hour | $D^2\times\pi\times H\times N/(4\times Q2)$ | | 3.36 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 149.28 |
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# 表 I.1　C1 処理場 容量計算書（11/16）

***Continuing Final Sedimentation Tank***
**(2) Proposed-1**

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Radial flow circular type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 24,800 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 1,033.3 |
| Basin Number | BN | basin | | | 2 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 25.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 992 |
| | A2 | $m^2$/basin | A1/BN | | 496 |
| Water Depth | WD | m | | | 4 |
| Diameter | D1 | m | $(4\times A2/3.14)^{0.5}$ | | 25.14 |
| *Therefore* | D2 | m | | | 25.5 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 150 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 82.67 |
| *Therefore* | WL2 | m/basin | | | 83.0 |
| | | | | | |
| | | | | | |
| | | | | | |
| **Dimension (Diameter)** | D | m | D2 | | **25.5** |
| **(Depth)** | H | m | WD | | **4.0** |
| **(Basin Number)** | N | basin | BN | | **2** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | $4\times Q1/(D^2\times 3.14\times N)$ | | 24.29 |
| Retention(Settling) Time | T | hour | $D^2\times\pi\times H\times N/(4\times Q2)$ | | 3.95 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 149.40 |

## 表 I.1　C1 処理場 容量計算書 (12/16)

***Continuing Final Sedimentation Tank***
**(3) Proposed-2**

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 24,800 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 1,033.3 |
| Basin Number | BN | basin | | | 4 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 25.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 992 |
| | A2 | $m^2$/basin | A1/BN | | 248 |
| Width | W1 | m | 3.0m~4.0m, Max5.0m | | 5.8 |
| Length | L1 | m | A2/W1 | | 42.76 |
| *Therefore* | L2 | m | | | 43.5 |
| Water Depth | WD | m | | | 3.5 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 150 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 41.33 |
| *Therefore* | WL2 | m/basin | | | 41.5 |
| | | | | | |
| **Dimension (Width)** | W | m | | | **5.8** |
| **(Depth)** | D | m | | | **3.5** |
| **(Length)** | L | m | | | **43.5** |
| **(Basin Number)** | N | basin | | | **4** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 24.57 |
| Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 3.42 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 149.40 |

表 I.1　C1 処理場 容量計算書 (13/16)

**2-6 Disinfection Channel**

**(1) Proposed**

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Chlorination | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 70,200 |
| (Maximum Daily Flow) | Q2 | $m^3$/min | | | 48.75 |
| Retention(Chlorination) Time | RT | min | | | 15.0 |
| Required Volume | RV | $m^3$ | Q2×RT | | 731 |
| Width of channel | W | m | | | 2.5 |
| Depth of channel | H | m | | | 2.0 |
| Pass Number | PN | pass | | | 6 |
| Length of channel | L1 | m/pass | RV/(W×H×PN) | | 24.4 |
| *Therefore* | L2 | m/pass | | | 24.5 |
| **Dimension (Width)** | W | m | | | **2.5** |
| **(Depth)** | H | m | | | **2.0** |
| **(Length)** | L | m/pass | | | **24.5** |
| **(Pass Number)** | N | pass | | | **6** |
| **(Check)** | | | | | |
| Retention(Chlorination) Time | RT | min | (W×H×L×PN)/Q2 | | 15.1 |

表 I.1　C1 処理場 容量計算書 (14/16)

**2-7 Sludge Thickening Tank**

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Gravity Thickener (Radial Flow Circular Type) | | |
| Generated Sludge Solids | GS | t-DS/day | Refer to Mass Balance Cal. | | 12.32 |
| Generated Sludge Volume | GSV | $m^3$/day | Refer to Mass Balance Cal. | | 1,503 |
| Solid Matter Load | SML | kg/$m^2$/day | | | 75 |
| Required Surface Area | SA | $m^2$ | (GS×$10^3$)/SML | | 164.3 |
| Water Depth | H | m | | | 4.1 |
| Basin Number | BN | basin | | | 2 |
| Required Tank Diameter | TD1 | m | (SA×4/(3.14×BN))$^{0.5}$ | | 10.23 |
| *Therefore* | TD2 | m | | | 10.5 |
| | | | | | |
| **Dimension (Diameter)** | D | m/basin | | | **10.5** |
| **(Depth)** | H | m | | | **4.1** |
| **(Basin Number)** | BN | basin | | | **2** |
| | | | | | |
| **(Check)** | | | | | |
| Solid Matter Load | SML | kg/$m^2$/day | GS×$10^3$/(3.14×$D^2$/4)×BN | | 71.2 |
| Sludge Thickened Time | T | hr | (3.14×$D^2$/4)×H×BN×24/GSV | | 11.3 |
| | | | | | |

**2-8 Sludge Dewatering**

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Mechanical Dewatering (Screw Press Type) | | |
| Thickened Sludge Solids | TS | t-DS/day | Refer to Material Balance | | 11.201 |
| Unit Number | UN | Unit | | | 4 |
| Operating Day | OD | day(/week) | | | 5.0 |
| Operating Time | OT | hr/day | | | 10.0 |
| Required Dewatering Capacit | DC | kg/hr/unit | TS×$10^3$×7/(OD×OT×UN) | | 392.0 |
| Solids Loading | $Q_{100}$ | kg-ds/hr/φ100 | | | 3.0 |
| Screnn Diameter | SD1 | mm | 100×(DC/$Q_{100}$)^(1/2.2) | | 916.0 |
| Therefore | SD2 | mm | | | 800 |
| | | | | | |
| **Dimension (unit)** | UN | Unit | | | **4** |
| **(Screen Diameter)** | SD | mm | | | **800** |
| | | | | | |
| **(Check)** | | | | | |
| Dewatering Capacity | DC | kg/hr/unit | (SD/100)^2.2×$Q_{100}$ | | 291.0 |
| Operating Time | OT | hour/day | TS×$10^3$/(DC×(UN-1))*(7/OT | | 13.5 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

# 表 I.1　C1 処理場 容量計算書（15/16）

**Material Balance Calculation (Primary and Secondary Sedimentation Tank + Thickening Tank + Mechanical Dewatering)**

**Table-1 Input Data**

| | | | |
|---|---|---|---|
| 1. Calculation Manner | | 1 | 1:Premise that the quality of supernatants are same level removed with inlet sewage<br>2:Premise that the entire supernatants are removed at treatment process |
| 2. Selection of Treatment Efficiency | | 2 | 1:Total Removal Ratio 2:Outlet Water Quality (input 1or2) |
| In case of 1 : input data | | 90 | (%) |
| In case of 2 : input data | | 30 | (mg/l) |
| 3. Excess Sludge Generation | | 1 | 1:Consideration of Solid Matter Only 2:Consideration of Converting of Solved BOD (input 1or2) |
| In case of 1:Input data (Sludge generation) | | 100 | Sludge generation ratio per removal SS(%) |
| In case of 2:Input data | a | | T2=Q2*S2=(a*$S_{BOD}$+b*S1-c*θ*XA)*Q1/10^6 * (Excess sludge generation formula) |
| | b | | a:Converting ratio of solved BOD(mgMLSS/mgBOD) |
| | c | | b:Converting ratio of SS(mgMLSS/mgSS) |
| | SBOD | | c:Sludge reduction ratio caused by endogenous respiration of activated sludge(1/day) |
| | XA | | $S_{BOD}$:Solved BOD quality at inlet to reactor |
| | θ | | XA:MLSS concentration(mg/l) |
| | | | θ:Hydraulic retention time(day) |

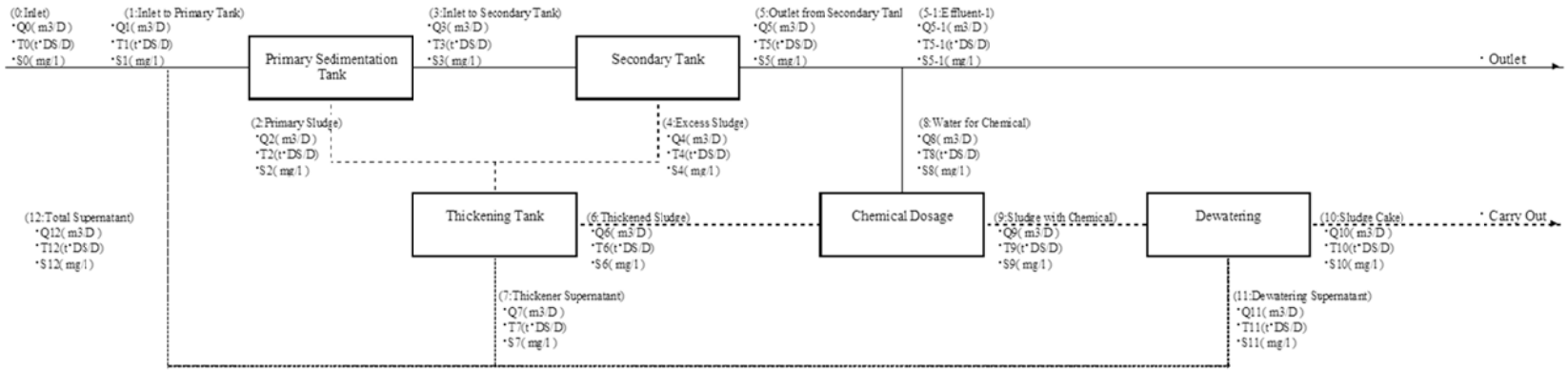
**Table-2 Basic Conditions**

| Water Flow and Quality | | Sludge Moisture and Recovery Ratio | | | | Chemical Conditions for Dewatering | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Inlet flow : Q0(m3/D) | 70200 | *Primary sludge moisture ratio : W1(%) | 98.5 | *Removal ratio in primary tank : A2(%) | 50.0 | *Chemical dosage : A5(%) | 1.0 | | |
| *Inlet quality : S0(mg/l) | 180 | *Excess sludge moisture ratio : W2(%) | 99.5 | *Recovery ratio in sludge thickener : A3(%) | 90.0 | *Chemical dissolve concentration : A6(%) | 0.2 | | |
| *Total removal ratio : A1(%) | - | *Thickened sludge moisture ratio : W3(%) | 98.0 | *Recovery ratio in dewatering : A4(%) | 95.0 | | | | |
| *Effluent quality: St(mg/l) | 30.0 | *Dewatered sludge moisture ratio : W4(%) | 80.0 | | | | | | |
| *Sludge generation ratio per removal SS : Si(%) | 100.0 | | | | | | | | |

**Table-3 Material Balance Calculation**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | 5-1 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q(m3/day) | 70,200 | 71,705 | 481 | 71,224 | 1,022 | 70,202 | 554 | 948 | 55 | 610 | 53 | 557 | 1,505 | | | 70,147 | | |
| T(t*DS/day) | 12.636 | 14.428 | 7.214 | 7.214 | 5.108 | 2.106 | 11.090 | 1.232 | 0.111 | 11.201 | 10.641 | 0.560 | 1.792 | | | 1.995 | | |
| S(mg/l) | 180 | 201 | 15,000 | 101 | 5,000 | 30 | 20,000 | 1,300 | 2,000 | 18,364 | 200,000 | 1,006 | 1,191 | | | 30 | | |
| X(Ti/T0*100) | 100 | 114.2 | 57.1 | 57.1 | 40.4 | 16.7 | 87.8 | 9.8 | 0.9 | 88.6 | 84.2 | 4.4 | 14.2 | | | 15.8 | | |

**Figure-1 Material Balance Model**




**Calculation Formula**

| | | | | | |
|---|---|---|---|---|---|
| *Q0=Input Data | *Q3=Q1-Q2 | *Q6=T4*100/(100-W3) | *Q9=Q6+Q8 | *Q12=Q7+Q11 | *Q5-1=Q5-Q8 |
| *T0=Q0*S0*10^(-6) | *T3=T1*(100-A2)/100 | *T6=(T2+T4)*A3/100 | *T9=T6+T8 | *T12=T7+T11 | *T5-1=T5-T8 |
| *S0=Input Data | *S3=T3*10^6/Q3 | *S6=10^6*(100-W3)/100 | *S9=T9*10^6/Q9 | *S11=T11*10^6/Q11 | *S5-1=S5 |
| *Q1=Q0+Q13 | *Q4=(Q3*ST-T3*10^6)/(ST-S4)*T4/(T3-T5) | *Q7=(Q2+Q4)-Q6 | *Q10=T10*100/(100-W4) | | |
| *T1=T0+T13 | *T4=((T1-T5)*Si/100)-T2 | *T7=(T2+T4)-T6 | *T10=T9*A4/100 | | |
| *S1=T1*10^6/Q1 | *S4=10^6*(100-W2)/100 | *S7=T7*10^6/Q7 | *S10=10^6*(100-W4)/100 | | |
| *Q2=T2*100/(100-W1) | *Q5=(T3*10^6-Q3*S4)/(ST-S4) | *Q8=T6*A5/A6 | *Q11=Q9-Q10 | | |
| *T2=T1-T3 | *T5=Q5*ST/10^6 | *T8=Q8*S8/10^6 | *T11=T9-T10 | | |
| *S2=10^6*(100-W1)/100 | *S5=St | *S8=10^4*A6 | *S11=T11*10^6/Q11 | | |

# 表 I.1　C1 処理場 容量計算書（16/16）

**Material Balance Sheet**

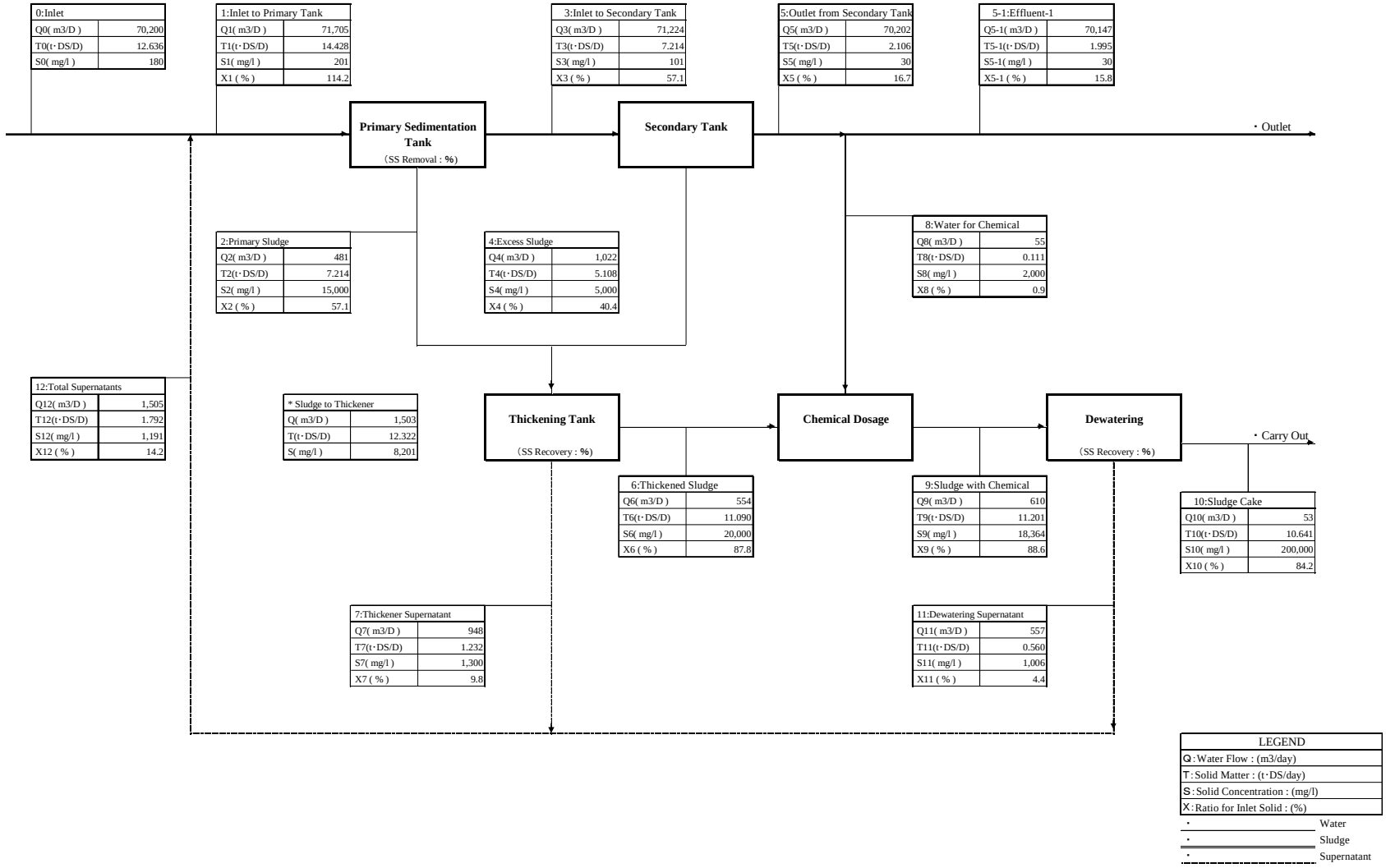


表 I.2　C2+E1 処理場 容量計算書 (1/11)

## 1 BASIC CONDITIONS

### 1-1 Basic Items

(1) Name : **C2+E1 WWTP**

(2) Land Area : Approximately xxxx ha

(3) Ground Level (Elevatio : + 4.00 m (Plan)

(4) Inlet Pipe Invert Level : - 15.82 m

(5) Pipe Diameter : 3,200 mm

(6) Land Use : ―

(7) Collection System : ~~Combined System~~ (Separate System)

(8) Treatment Process : Conventional Activated Sludge Process

(9) Effluent Point : Ngamoeyeik Creek

(10) Water Level at the Effluent Poir :
High water leve = 3.70 m
Low water leve = ― m

(11) Target Year : 2020 (F/S Stage)
2040 (M/P Stage)

### 1-2 Service Area and Design Population

(1) Service Area : 11,286 ha

(2) Design Population

| Item | | Year 2020 | Year 2040 |
|---|---|---|---|
| Design Population | person | - | 1,902,000 |

表 I.2　C2+E1 処理場 容量計算書 (2/11)

**1-3 Design Sewage Flow**

**(Year 2020)**

| Item | $m^3$/day | $m^3$/hr | $m^3$/min | $m^3$/sec |
|---|---|---|---|---|
| Maximum Daily Flow | | 0.0 | 0.00 | 0.000 |
| Maximum Hourly Flow | 0 | 0.0 | 0.00 | 0.000 |

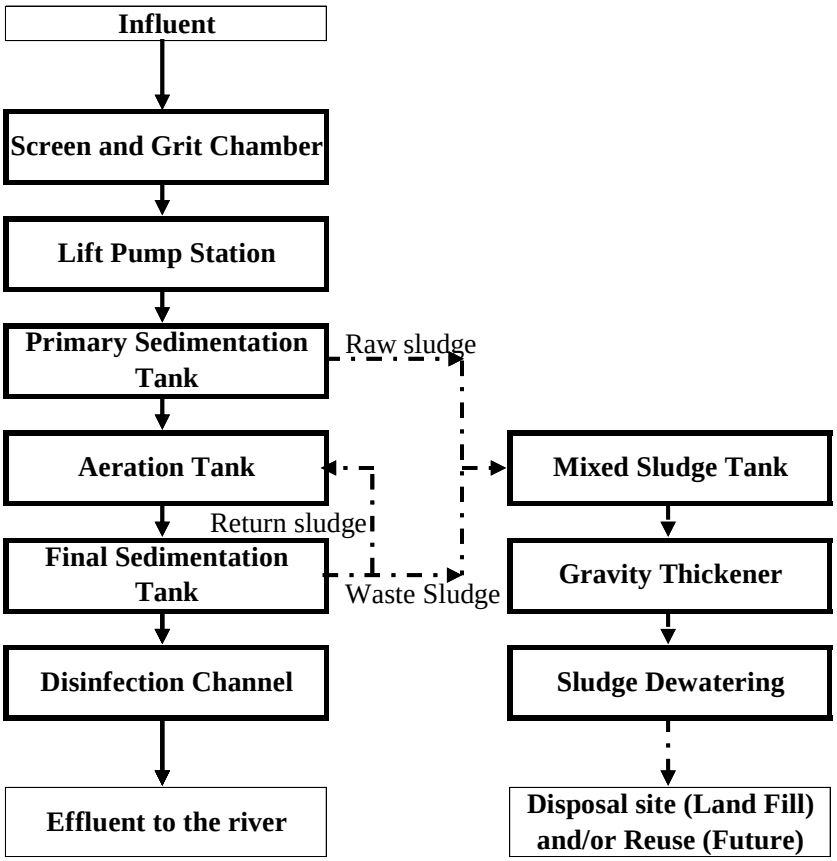
**(Year 2040)**

| Item | $m^3$/day | $m^3$/hr | $m^3$/min | $m^3$/sec |
|---|---|---|---|---|
| Maximum Daily Flow | 744,000 | 31,000.0 | 516.67 | 8.611 |
| Maximum Hourly Flow | 1,116,000 | 46,500.0 | 775.00 | 12.917 |

**1-4 Design Sewage Quality**

| Item | BOD | SS | T-N | Coli-group | Oil&Greese |
|---|---|---|---|---|---|
| | (mg/l) | (mg/l) | (mg/l) | (MPN/$cm^3$) | (mg/l) |
| Influent | 200 | 180 | - | - | - |
| Effluent | 20 | 30 | - | 3,000 | 5 |

**1-5 Process Flow Diagram**



# 表 I.2　C2+E1 処理場 容量計算書 (3/11)

## 1.6 Design Criteria

| ITEMS | UNIT | Formula or Value | Application |
|---|---|---|---|
| **1** Grit Chamber (For Maximum Hourly Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 1,800 | 1,800 |
| (2) Average Velocity | m/sec | 0.3 | 0.3 |
| **2** Primary Sedimentation Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 35.0-70.0 | 50 |
| (2) Settling Time (Ref.) | hour | 1.5 | 1.5 |
| (3) Water Depth | m | 2.5-4.0 | 3.5 |
| (4) Weir Loading | $m^3/m/day$ | 250 | 250 |
| **3** Aeration Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Retention Time (HRT) | hour | 6 - 8 | 6.0 |
| (2) MLSS Concentration | mg/l | 1,500 -2,000 | 2,000 |
| (3) BOD-SS Load (Reference only) | kg/kg/day | 0.2 - 0.4 | - |
| **4** Final Sedimentation Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 20.0-30.0 | 25 |
| (2) Settling Time (Ref.) | hour | 3.0-4.0 | - |
| (3) Water Depth | m | 2.5-4.0 | 3.5 |
| (4) Weir Loading | $m^3/m/day$ | 150 | 150 |
| **5** Disinfection Tank (For Maximum Daily Flow) | | | |
| (1) Retention (Chlorination) Time | min | 15 | 15 |
| **6** Gravity Thickener (For Maximum Daily Flow) | | | |
| (1) Solids Loading | $kg/m^2/day$ | 60-90 | 75 |
| (2) Water Depth | m | | 4.0 |
| | | | |

# 表 I.2　C2+E1 処理場 容量計算書 (4/11)

## 2 CAPACITY CALCULATION

### 2-1 Grit Chamber

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 1,116,000 |
| (Maximum Hourly Flow) | Q2 | $m^3$/sec | | | 12.917 |
| Water Surface Load | WSL | $m^3/m^2$/day | | | 1,800 |
| Required Surface Area | RSA | $m^2$ | Q1/WSL | | 620.00 |
| Basin Number | BN | basin | | | 16 |
| Average Velocity | AV | m/sec | | | 0.3 |
| Depth | H | m | | | 1 |
| Width | W1 | m | Q2/(AV×H×BN) | | 2.69 |
| *Therefore* | W2 | m | | | 3.0 |
| Length | L1 | m | RSA/(W2×BN) | | 12.92 |
| *Therefore* | L2 | m | | | 13.0 |
| **Dimension (Width)** | W | m | | | **3.0** |
| **(Length)** | L | m | L2 | | **13.0** |
| **(Depth)** | H | m | H | | **1.0** |
| **(Basin Number)** | N | basin | | | **16** |
| **(Check)** | | | | | |
| Water Surface Load | | $m^3/m^2$/day | Q1/(W×L×N) | | 1,788 |
| Average Velocity | | m/sec | Q2/(W×H×N) | | 0.269 |
| | | | | | |

### 2-2 Lift Pump Station

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Vertical shaft Volute type mixed flow pump | | |
| Design Sewage Flow | Q1 | $m^3$/min | Peak Flow/4Nos | | 193.75 |
| | | | | | |
| Pump Unit -1 Number | UN1 | unit | | | 2 |
| Discharge per Unit | DU1 | $m^3$/min | 1/10×Q1 | | 19.38 |
| Pump Diameter(V=1.5~3.0m/s | D1 | mm | $146\times(DU1/1.5\sim3.0)^{0.5}$ | | 371 ～525 |
| *Therefore* | D1 | mm | | | 450 |
| | | | | | |
| Pump Unit -2 Number | UN2 | unit | | | 2 |
| Discharge per Unit | DU2 | $m^3$/min | 2/10×Q1 | | 38.75 |
| Pump Diameter(V=1.5~3.0m/s | D2 | mm | $146\times(DU2/1.5\sim3.0)^{0.5}$ | | 525 ～742 |
| *Therefore* | D2 | mm | | | 600 |
| | | | | | |
| Pump Unit -3 Number | UN3 | unit | including 1 stand-by | | 2 |
| Discharge per Unit | DU3 | $m^3$/min | 4/10×Q1 | | 77.50 |
| Pump Diameter(V=1.5~3.0m/s | D3 | mm | $146\times(DU3/1.5\sim3.0)^{0.5}$ | | 742 ##### |
| *Therefore* | D3 | mm | | | 900 |

## 表 I.2　C2+E1 処理場 容量計算書 (5/11)

### 2-3 Primary Sedimentation Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 744,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 31,000.0 |
| Basin Number | BN | basin | | | 64 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 50.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 14,880 |
| | A2 | $m^2$/basin | A1/BN | | 233 |
| Width | W1 | m | 3.0m~4.0m, Max5.0m | | 5.0 |
| Length | L1 | m | A2/W1 | | 46.50 |
| *Therefore* | L2 | m | | | 47.0 |
| Water Depth | WD | m | | | 3.5 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 250 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 46.50 |
| *Therefore* | WL2 | m/basin | | | 47.0 |
| | | | | | |
| **Dimension (Width)** | W | m | | | **5.0** |
| **(Depth)** | D | m | | | **3.5** |
| **(Length)** | L | m | Two-story Sedimentation Tan | | **47.0** |
| | | | Upper Tank | | **18.8** |
| | | | Lower Tank | | **28.2** |
| **(Basin Number)** | N | basin | | | **64** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 49.47 |
| Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 1.70 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 247.34 |

## 表 I.2　C2+E1 処理場 容量計算書 (6/11)

### 2-4 Aeration Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Multi-tank Complete mixing Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 744,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 31,000.0 |
| Hydraulic Retention Time | HRT | hr | | | 6.0 |
| Basin Number | BN | basin | | | 32 |
| Required Volume per basin | RV | $m^3$/basin | Q2×RT/BN | | 5,813 |
| Width | W | m | 1~2H | | 10.5 |
| Water Depth | H | m | Deep Aeration Tank | | 10.0 |
| Length | L1 | m | RV/(W×H) | | 55.4 |
| *Therefore* | L2 | m | | | 56.0 |
| **Dimension (Width)** | W | m | | | **10.5** |
| **(Depth)** | H | m | | | **10.0** |
| **(Length)** | L | m | | | **56.0** |
| **(Basin Number)** | N | basin | | | **32** |
| | | | | | |
| **(Check)** | | | | | |
| Hydraulic Retention Time | HRT | hour | W×H×L×N/Q2 | | 6.1 |
| BOD-SS load | $BSS_L$ | kgBOD/kgSS/d | (Q1×BODin)/(W×H×L×N×Xa) | | 0.24 |
| $BOD_{in}$ : Inflow BOD Concentration | | | 120 mg/L | (Removal Rate in PST : 40%) | |
| Xa : MLSS Concentration | | | 2,000 mg/L | | |
| Aerobic Sludge Retention Time | ASRT | day | HRT/24×Xa / (a×S-BODin + b×SSin - c×HRT/24×Xa) = | | 4.805 |
| $S\text{-}BOD_{in}$ : Inflow S-BOD Concentration | | | 80 mg/L | (S-BOD[Solved BOD]=BODin×0.6 | |
| $SS_{in}$ : Inflow SS Concentration | | | 90 mg/L | (Removal Rate in PST : 50%) | |
| a : Sludge converting ratio of solved BOI | | | 0.5 mgMLSS/mgBOD | (0.4~0.6) | |
| b : Sludge converting ratio of SS | | | 0.95 mgMLSS/mgSS | (0.9~1.0) | |
| c : Sludge reduction ratio caused by endogenous respiration | | | 0.04 | (1/day)(0.03~0.05) | |
| Effluent Quality (C-BOD) | EQ | mg/L | $10.42\times A\text{-}SRT^{(-0.519)}$ (15~20℃) | | 4.614 |
| Water Temperature | | | 20 ℃ | | |
| Effluent Water Quality (C=BOD Maximum) | | | EQ×3　20mg/l > | | 14 |
| | | | | | -OK- |
| | | | | | |
| | | | 1 : 1.5 : 1.5 : 2.25 | | |
| Partition of Aeration Tank | | | No.1 \| No.2 \| No.3 \| No.4 | | |
| | | | | | |
| Total Length of Tank | TL | m | | | 56.0 |
| No.1 Tank Length | L1 | m | TL×1/(1+1.5+1.5+2.25) | | 9.0 |
| No.2 Tank Length | L2 | m | TL×1.5/(1+1.5+1.5+2.25) | | 13.4 |
| No.3 Tank Length | L3 | m | TL×1.5/(1+1.5+1.5+2.25) | | 13.4 |
| No.4 Tank Length | L4 | m | TL×2.25/(1+1.5+1.5+2.25) | | 20.2 |
| | | | **Total** | | **56.0** |
| | | | | | |

## 表 I.2　C2+E1 処理場 容量計算書 (7/11)

### 2-5 Final Sedimentation Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 744,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 31,000.0 |
| Basin Number | BN | basin | | | 64 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 25.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 29,760 |
| | A2 | $m^2$/basin | A1/BN | | 465 |
| Width | W1 | m | 3.0m~4.0m, Max5.0m | | 5.0 |
| Length | L1 | m | A2/W1 | | 93.00 |
| *Therefore* | L2 | m | | | 93.0 |
| Water Depth | WD | m | | | 3.5 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 150 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 77.50 |
| *Therefore* | WL2 | m/basin | | | 78.0 |
| | | | | | |
| **Dimension (Width)** | W | m | | | **5.0** |
| **(Depth)** | D | m | | | **3.5** |
| **(Length)** | L | m | Two-story Sedimentation Tan | | **93.0** |
| | | | Upper Tank | | **37.2** |
| | | | Lower Tank | | **55.8** |
| **(Basin Number)** | N | basin | | | **64** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 25.00 |
| Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 3.36 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 149.04 |

## 表 I.2　C2+E1 処理場 容量計算書 (8/11)

### 2-6 Disinfection Channel

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Chlorination | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 744,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/min | | | 516.7 |
| Retention(Chlorination) Time | RT | min | | | 15.0 |
| Required Volume | RV | $m^3$ | Q2×RT | | 7,750 |
| Width of channel | W | m | | | 2.0 |
| Depth of channel | H | m | | | 3.0 |
| Pass Number | PN | pass | | | 32 |
| Length of channel | L1 | m/pass | RV/(W×H×PN) | | 40.4 |
| *Therefore* | L2 | m/pass | | | 41.0 |
| **Dimension (Width)** | W | m | | | **2.0** |
| **(Depth)** | H | m | | | **3.0** |
| **(Length)** | L | m/pass | | | **41.0** |
| **(Pass Number)** | N | pass | | | **32** |
| **(Check)** | | | | | |
| Retention(Chlorination) Time | RT | min | (W×H×L×PN)/Q2 | | 15.2 |

### 2-7 Sludge Thickening Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Gravity Thickener (Radial Flow Circular Type) | | |
| Generated Sludge Solids | GS | t-DS/day | Refer to Mass Balance Cal. | | 138.68 |
| Generated Sludge Volume | GSV | $m^3$/day | Refer to Mass Balance Cal. | | 17,464 |
| Solid Matter Load | SML | kg/$m^2$/day | | | 75 |
| Required Surface Area | SA | $m^2$ | $(GS\times10^3)/SML$ | | 1849.1 |
| Water Depth | H | m | | | 4.0 |
| Basin Number | BN | basin | | | 16 |
| Required Tank Diameter | TD1 | m | $(SA\times4/(3.14\times BN))^{0.5}$ | | 12.13 |
| *Therefore* | TD2 | m | | | 12.5 |
| | | | | | |
| **Dimension (Diameter)** | D | m/basin | | | **12.5** |
| **(Depth)** | H | m | | | **4.0** |
| **(Basin Number)** | BN | basin | | | **16** |
| | | | | | |
| **(Check)** | | | | | |
| Solid Matter Load | SML | kg/$m^2$/day | $GS\times10^3/(3.14\times D^2/4)\times BN$ | | 70.7 |
| Sludge Thickened Time | T | hr | $(3.14\times D^2/4)\times H\times BN\times24/GSV$ | | 10.8 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## 表 I.2　C2+E1 処理場 容量計算書 (9/11)

### 2-8 Sludge Dewatering

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Mechanical Dewatering (Screw Press Type) | | |
| Thickened Sludge Solids | TS | t-DS/day | Refer to Material Balance | | 126.062 |
| Unit Number | UN | Unit | | | 24 |
| Operating Time | OT | hr/day | | | 24.0 |
| Required Dewatering Capacity | DC | kg/hr/unit | $TS\times10^3/(OT\times UN)$ | | 218.9 |
| Solids Loading | $Q_{100}$ | kg-ds/hr/φ100 | | | 3.0 |
| Screen Diameter | SD1 | mm | $100\times(DC/Q_{100})\text{^}(1/2.2)$ | | 702.8 |
| Therefore | SD2 | mm | | | 800 |
| | | | | | |
| **Dimension (unit)** | UN | Unit | | | **24** |
| **(Screen Diameter)** | SD | mm | | | **800** |
| | | | | | |
| **(Check)** | | | | | |
| Dewatering Capacity | DC | kg/hr/unit | $(SD/100)\text{^}2.2\times Q_{100}$ | | 291.0 |
| Operating Time | OT | hour/day | $TS\times10^3/(DC\times(UN-1))$ | | 18.0 |

# 表 I.2　C2+E1 処理場 容量計算書（10/11）

**Material Balance Calculation (Primary and Secondary Sedimentation Tank + Thickening Tank + Mechanical Dewatering)**

**Table-1 Input Data**

| | | | |
|---|---|---|---|
| 1. Calculation Manner | | 1 | 1:Premise that the quality of supernatants are same level removed with inlet sewage<br>2:Premise that the entire supernatants are removed at treatment process |
| 2. Selection of Treatment Efficiency | | 1 | 1:Total Removal Ratio 2:Outlet Water Quality(input 1or2) |
| In case of 1 : input data | | 90 | (%) |
| In case of 2 : input data | | | (mg/l) |
| 3. Excess Sludge Generation | | 1 | 1:Consideration of Solid Matter Only 2:Consideration of Converting of Solved BOD (input 1or2) |
| In case of 1:Input data (Sludge generation) | | 100 | Sludge generation ratio per removal SS(%) |
| In case of 2:Input data | a | | T2=Q2*S2=(a*$S_{BOD}$-b*S1-c*θ*XA)*Q1/10^6 **(Excess sludge generation formula) |
| | b | | a:Converting ratio of solved BOD(mgMLSS/mgBOD) |
| | c | | b:Converting ratio of SS(mgMLSS/mgSS) |
| | SBOD | | c:Sludge reduction ratio caused by endogenous respiration of activated sludge(1/day) |
| | XA | | Sbod:Solved BOD quality at inlet to reactor |
| | θ | | XA:MLSS concentration(mg/l) |
| | | | θ:Hydraulic retention time(day) |

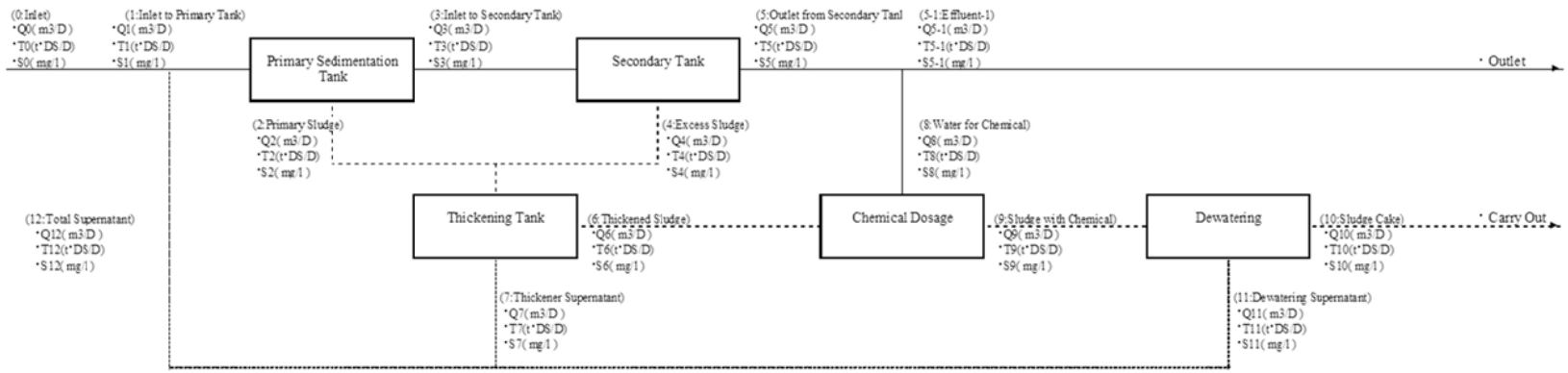
**Table-2 Basic Conditions**

| Water Flow and Quality | | Sludge Moisture and Recovery Ratio | | | | Chemical Conditions for Dewatering | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Inlet flow : Q0(m3/D) | 744000 | *Primary sludge moisture ratio : W1(%) | 98.5 | *Removal ratio in primary tank : A2(%) | 50.0 | *Chemical dosage : A5(%) | 1.0 | | |
| *Inlet quality : S0(mg/l) | 180 | *Excess sludge moisture ratio : W2(%) | 99.5 | *Recoveryratio in sludge thickener : A3(%) | 90.0 | *Chemical dissolve concentration : A6(%) | 0.2 | | |
| *Total removal ratio : A1(%) | 90.0 | *Thickened sludge moisture ratio : W3(%) | 98.0 | *Recoveryratio in dewatering : A4(%) | 95.0 | | | | |
| *Effluent quality : St(mg/l) | - | *Dewatered sludge moisture ratio : W4(%) | 80.0 | | | | | | |
| *Sludge generation ratio per removal SS : Si(%) | 100.0 | | | | | | | | |

**Table-3 Material Balance Calculation**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | 5-1 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q(m3/dav) | 744,000 | 761,489 | 5,136 | 756,353 | 12,327 | 744,025 | 6,241 | 11,223 | 624 | 6,865 | 599 | 6,266 | 17,489 | | | 743,401 | | |
| T(t*DS/dav) | 133.920 | 154.091 | 77.046 | 77.046 | 61.637 | 15.409 | 124.814 | 13.868 | 1.248 | 126.062 | 119.759 | 6.303 | 20.171 | | | 14.161 | | |
| S(mg/l) | 180 | 202 | 15,000 | 102 | 5,000 | 21 | 20,000 | 1,236 | 2,000 | 18,364 | 200,000 | 1,006 | 1,153 | | | 21 | | |
| X(Ti/T0*100) | 100 | 115.1 | 57.5 | 57.5 | 46.0 | 11.5 | 93.2 | 10.4 | 0.9 | 94.1 | 89.4 | 4.7 | 15.1 | | | 10.6 | | |

**Figure-1 Material Balance Model**




**Calculation Formula**

| | | | | | |
|---|---|---|---|---|---|
| *Q0=Input Data<br>*T0=Q0*S0*10^(-6)<br>*S0=Input Data | *Q3=Q1-Q2<br>*T3=T1*(100-A2)/100<br>*S3=T3*10^6/Q3 | *Q6=T4*100/(100-W3)<br>*T6=(T2+T4)*A3/100<br>*S6=10^6*(100-W3)/100 | *Q9=Q6-Q8<br>*T9=T6+T8<br>*S9=T9*10^6/Q9 | *Q12=Q7+Q11<br>*T12=T7+T11<br>*S11=T11*10^6/Q11 | *Q5-1=Q5-Q8<br>*T5-1=T5-T8<br>*S5-1=S5 |
| *Q1=Q0+Q13<br>*T1=T0+T13<br>*S1=T1*10^6/Q1 | *Q4=T4*100/(100-W2)<br>*T4=((T1-T5)*Si/100)-T2<br>*S4=10^6*(100-W2)/100 | *Q7=(Q2+Q4)-Q6<br>*T7=(T2+T4)-T6<br>*S7=T7*10^6/Q7 | *Q10=T10*100/(100-W4)<br>*T10=T9*A4/100<br>*S10=10^6*(100-W4)/100 | | |
| *Q2=T2*100/(100-W1)<br>*T2=T1-T3<br>*S2=10^6*(100-W1)/100 | *Q5=Q3-Q4*(T3-T5)/T4<br>*T5=T1*(100-A1)/100<br>*S5=T5*10^6/Q5 | *Q8=T6*A5/A6<br>*T8=Q8*S8/10^6<br>*S8=10^4*A6 | *Q11=Q9-Q10<br>*T11=T9-T10<br>*S11=T11*10^6/Q11 | | |

# 表 I.2　C2+E1 処理場 容量計算書（11/11）

**Material Balance Sheet**

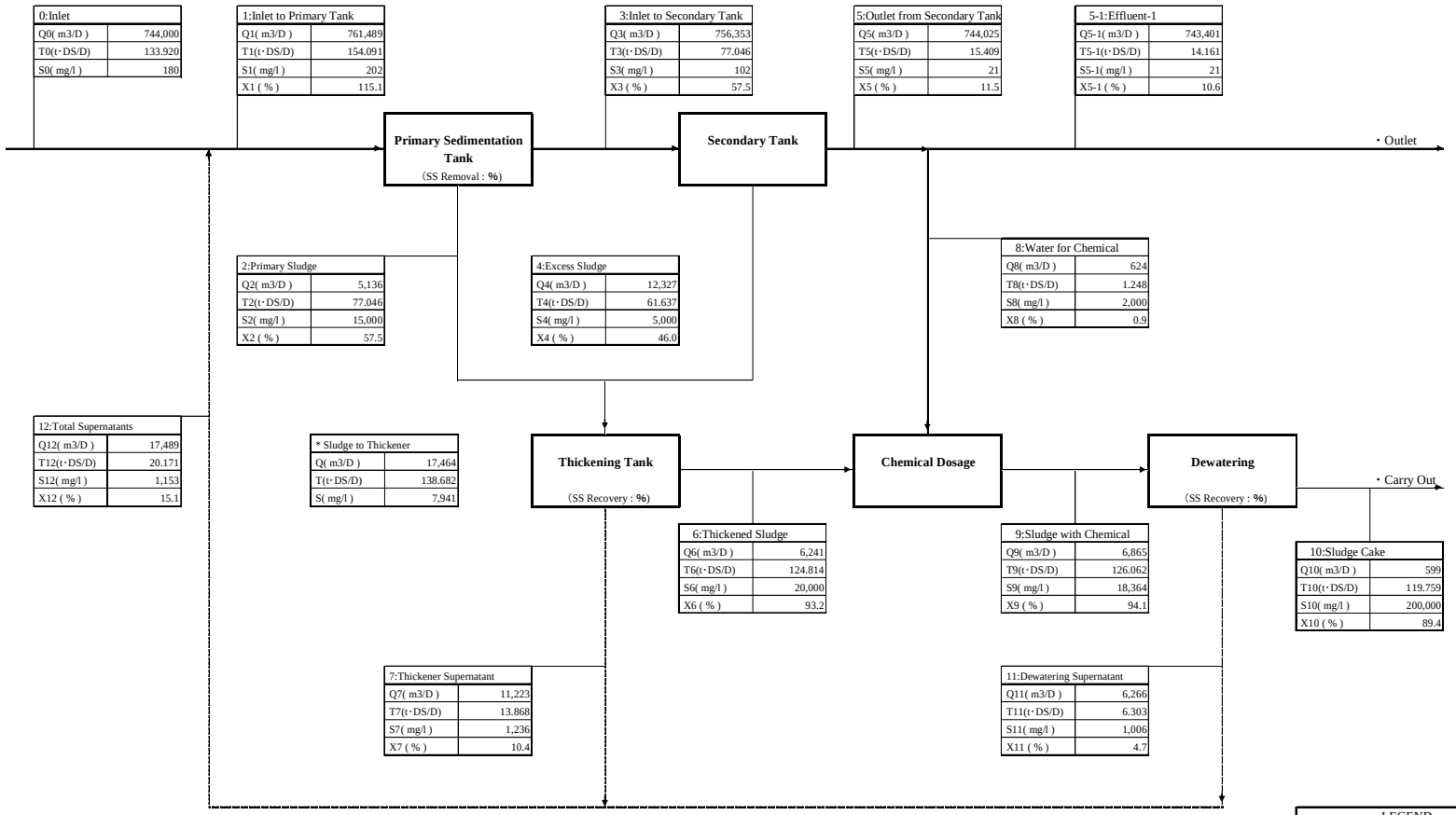


表 I.3　W1 処理場 容量計算書（1/11）

## 1 BASIC CONDITIONS

### 1-1 Basic Items

(1) Name : **W1 WWTP**

(2) Land Area : Approximately xxxx ha

(3) Ground Level (Elevatio : + 4.10 m (Plan)

(4) Inlet Pipe Invert Level : - 7.60 m

(5) Pipe Diameter : 2,000 mm

(6) Land Use : ―

(7) Collection System : ~~Combined System~~ (Separate System)

(8) Treatment Process : Conventional Activated Sludge Process

(9) Effluent Point : Hlaing River

(10) Water Level at the Effluent Poir :
High water leve = 3.70 m
Low water leve = ― m

(11) Target Year : 2020 (F/S Stage)
2040 (M/P Stage)

### 1-2 Service Area and Design Population

(1) Service Area : 1,654 ha

(2) Design Population

| Item | | Year 2020 | Year 2040 |
|---|---|---|---|
| Design Population | person | - | 483,300 |

## 表 I.3　W1 処理場 容量計算書 (2/11)

### 1-3 Design Sewage Flow

**(Year 2020)**

| Item | $m^3$/day | $m^3$/hr | $m^3$/min | $m^3$/sec |
|---|---|---|---|---|
| Maximum Daily Flow | | 0.0 | 0.00 | 0.000 |
| Maximum Hourly Flow | 0 | 0.0 | 0.00 | 0.000 |

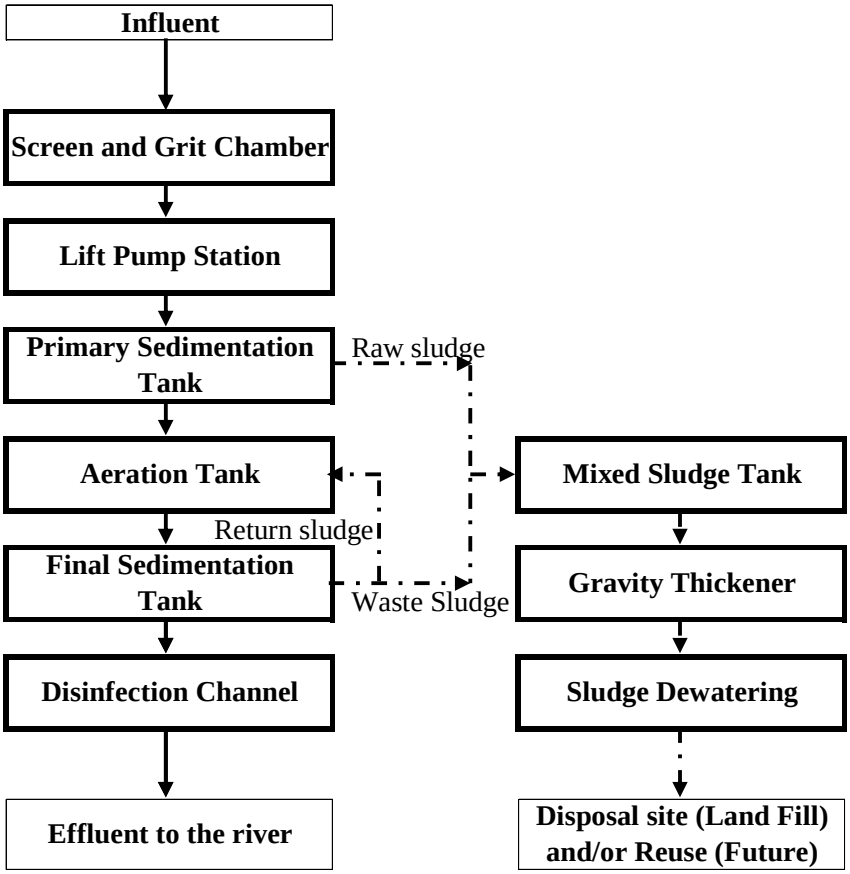
**(Year 2040)**

| Item | $m^3$/day | $m^3$/hr | $m^3$/min | $m^3$/sec |
|---|---|---|---|---|
| Maximum Daily Flow | 184,000 | 7,666.7 | 127.78 | 2.130 |
| Maximum Hourly Flow | 276,000 | 11,500.0 | 191.67 | 3.194 |

### 1-4 Design Sewage Quality

| Item | BOD | SS | T-N | Coli-group | Oil&Greese |
|---|---|---|---|---|---|
| | (mg/l) | (mg/l) | (mg/l) | (MPN/$cm^3$) | (mg/l) |
| Influent | 200 | 180 | - | - | - |
| Effluent | 20 | 30 | - | 3,000 | 5 |

### 1-5 Process Flow Diagram



# 表 I.3　W1 処理場 容量計算書 (3/11)

## 1.6 Design Criteria

| ITEMS | UNIT | Formula or Value | Application |
|---|---|---|---|
| **1** Grit Chamber (For Maximum Hourly Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 1,800 | 1,800 |
| (2) Average Velocity | m/sec | 0.3 | 0.3 |
| **2** Primary Sedimentation Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 35.0-70.0 | 50 |
| (2) Settling Time (Ref.) | hour | 1.5 | 1.5 |
| (3) Water Depth | m | 2.5-4.0 | 3.5 |
| (4) Weir Loading | $m^3/m/day$ | 250 | 250 |
| **3** Aeration Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Retention Time (HRT) | hour | 6 - 8 | 6.0 |
| (2) MLSS Concentration | mg/l | 1,500 -2,000 | 2,000 |
| (3) BOD-SS Load (Reference only) | kg/kg/day | 0.2 - 0.4 | - |
| **4** Final Sedimentation Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 20.0-30.0 | 25 |
| (2) Settling Time (Ref.) | hour | 3.0-4.0 | - |
| (3) Water Depth | m | 2.5-4.0 | 3.5 |
| (4) Weir Loading | $m^3/m/day$ | 150 | 150 |
| **5** Disinfection Tank (For Maximum Daily Flow) | | | |
| (1) Retention (Chlorination) Time | min | 15 | 15 |
| **6** Gravity Thickener (For Maximum Daily Flow) | | | |
| (1) Solids Loading | $kg/m^2/day$ | 60-90 | 75 |
| (2) Water Depth | m | | 4.0 |
| | | | |

# 表 I.3　W1 処理場 容量計算書 (4/11)

## 2　CAPACITY CALCULATION

### 2-1 Grit Chamber

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 276,000 |
| (Maximum Hourly Flow) | Q2 | $m^3$/sec | | | 3.194 |
| Water Surface Load | WSL | $m^3/m^2$/day | | | 1,800 |
| Required Surface Area | RSA | $m^2$ | Q1/WSL | | 153.33 |
| Basin Number | BN | basin | | | 4 |
| Average Velocity | AV | m/sec | | | 0.3 |
| Depth | H | m | | | 1 |
| Width | W1 | m | Q2/(AV×H×BN) | | 2.66 |
| *Therefore* | W2 | m | | | 3.0 |
| Length | L1 | m | RSA/(W2×BN) | | 12.78 |
| *Therefore* | L2 | m | | | 12.5 |
| **Dimension (Width)** | W | m | | | **3.0** |
| **(Length)** | L | m | L2 | | **12.5** |
| **(Depth)** | H | m | H | | **1.0** |
| **(Basin Number)** | N | basin | | | **4** |
| **(Check)** | | | | | |
| Water Surface Load | | $m^3/m^2$/day | Q1/(W×L×N) | | 1,840 |
| Average Velocity | | m/sec | Q2/(W×H×N) | | 0.266 |
| | | | | | |

### 2-2 Lift Pump Station

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Vertical shaft Volute type mixed flow pump | | |
| Design Sewage Flow | Q1 | $m^3$/min | Peak Flow | | 191.67 |
| | | | | | |
| Pump Unit -1 Number | UN1 | unit | | | 2 |
| Discharge per Unit | DU1 | $m^3$/min | 1/10×Q1 | | 19.17 |
| Pump Diameter(V=1.5~3.0m/s | D1 | mm | $146\times(DU1/1.5\sim3.0)^{0.5}$ | | 369 ～522 |
| *Therefore* | D1 | mm | | | 450 |
| | | | | | |
| Pump Unit -2 Number | UN2 | unit | | | 2 |
| Discharge per Unit | DU2 | $m^3$/min | 2/10×Q1 | | 38.33 |
| Pump Diameter(V=1.5~3.0m/s | D2 | mm | $146\times(DU2/1.5\sim3.0)^{0.5}$ | | 522 ～738 |
| *Therefore* | D2 | mm | | | 600 |
| | | | | | |
| Pump Unit -3 Number | UN3 | unit | including 1 stand-by | | 2 |
| Discharge per Unit | DU3 | $m^3$/min | 4/10×Q1 | | 76.67 |
| Pump Diameter(V=1.5~3.0m/s | D3 | mm | $146\times(DU3/1.5\sim3.0)^{0.5}$ | | 738 ##### |
| *Therefore* | D3 | mm | | | 800 |

## 表 I.3　W1 処理場 容量計算書 (5/11)

### 2-3 Primary Sedimentation Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 184,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 7,666.7 |
| Basin Number | BN | basin | | | 12 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 50.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 3,680 |
| | A2 | $m^2$/basin | A1/BN | | 307 |
| Width | W1 | m | 3.0m~4.0m, Max5.0m | | 5.0 |
| Length | L1 | m | A2/W1 | | 61.33 |
| *Therefore* | L2 | m | | | 62.0 |
| Water Depth | WD | m | | | 3.5 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 250 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 61.33 |
| *Therefore* | WL2 | m/basin | | | 62.0 |
| | | | | | |
| **Dimension (Width)** | W | m | | | **5.0** |
| **(Depth)** | D | m | | | **3.5** |
| **(Length)** | L | m | Two-story Sedimentation Tan | | **62.0** |
| | | | Upper Tank | | **24.8** |
| | | | Lower Tank | | **37.2** |
| **(Basin Number)** | N | basin | | | **12** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 49.46 |
| Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 1.70 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 247.31 |

## 表 I.3　W1 処理場 容量計算書 (6/11)

### 2-4 Aeration Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Multi-tank Complete mixing Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 184,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 7,666.7 |
| Hydraulic Retention Time | HRT | hr | | | 6.0 |
| Basin Number | BN | basin | | | 6 |
| Required Volume per basin | RV | $m^3$/basin | Q2×RT/BN | | 7,667 |
| Width | W | m | 1~2H | | 10.5 |
| Water Depth | H | m | Deep Aeration Tank | | 10.0 |
| Length | L1 | m | RV/(W×H) | | 73.0 |
| *Therefore* | L2 | m | | | 73.0 |
| **Dimension (Width)** | W | m | | | **10.5** |
| **(Depth)** | H | m | | | **10.0** |
| **(Length)** | L | m | | | **73.0** |
| **(Basin Number)** | N | basin | | | **6** |
| | | | | | |
| **(Check)** | | | | | |
| Hydraulic Retention Time | HRT | hour | W×H×L×N/Q2 | | 6.0 |
| BOD-SS load | $BSS_L$ | kgBOD/kgSS/d | (Q1×BODin)/(W×H×L×N×Xa) | | 0.24 |
| $BOD_{in}$ : Inflow BOD Concentration | | | 120 mg/L | (Removal Rate in PST : 40%) | |
| Xa : MLSS Concentration | | | 2,000 mg/L | | |
| Aerobic Sludge Retention Time | ASRT | day | HRT/24×Xa / (a×S-BODin + b×SSin - c×HRT/24×Xa) = | | 4.738 |
| $S\text{-}BOD_{in}$ : Inflow S-BOD Concentration | | | 80 mg/L | (S-BOD[Solved BOD]=BODin×0.6 | |
| $SS_{in}$ : Inflow SS Concentration | | | 90 mg/L | (Removal Rate in PST : 50%) | |
| a : Sludge converting ratio of solved BOI | | | 0.5 mgMLSS/mgBOD | (0.4~0.6) | |
| b : Sludge converting ratio of SS | | | 0.95 mgMLSS/mgSS | (0.9~1.0) | |
| c : Sludge reduction ratio caused by endogenous respiration | | | 0.04 | (1/day)(0.03~0.05) | |
| Effluent Quality (C-BOD) | EQ | mg/L | $10.42\times A\text{-}SRT^{(-0.519)}$ (15~20℃) | | 4.648 |
| Water Temperature | | | 20 ℃ | | |
| Effluent Water Quality (C=BOD Maximum) | | | EQ×3　20mg/l > | | 14 |
| | | | | | -OK- |
| | | | | | |
| | | | 1 : 1.5 : 1.5 : 2.25 | | |
| Partition of Aeration Tank | | | No.1 \| No.2 \| No.3 \| No.4 | | |
| | | | | | |
| Total Length of Tank | TL | m | | | 73.0 |
| No.1 Tank Length | L1 | m | TL×1/(1+1.5+1.5+2.25) | | 11.7 |
| No.2 Tank Length | L2 | m | TL×1.5/(1+1.5+1.5+2.25) | | 17.5 |
| No.3 Tank Length | L3 | m | TL×1.5/(1+1.5+1.5+2.25) | | 17.5 |
| No.4 Tank Length | L4 | m | TL×2.25/(1+1.5+1.5+2.25) | | 26.3 |
| | | | **Total** | | **73.0** |
| | | | | | |

## 表 I.3　W1 処理場 容量計算書 (7/11)

### 2-5 Final Sedimentation Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 184,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 7,666.7 |
| Basin Number | BN | basin | | | 12 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 25.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 7,360 |
| | A2 | $m^2$/basin | A1/BN | | 613 |
| Width | W1 | m | 3.0m~4.0m, Max5.0m | | 5.0 |
| Length | L1 | m | A2/W1 | | 122.67 |
| *Therefore* | L2 | m | | | 123.0 |
| Water Depth | WD | m | | | 3.5 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 150 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 102.22 |
| *Therefore* | WL2 | m/basin | | | 103.0 |
| | | | | | |
| **Dimension (Width)** | W | m | | | **5.0** |
| **(Depth)** | D | m | | | **3.5** |
| **(Length)** | L | m | Two-story Sedimentation Tan | | **123.0** |
| | | | Upper Tank | | **49.2** |
| | | | Lower Tank | | **73.8** |
| **(Basin Number)** | N | basin | | | **12** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 24.93 |
| Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 3.37 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 148.87 |

## 表 I.3　W1 処理場 容量計算書 (8/11)

### 2-6 Disinfection Channel

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Chlorination | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 184,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/min | | | 127.8 |
| Retention(Chlorination) Time | RT | min | | | 15.0 |
| Required Volume | RV | $m^3$ | Q2×RT | | 1,917 |
| Width of channel | W | m | | | 2.5 |
| Depth of channel | H | m | | | 3.0 |
| Pass Number | PN | pass | | | 4 |
| Length of channel | L1 | m/pass | RV/(W×H×PN) | | 63.9 |
| *Therefore* | L2 | m/pass | | | 64.0 |
| **Dimension (Width)** | W | m | | | **2.5** |
| **(Depth)** | H | m | | | **3.0** |
| **(Length)** | L | m/pass | | | **64.0** |
| **(Pass Number)** | N | pass | | | **4** |
| **(Check)** | | | | | |
| Retention(Chlorination) Time | RT | min | (W×H×L×PN)/Q2 | | 15.0 |

### 2-7 Sludge Thickening Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Gravity Thickener (Radial Flow Circular Type) | | |
| Generated Sludge Solids | GS | t-DS/day | Refer to Mass Balance Cal. | | 34.298 |
| Generated Sludge Volume | GSV | $m^3$/day | Refer to Mass Balance Cal. | | 4,319 |
| Solid Matter Load | SML | kg/$m^2$/day | | | 75 |
| Required Surface Area | SA | $m^2$ | $(GS\times10^3)/SML$ | | 457.3 |
| Water Depth | H | m | | | 4.0 |
| Basin Number | BN | basin | | | 4 |
| Required Tank Diameter | TD1 | m | $(SA\times4/(3.14\times BN))^{0.5}$ | | 12.07 |
| *Therefore* | TD2 | m | | | 12.0 |
| | | | | | |
| **Dimension (Diameter)** | D | m/basin | | | **12.0** |
| **(Depth)** | H | m | | | **4.0** |
| **(Basin Number)** | BN | basin | | | **4** |
| | | | | | |
| **(Check)** | | | | | |
| Solid Matter Load | SML | kg/$m^2$/day | $GS\times10^3/(3.14\times D^2/4)\times BN$ | | 75.9 |
| Sludge Thickened Time | T | hr | $(3.14\times D^2/4)\times H\times BN\times24/GSV$ | | 10.1 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## 表 I.3　W1 処理場 容量計算書 (9/11)

### 2-8 Sludge Dewatering

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Mechanical Dewatering (Screw Press Type) | | |
| Thickened Sludge Solids | TS | t-DS/day | Refer to Material Balance | | 31.177 |
| Unit Number | UN | Unit | | | 8 |
| Operating Time | OT | hr/day | | | 24.0 |
| Required Dewatering Capacity | DC | kg/hr/unit | $TS\times10^3/(OT\times UN)$ | | 162.4 |
| Solids Loading | $Q_{100}$ | kg-ds/hr/φ100 | | | 3.0 |
| Screen Diameter | SD1 | mm | $100\times(DC/Q_{100})^{(1/2.2)}$ | | 613.6 |
| Therefore | SD2 | mm | | | 700 |
| | | | | | |
| **Dimension (unit)** | UN | Unit | | | **8** |
| **(Screen Diameter)** | SD | mm | | | **700** |
| | | | | | |
| **(Check)** | | | | | |
| Dewatering Capacity | DC | kg/hr/unit | $(SD/100)^{2.2}\times Q_{100}$ | | 216.9 |
| Operating Time | OT | hour/day | $TS\times10^3/(DC\times(UN-1))$ | | 18.0 |

# 表 I.3　W1 処理場 容量計算書 (10/11)

**Material Balance Calculation (Primary and Secondary Sedimentation Tank + Thickening Tank + Mechanical Dewatering)**

**Table-1 Input Data**

| | | | |
|---|---|---|---|
| 1. Calculation Manner | | 1 | 1:Premise that the quality of supernatants are same level removed with inlet sewage<br>2:Premise that the entire supernatants are removed at treatment process |
| 2. Selection of Treatment Efficiency | | 1 | 1:Total Removal Ratio 2:Outlet Water Quality(input 1or2) |
| In case of 1 : input data | | 90 | (%) |
| In case of 2 : input data | | | (mg/l) |
| 3. Excess Sludge Generation | | 1 | 1:Consideration of Solid Matter Only 2:Consideration of Converting of Solved BOD (input 1or2) |
| In case of 1:Input data (Sludge generation) | | 100 | Sludge generation ratio per removal SS(%) |
| In case of 2:Input data | a | | T2=Q2*S2=(a*$S_{BOD}$+b*S1-c*θ*XA)*Q1/10^6 **(Excess sludge generation formula) |
| | b | | a:Converting ratio of solved BOD(mgMLSS/mgBOD) |
| | c | | b:Converting ratio of SS(mgMLSS/mgSS) |
| | SBOD | | c:Sludge reduction ratio caused by endogenous respiration of activated sludge(1/day) |
| | XA | | Sbod:Solved BOD quality at inlet to reactor |
| | θ | | XA:MLSS concentration(mg/l) |
| | | | θ:Hydraulic retention time(day) |

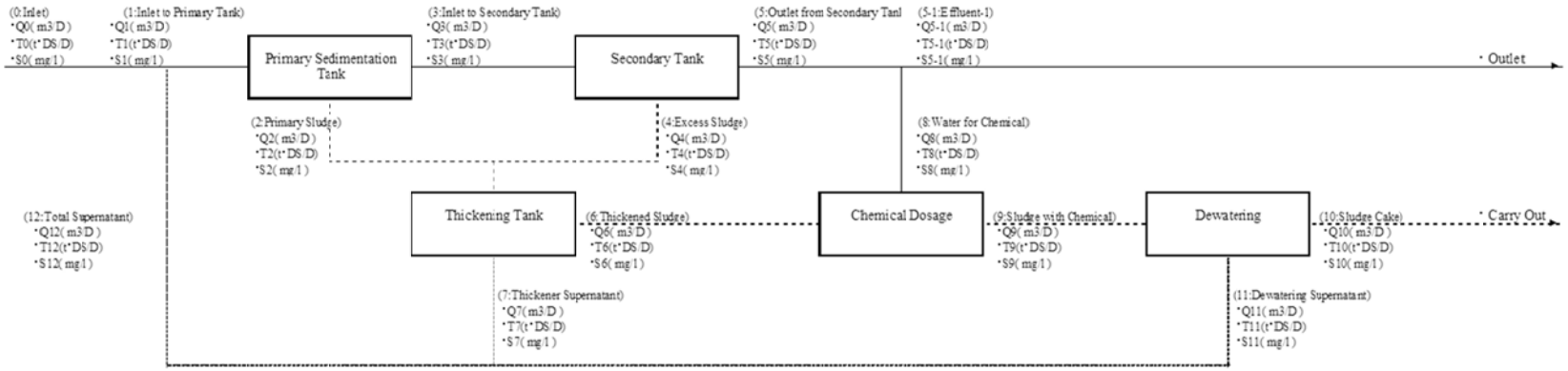
**Table-2 Basic Conditions**

| Water Flow and Quality | | Sludge Moisture and Recovery Ratio | | | | Chemical Conditions for Dewatering | | | |
|---|---|---|---|---|---|---|---|---|---|
| ・Inlet flow : Q0(m3/D) | 184000 | ・Primary sludge moisture ratio : W1(%) | 98.5 | ・Removal ratio in primary tank : A2(%) | 50.0 | ・Chemical dosage : A5(%) | 1.0 | | |
| ・Inlet quality : S0(mg/l) | 180 | ・Excess sludge moisture ratio : W2(%) | 99.5 | ・Recovery ratio in sludge thickener : A3(%) | 90.0 | ・Chemical dissolve concentration : A6(%) | 0.2 | | |
| ・Total removal ratio : A1(%) | 90.0 | ・Thickened sludge moisture ratio : W3(%) | 98.0 | ・Recovery ratio in dewatering : A4(%) | 95.0 | | | | |
| ・Effluent quality: Si(mg/l) | - | ・Dewatered sludge moisture ratio : W4(%) | 80.0 | | | | | | |
| ・Sludge generation ratio per removal SS : Si(%) | 100.0 | | | | | | | | |

**Table-3 Material Balance Calculation**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | 5-1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q(m3/day) | 184,000 | 188,325 | 1,270 | 187,055 | 3,049 | 184,006 | 1,543 | 2,776 | 154 | 1,698 | 148 | 1,550 | 4,325 | | 183,852 | |
| T(t*DS/day) | 33.120 | 38.109 | 19.054 | 19.054 | 15.243 | 3.811 | 30.868 | 3.430 | 0.309 | 31.177 | 29.618 | 1.559 | 4.989 | | 3.502 | |
| S(mg/l) | 180 | 202 | 15,000 | 102 | 5,000 | 21 | 20,000 | 1,236 | 2,000 | 18,364 | 200,000 | 1,006 | 1,153 | | 21 | |
| X(T/T0*100) | 100 | 115.1 | 57.5 | 57.5 | 46.0 | 11.5 | 93.2 | 10.4 | 0.9 | 94.1 | 89.4 | 4.7 | 15.1 | | 10.6 | |

**Figure-1 Material Balance Model**




**Calculation Formula**

| | | | | | |
|---|---|---|---|---|---|
| ・Q0=Input Data<br>・T0=Q0*S0*10^(-6)<br>・S0=Input Data | ・Q3=Q1-Q2<br>・T3=T1*(100-A2)/100<br>・S3=T3*10^6/Q3 | ・Q6=T4*100/(100-W3)<br>・T6=(T2+T4)*A3/100<br>・S6=10^6*(100-W3)/100 | ・Q9=Q6+Q8<br>・T9=T6+T8<br>・S9=T9*10^6/Q9 | ・Q12=Q7+Q11<br>・T12=T7+T11<br>・S11=T11*10^6/Q11 | ・Q5-1=Q5-Q8<br>・T5-1=T5-T8<br>・S5-1=S5 |
| ・Q1=Q0+Q13<br>・T1=T0+T13<br>・S1=T1*10^6/Q1 | ・Q4=T4*100/(100-W2)<br>・T4=((T1-T5)*Si/100)-T2<br>・S4=10^6*(100-W2)/100 | ・Q7=(Q2+Q4)-Q6<br>・T7=(T2+T4)-T6<br>・S7=T7*10^6/Q7 | ・Q10=T10*100/(100-W4)<br>・T10=T9*A4/100<br>・S10=10^6*(100-W4)/100 | | |
| ・Q2=T2*100/(100-W1)<br>・T2=T1-T3<br>・S2=10^6*(100-W1)/100 | ・Q5=Q3-Q4*(T3-T5)/T4<br>・T5=T1*(100-A1)/100<br>・S5=T5*10^6/Q5 | ・Q8=T6*A5/A6<br>・T8=Q8*S8/10^6<br>・S8=10^4*A6 | ・Q11=Q9-Q10<br>・T11=T9-T10<br>・S11=T11*10^6/Q11 | | |

# 表 I.3 W1 処理場 容量計算書 (11/11)

**Material Balance Sheet**

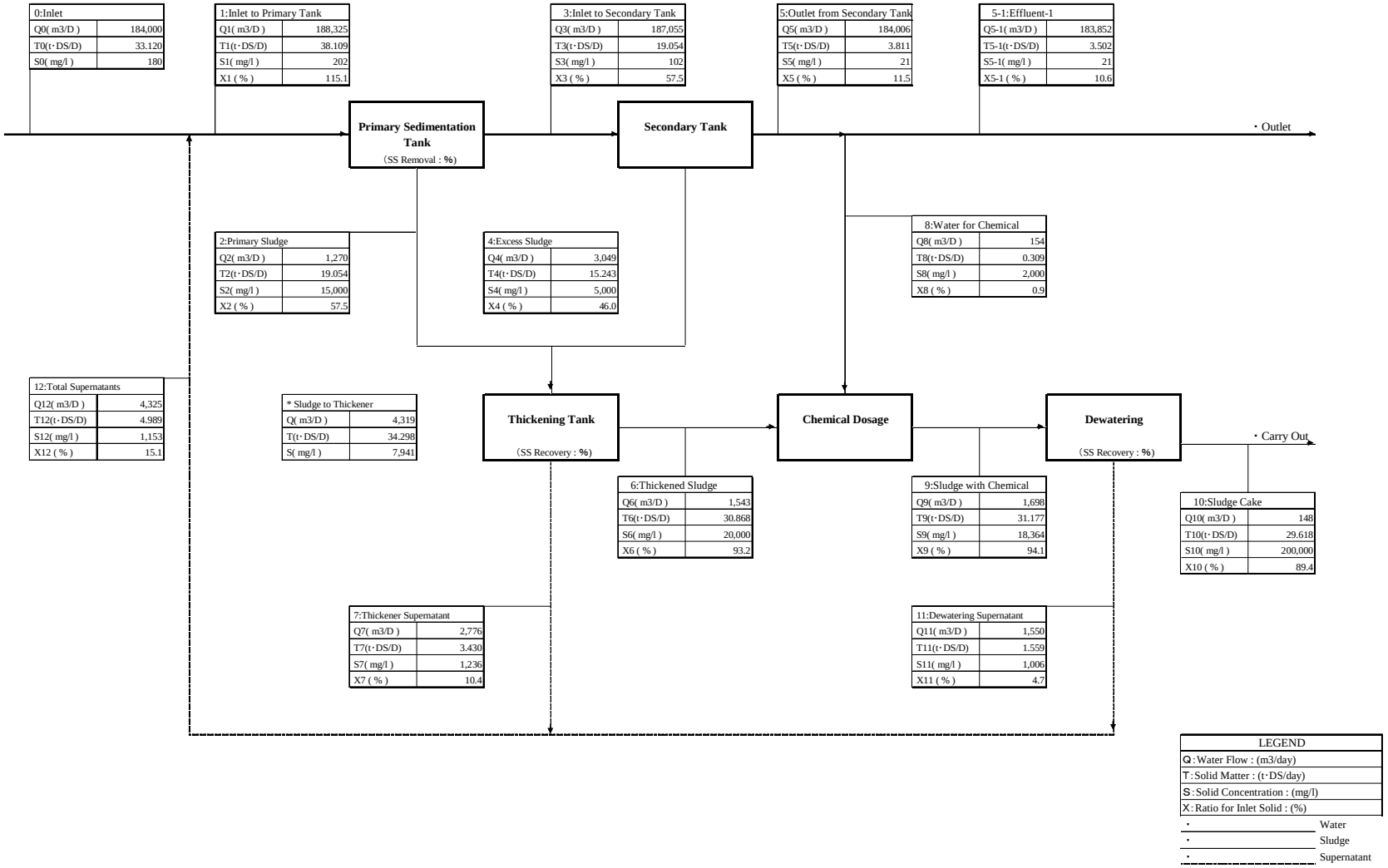


表 I.4　W2 処理場 容量計算書（1/11）

## 1 BASIC CONDITIONS

### 1-1 Basic Items

(1) Name : **W2 WWTP**

(2) Land Area : Approximately xxxx ha

(3) Ground Level (Elevatio : + 4.50 m (Plan)

(4) Inlet Pipe Invert Level : - 6.54 m

(5) Pipe Diameter : 1,800 mm

(6) Land Use : －

(7) Collection System : ~~Combined System~~ (Separate System)

(8) Treatment Process : Conventional Activated Sludge Process

(9) Effluent Point : Hlaing River

(10) Water Level at the Effluent Poir :
High water leve = 3.70 m
Low water leve = － m

(11) Target Year : 2020 (F/S Stage)
2040 (M/P Stage)

### 1-2 Service Area and Design Population

(1) Service Area : 2,356 ha

(2) Design Population

| Item | | Year 2020 | Year 2040 |
|---|---|---|---|
| Design Population | person | - | 349,500 |

表 I.4　W2 処理場 容量計算書 (2/11)

**1-3 Design Sewage Flow**

**(Year 2020)**

| Item | $m^3$/day | $m^3$/hr | $m^3$/min | $m^3$/sec |
|---|---|---|---|---|
| Maximum Daily Flow | | 0.0 | 0.00 | 0.000 |
| Maximum Hourly Flow | 0 | 0.0 | 0.00 | 0.000 |

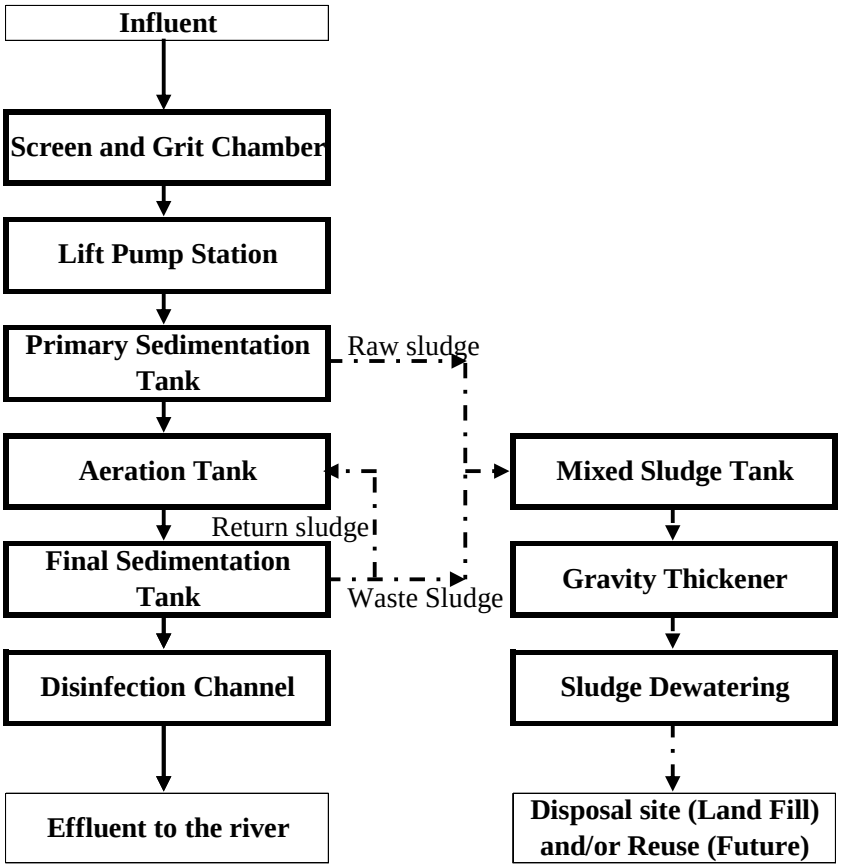
**(Year 2040)**

| Item | $m^3$/day | $m^3$/hr | $m^3$/min | $m^3$/sec |
|---|---|---|---|---|
| Maximum Daily Flow | 126,000 | 5,250.0 | 87.50 | 1.458 |
| Maximum Hourly Flow | 189,000 | 7,875.0 | 131.25 | 2.188 |

**1-4 Design Sewage Quality**

| Item | BOD | SS | T-N | Coli-group | Oil&Greese |
|---|---|---|---|---|---|
| | (mg/l) | (mg/l) | (mg/l) | (MPN/$cm^3$) | (mg/l) |
| Influent | 200 | 180 | - | - | - |
| Effluent | 20 | 30 | - | 3,000 | 5 |

**1-5 Process Flow Diagram**



# 表 I.4　W2 処理場 容量計算書 (3/11)

## 1.6 Design Criteria

| ITEMS | UNIT | Formula or Value | Application |
|---|---|---|---|
| **1** Grit Chamber (For Maximum Hourly Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 1,800 | 1,800 |
| (2) Average Velocity | m/sec | 0.3 | 0.3 |
| **2** Primary Sedimentation Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 35.0-70.0 | 50 |
| (2) Settling Time (Ref.) | hour | 1.5 | 1.5 |
| (3) Water Depth | m | 2.5-4.0 | 3.5 |
| (4) Weir Loading | $m^3/m/day$ | 250 | 250 |
| **3** Aeration Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Retention Time (HRT) | hour | 6 - 8 | 6.0 |
| (2) MLSS Concentration | mg/l | 1,500 -2,000 | 2,000 |
| (3) BOD-SS Load (Reference only) | kg/kg/day | 0.2 - 0.4 | - |
| **4** Final Sedimentation Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 20.0-30.0 | 25 |
| (2) Settling Time (Ref.) | hour | 3.0-4.0 | - |
| (3) Water Depth | m | 2.5-4.0 | 3.5 |
| (4) Weir Loading | $m^3/m/day$ | 150 | 150 |
| **5** Disinfection Tank (For Maximum Daily Flow) | | | |
| (1) Retention (Chlorination) Time | min | 15 | 15 |
| **6** Gravity Thickener (For Maximum Daily Flow) | | | |
| (1) Solids Loading | $kg/m^2/day$ | 60-90 | 75 |
| (2) Water Depth | m | | 4.0 |
| | | | |

## 表 I.4　W2 処理場 容量計算書 (4/11)

### 2 CAPACITY CALCULATION

#### 2-1 Grit Chamber

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 189,000 |
| (Maximum Hourly Flow) | Q2 | $m^3$/sec | | | 2.188 |
| Water Surface Load | WSL | $m^3/m^2$/day | | | 1,800 |
| Required Surface Area | RSA | $m^2$ | Q1/WSL | | 105.00 |
| Basin Number | BN | basin | | | 4 |
| Average Velocity | AV | m/sec | | | 0.3 |
| Depth | H | m | | | 0.8 |
| Width | W1 | m | Q2/(AV×H×BN) | | 2.28 |
| *Therefore* | W2 | m | | | 2.5 |
| Length | L1 | m | RSA/(W2×BN) | | 10.50 |
| *Therefore* | L2 | m | | | 11.0 |
| **Dimension (Width)** | W | m | | | **2.5** |
| **(Depth)** | L | m | L2 | | **11.0** |
| **(Length)** | H | m | H | | **0.8** |
| **(Basin Number)** | N | basin | | | **4** |
| **(Check)** | | | | | |
| Water Surface Load | | $m^3/m^2$/day | Q1/(W×L×N) | | 1,718 |
| Average Velocity | | m/sec | Q2/(W×H×N) | | 0.273 |
| | | | | | |

#### 2-2 Lift Pump Station

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Vertical shaft Volute type mixed flow pump | | |
| Design Sewage Flow | Q1 | $m^3$/min | Peak Flow | | 131.25 |
| | | | | | |
| Pump Unit -1 Number | UN1 | unit | | | 2 |
| Discharge per Unit | DU1 | $m^3$/min | 1/10×Q1/UN1 | | 13.13 |
| Pump Diameter(V=1.5~3.0m/s | D1 | mm | $146\times(DU1/1.5\sim3.0)^{0.5}$ | | 305 ～432 |
| *Therefore* | D1 | mm | | | 350 |
| | | | | | |
| Pump Unit -2 Number | UN2 | unit | | | 2 |
| Discharge per Unit | DU2 | $m^3$/min | 2/10×Q1/UN2 | | 26.25 |
| Pump Diameter(V=1.5~3.0m/s | D2 | mm | $146\times(DU2/1.5\sim3.0)^{0.5}$ | | 432 ～611 |
| *Therefore* | D2 | mm | | | 500 |
| | | | | | |
| Pump Unit -3 Number | UN3 | unit | including 1 stand-by | | 2 |
| Discharge per Unit | DU3 | $m^3$/min | 4/10×Q1/UN3 | | 52.50 |
| Pump Diameter(V=1.5~3.0m/s | D3 | mm | $146\times(DU3/1.5\sim3.0)^{0.5}$ | | 611 ～864 |
| *Therefore* | D3 | mm | | | 700 |

## 表 I.4　W2 処理場 容量計算書 (5/11)

### 2-3 Primary Sedimentation Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 126,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 5,250.0 |
| Basin Number | BN | basin | | | 16 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 50.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 2,520 |
| | A2 | $m^2$/basin | A1/BN | | 158 |
| Width | W1 | m | 3.0m~4.0m, Max5.0m | | 5.0 |
| Length | L1 | m | A2/W1 | | 31.50 |
| *Therefore* | L2 | m | | | 32.0 |
| Water Depth | WD | m | | | 3.5 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 250 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 31.50 |
| *Therefore* | WL2 | m/basin | | | 32.0 |
| | | | | | |
| **Dimension (Width)** | W | m | | | **5.0** |
| **(Depth)** | D | m | | | **3.5** |
| **(Length)** | L | m | | | **32.0** |
| **(Basin Number)** | N | basin | | | **16** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 49.22 |
| Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 1.71 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 246.09 |

## 表 I.4　W2 処理場 容量計算書 (6/11)

### 2-4 Aeration Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Multi-tank Complete mixing Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 126,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 5,250.0 |
| Hydraulic Retention Time | HRT | hr | | | 6.0 |
| Basin Number | BN | basin | | | 8 |
| Required Volume per basin | RV | $m^3$/basin | Q2×RT/BN | | 3,938 |
| Width | W | m | 1~2H | | 10.5 |
| Water Depth | H | m | 4.0m~6.0m | | 6.0 |
| Length | L1 | m | RV/(W×H) | | 62.5 |
| *Therefore* | L2 | m | | | 63.0 |
| **Dimension (Width)** | W | m | | | **10.5** |
| **(Depth)** | H | m | | | **6.0** |
| **(Length)** | L | m | | | **63.0** |
| **(Basin Number)** | N | basin | | | **8** |
| | | | | | |
| **(Check)** | | | | | |
| Hydraulic Retention Time | HRT | hour | W×H×L×N/Q2 | | 6.0 |
| BOD-SS load | $BSS_L$ | kgBOD/kgSS/d | (Q1×BODin)/(W×H×L×N×Xa) | | 0.24 |
| $BOD_{in}$ : Inflow BOD Concentration | | | 120 mg/L | (Removal Rate in PST : 40%) | |
| Xa : MLSS Concentration | | | 2,000 mg/L | | |
| Aerobic Sludge Retention Time | ASRT | day | HRT/24×Xa / (a×S-BODin + b×SSin - c×HRT/24×Xa) = | | 4.785 |
| $S\text{-}BOD_{in}$ : Inflow S-BOD Concentration | | | 80 mg/L | (S-BOD[Solved BOD]=BODin×0.6 | |
| $SS_{in}$ : Inflow SS Concentration | | | 90 mg/L | (Removal Rate in PST : 50%) | |
| a : Sludge converting ratio of solved BOI | | | 0.5 mgMLSS/mgBOD | (0.4~0.6) | |
| b : Sludge converting ratio of SS | | | 0.95 mgMLSS/mgSS | (0.9~1.0) | |
| c : Sludge reduction ratio caused by endogenous respiration | | | 0.04 | (1/day)(0.03~0.05) | |
| Effluent Quality (C-BOD) | EQ | mg/L | $10.42\times A\text{-}SRT^{(-0.519)}$ (15~20℃) | | 4.624 |
| Water Temperature | | | 20 ℃ | | |
| Effluent Water Quality (C=BOD Maximum) | | | EQ×3　20mg/l > | | 14 |
| | | | | | -OK- |
| | | | | | |
| | | | 1 : 1.5 : 1.5 : 2.25 | | |
| Partition of Aeration Tank | | | No.1 \| No.2 \| No.3 \| No.4 | | |
| | | | | | |
| Total Length of Tank | TL | m | | | 63.0 |
| No.1 Tank Length | L1 | m | TL×1/(1+1.5+1.5+2.25) | | 10.1 |
| No.2 Tank Length | L2 | m | TL×1.5/(1+1.5+1.5+2.25) | | 15.1 |
| No.3 Tank Length | L3 | m | TL×1.5/(1+1.5+1.5+2.25) | | 15.1 |
| No.4 Tank Length | L4 | m | TL×2.25/(1+1.5+1.5+2.25) | | 22.7 |
| | | | **Total** | | **63.0** |
| | | | | | |

## 表 I.4　W2 処理場 容量計算書 (7/11)

### 2-5 Final Sedimentation Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 126,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 5,250.0 |
| Basin Number | BN | basin | | | 16 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 25.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 5,040 |
| | A2 | $m^2$/basin | A1/BN | | 315 |
| Width | W1 | m | 3.0m~4.0m, Max5.0m | | 5.0 |
| Length | L1 | m | A2/W1 | | 63.00 |
| *Therefore* | L2 | m | | | 63.0 |
| Water Depth | WD | m | | | 3.5 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 150 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 52.50 |
| *Therefore* | WL2 | m/basin | | | 53.0 |
| | | | | | |
| **Dimension (Width)** | W | m | | | **5.0** |
| **(Depth)** | D | m | | | **3.5** |
| **(Length)** | L | m | | | **63.0** |
| **(Basin Number)** | N | basin | | | **16** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 25.00 |
| Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 3.36 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 148.58 |

表 I.4　W2 処理場 容量計算書 (8/11)

**2-6 Disinfection Channel**

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Chlorination | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 126,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/min | | | 87.5 |
| Retention(Chlorination) Time | RT | min | | | 15.0 |
| Required Volume | RV | $m^3$ | Q2×RT | | 1,313 |
| Width of channel | W | m | | | 2.0 |
| Depth of channel | H | m | | | 2.5 |
| Pass Number | PN | pass | | | 8 |
| Length of channel | L1 | m/pass | RV/(W×H×PN) | | 32.8 |
| *Therefore* | L2 | m/pass | | | 33.0 |
| **Dimension (Width)** | W | m | | | **2.0** |
| **(Depth)** | H | m | | | **2.5** |
| **(Length)** | L | m/pass | | | **33.0** |
| **(Pass Number)** | N | pass | | | **8** |
| **(Check)** | | | | | |
| Retention(Chlorination) Time | RT | min | (W×H×L×PN)/Q2 | | 15.1 |

**2-7 Sludge Thickening Tank**

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Gravity Thickener (Radial Flow Circular Type) | | |
| Generated Sludge Solids | GS | t-DS/day | Refer to Mass Balance Cal. | | 23.487 |
| Generated Sludge Volume | GSV | $m^3$/day | Refer to Mass Balance Cal. | | 2,958 |
| Solid Matter Load | SML | kg/$m^2$/day | | | 75 |
| Required Surface Area | SA | $m^2$ | $(GS\times10^3)/SML$ | | 313.2 |
| Water Depth | H | m | | | 4.0 |
| Basin Number | BN | basin | | | 4 |
| Required Tank Diameter | TD1 | m | $(SA\times4/(3.14\times BN))^{0.5}$ | | 9.99 |
| *Therefore* | TD2 | m | | | 10.0 |
| | | | | | |
| **Dimension (Diameter)** | D | m/basin | | | **10.0** |
| **(Depth)** | H | m | | | **4.0** |
| **(Basin Number)** | BN | basin | | | **4** |
| | | | | | |
| **(Check)** | | | | | |
| Solid Matter Load | SML | kg/$m^2$/day | $GS\times10^3/(3.14\times D^2/4)\times BN$ | | 74.8 |
| Sludge Thickened Time | T | hr | $(3.14\times D^2/4)\times H\times BN\times24/GSV$ | | 10.2 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## 表 I.4　W2 処理場 容量計算書 (9/11)

### 2-8 Sludge Dewatering

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Mechanical Dewatering (Screw Press Type) | | |
| Thickened Sludge Solids | TS | t-DS/day | Refer to Material Balance | | 21.349 |
| Unit Number | UN | Unit | | | 4 |
| Operating Time | OT | hr/day | | | 24.0 |
| Required Dewatering Capacity | DC | kg/hr/unit | $TS\times10^3/(OT\times UN)$ | | 222.4 |
| Solids Loading | $Q_{100}$ | kg-ds/hr/φ100 | | | 3.0 |
| Screnn Diameter | SD1 | mm | $100\times(DC/Q_{100})^{(1/2.2)}$ | | 707.9 |
| Therefore | SD2 | mm | | | 800 |
| | | | | | |
| **Dimension (unit)** | UN | Unit | | | **4** |
| **(Screen Diameter)** | SD | mm | | | **800** |
| | | | | | |
| **(Check)** | | | | | |
| Dewatering Capacity | DC | kg/hr/unit | $(SD/100)^{2.2}\times Q_{100}$ | | 291.0 |
| Operating Time | OT | hour/day | $TS\times10^3/(DC\times(UN-1))$ | | 18.3 |

# 表 I.4　W2 処理場 容量計算書（10/11）

**Material Balance Calculation (Primary and Secondary Sedimentation Tank + Thickening Tank + Mechanical Dewatering)**

**Table-1 Input Data**

| | | | |
|---|---|---|---|
| 1. Calculation Manner | | 1 | 1:Premise that the quality of supernatants are same level removed with inlet sewage<br>2:Premise that the entire supernatants are removed at treatment process |
| 2. Selection of Treatment Efficiency | | 1 | 1:Total Removal Ratio 2:Outlet Water Quality(input 1or2) |
| In case of 1 : input data | | 90 | (%) |
| In case of 2 : input data | | | (mg/l) |
| 3. Excess Sludge Generation | | 1 | 1:Consideration of Solid Matter Only 2:Consideration of Converting of Solved BOD (input 1or2) |
| In case of 1:Input data (Sludge generation) | | 100 | Sludge generation ratio per removal SS(%) |
| In case of 2:Input data | a | | T2=Q2*S2=(a*$S_{BOD}$+b*S1-c*θ*XA)*Q1/10^6 **(Excess sludge generation formula) |
| | b | | a:Converting ratio of solved BOD(mg)/MLSS/mgBOD) |
| | c | | b:Converting ratio of SS(mg)/MLSS/mgSS) |
| | SBOD | | c:Sludge reduction ratio caused by endogenous respiration of activated sludge(1/day) |
| | XA | | Saoo:Solved BOD quality at inlet to reactor |
| | θ | | XA:MLSS concentration(mg/l) |
| | | | θ:Hydraulic retention time(day) |

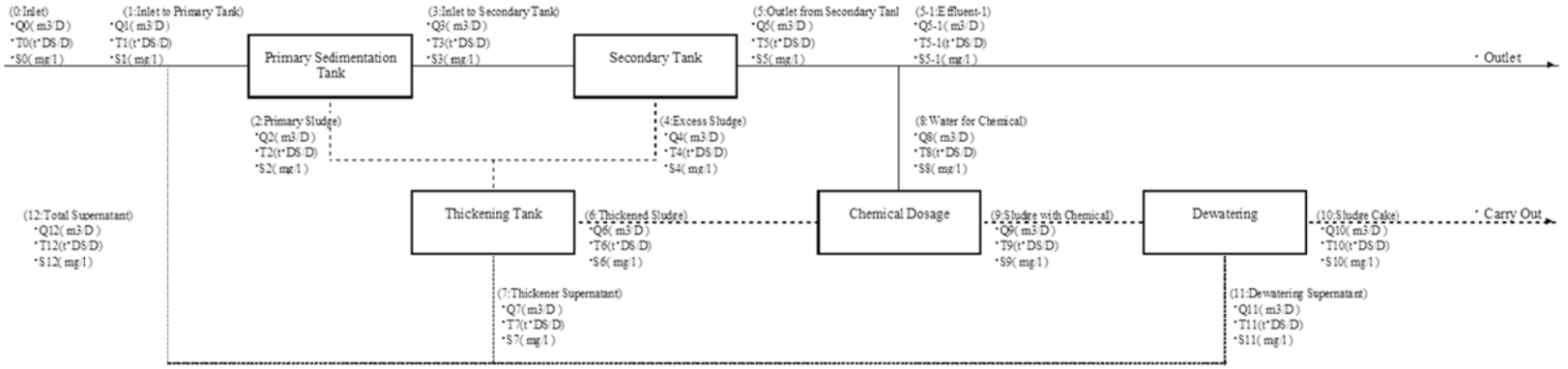
**Table-2 Basic Conditions**

| Water Flow and Quality | | Sludge Moisture and Recovery Ratio | | | | Chemical Conditions for Dewatering | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Inlet flow : Q0(m3/D) | 126000 | *Primary sludge moisture ratio : W1(%) | 98.5 | *Removal ratio in primary tank : A2(%) | 50.0 | *Chemical dosage : A5(%) | 1.0 | | |
| *Inlet quality : S0(mg/l) | 180 | *Excess sludge moisture ratio : W2(%) | 99.5 | *Recovery ratio in sludge thickener : A3(%) | 90.0 | *Chemical dissolve concentration : A6(%) | 0.2 | | |
| *Total removal ratio : A1(%) | 90.0 | *Thickened sludge moisture ratio : W3(%) | 98.0 | *Recovery ratio in dewatering : A4(%) | 95.0 | | | | |
| *Effluent quality : St(mg/l) | - | *Dewatered sludge moisture ratio : W4(%) | 80.0 | | | | | | |
| *Sludge generation ratio per removal SS : Si(%) | 100.0 | | | | | | | | |

**Table-3 Material Balance Calculation**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | 5-1 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q(m3/day) | 126.000 | 128.962 | 870 | 128.092 | 2.088 | 126.004 | 1.057 | 1.901 | 106 | 1.163 | 101 | 1.061 | 2.962 | | | 125.899 | | |
| T(t*DS/day) | 22.680 | 26.096 | 13.048 | 13.048 | 10.438 | 2.610 | 21.138 | 2.349 | 0.211 | 21.349 | 20.282 | 1.067 | 3.416 | | | 2.398 | | |
| S(mg/l) | 180 | 202 | 15.000 | 102 | 5.000 | 21 | 20.000 | 1.236 | 2.000 | 18.364 | 200.000 | 1.006 | 1.153 | | | 21 | | |
| X(Ti,T0*100) | 100 | 115.1 | 57.5 | 57.5 | 46.0 | 11.5 | 93.2 | 10.4 | 0.9 | 94.1 | 89.4 | 4.7 | 15.1 | | | 10.6 | | |

**Figure-1 Material Balance Model**




**Calculation Formula**

| | | | | | |
|---|---|---|---|---|---|
| *Q0=Input Data<br>*T0=Q0*S0*10^(-6)<br>*S0=Input Data | *Q3=Q1-Q2<br>*T3=T1*(100-A2)/100<br>*S3=T3*10^6/Q3 | *Q6=T4*100/(100-W3)<br>*T6=(T2+T4)*A3/100<br>*S6=10^6*(100-W3)/100 | *Q9=Q6+Q8<br>*T9=T6+T8<br>*S9=T9*10^6/Q9 | *Q12=Q7+Q11<br>*T12=T7+T11<br>*S11=T11*10^6/Q11 | *Q5-1=Q5-Q8<br>*T5-1=T5-T8<br>*S5-1=S5 |
| *Q1=Q0+Q13<br>*T1=T0+T13<br>*S1=T1*10^6/Q1 | *Q4=T4*100/(100-W2)<br>*T4=((T1-T5)*Si/100)-T2<br>*S4=10^6*(100-W2)/100 | *Q7=(Q2+Q4)-Q6<br>*T7=(T2+T4)-T6<br>*S7=T7*10^6/Q7 | *Q10=T10*100/(100-W4)<br>*T10=T9*A4/100<br>*S10=10^6*(100-W4)/100 | | |
| *Q2=T2*100/(100-W1)<br>*T2=T1-T3<br>*S2=10^6*(100-W1)/100 | *Q5=Q3-Q4*(T3-T5)/T4<br>*T5=T1*(100-A1)/100<br>*S5=T5*10^6/Q5 | *Q8=T8*A5/A6<br>*T8=Q8*S8/10^6<br>*S8=10^4*A6 | *Q11=Q9-Q10<br>*T11=T9-T10<br>*S11=T11*10^6/Q11 | | |

# 表 I.4　W2 処理場 容量計算書 (11/11)

**Material Balance Sheet**

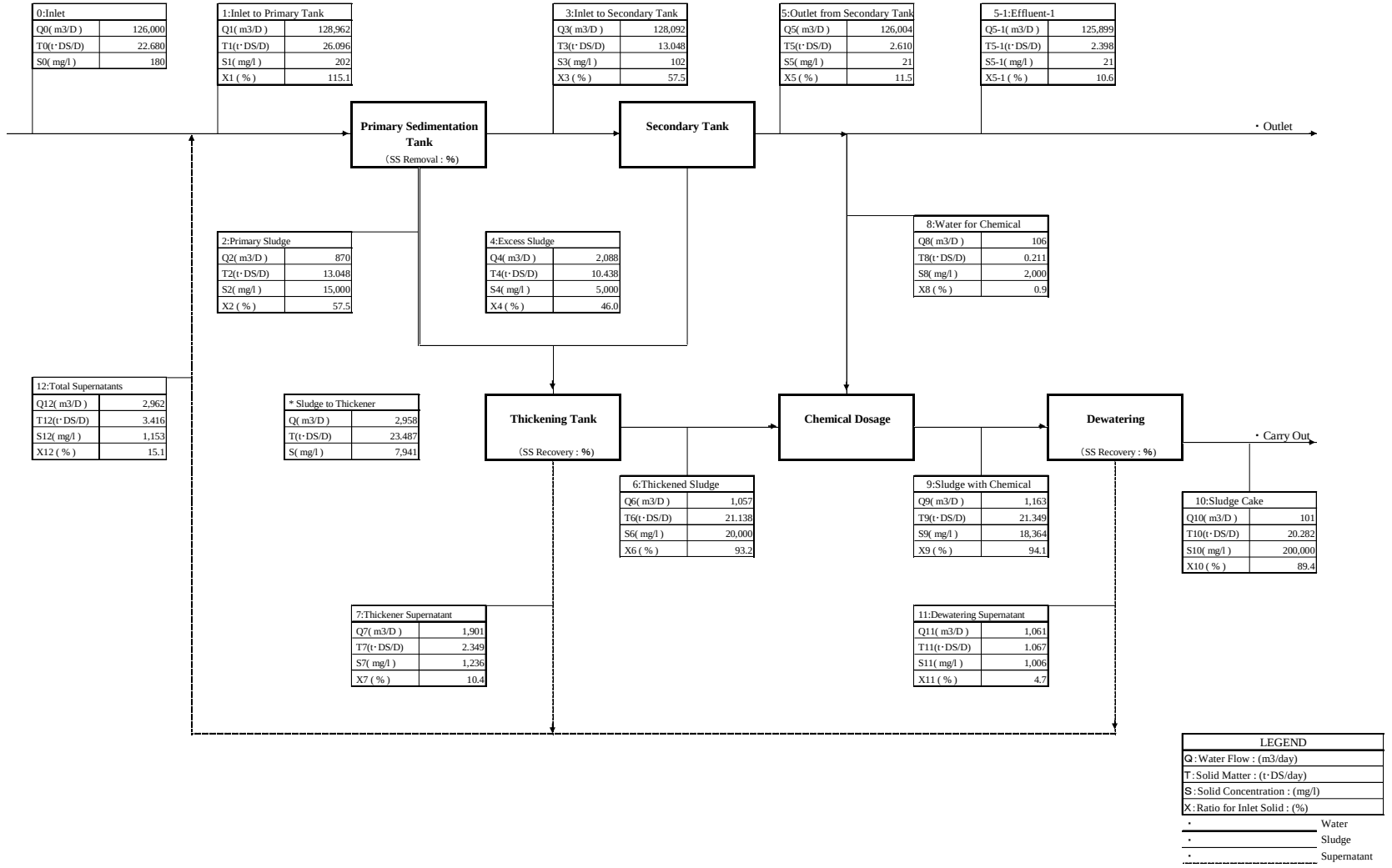


表 I.5　E3 処理場 容量計算書（1/11）

## 1 BASIC CONDITIONS

### 1-1 Basic Items

(1) Name : **E3 WWTP**

(2) Land Area : Approximately xxxx ha

(3) Ground Level (Elevatio : + 6.90 m (Plan)

(4) Inlet Pipe Invert Level : - 10.82 m

(5) Pipe Diameter : 2,400 mm

(6) Land Use : ―

(7) Collection System : ~~Combined System~~ (Separate System)

(8) Treatment Process : Conventional Activated Sludge Process

(9) Effluent Point : Ngamoeyeik Creek

(10) Water Level at the Effluent Poir :
High water leve = 3.70 m
Low water leve = ― m

(11) Target Year : 2020 (F/S Stage)
2040 (M/P Stage)

### 1-2 Service Area and Design Population

(1) Service Area : 5,418 ha

(2) Design Population

| Item | | Year 2020 | Year 2040 |
|---|---|---|---|
| Design Population | person | - | 921,000 |

表 I.5　E3 処理場 容量計算書 (2/11)

**1-3 Design Sewage Flow**

**(Year 2020)**

| Item | $m^3$/day | $m^3$/hr | $m^3$/min | $m^3$/sec |
|---|---|---|---|---|
| Maximum Daily Flow | | 0.0 | 0.00 | 0.000 |
| Maximum Hourly Flow | 0 | 0.0 | 0.00 | 0.000 |

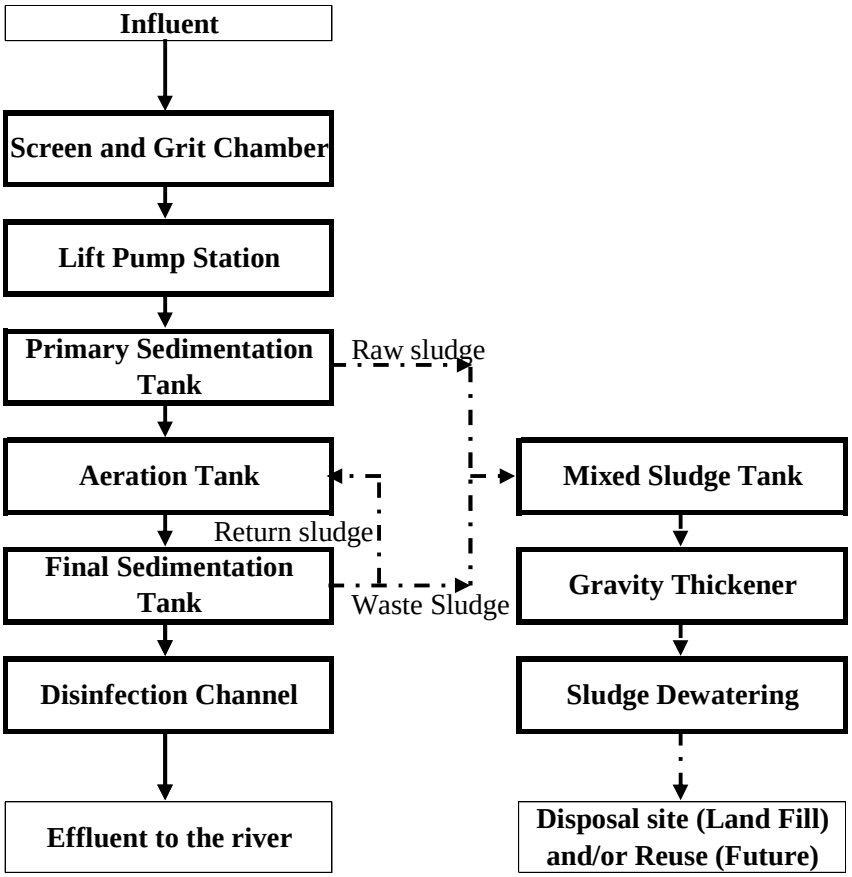
**(Year 2040)**

| Item | $m^3$/day | $m^3$/hr | $m^3$/min | $m^3$/sec |
|---|---|---|---|---|
| Maximum Daily Flow | 264,000 | 11,000.0 | 183.33 | 3.056 |
| Maximum Hourly Flow | 396,000 | 16,500.0 | 275.00 | 4.583 |

**1-4 Design Sewage Quality**

| Item | BOD | SS | T-N | Coli-group | Oil&Greese |
|---|---|---|---|---|---|
| | (mg/l) | (mg/l) | (mg/l) | (MPN/$cm^3$) | (mg/l) |
| Influent | 200 | 180 | - | - | - |
| Effluent | 20 | 30 | - | 3,000 | 5 |

**1-5 Process Flow Diagram**



# 表 I.5　E3 処理場 容量計算書 (3/11)

## 1.6 Design Criteria

| ITEMS | UNIT | Formula or Value | Application |
|---|---|---|---|
| **1** Grit Chamber (For Maximum Hourly Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 1,800 | 1,800 |
| (2) Average Velocity | m/sec | 0.3 | 0.3 |
| **2** Primary Sedimentation Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 35.0-70.0 | 50 |
| (2) Settling Time (Ref.) | hour | 1.5 | 1.5 |
| (3) Water Depth | m | 2.5-4.0 | 3.5 |
| (4) Weir Loading | $m^3/m/day$ | 250 | 250 |
| **3** Aeration Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Retention Time (HRT) | hour | 6 - 8 | 6.0 |
| (2) MLSS Concentration | mg/l | 1,500 -2,000 | 2,000 |
| (3) BOD-SS Load (Reference only) | kg/kg/day | 0.2 - 0.4 | - |
| **4** Final Sedimentation Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 20.0-30.0 | 25 |
| (2) Settling Time (Ref.) | hour | 3.0-4.0 | - |
| (3) Water Depth | m | 2.5-4.0 | 3.5 |
| (4) Weir Loading | $m^3/m/day$ | 150 | 150 |
| **5** Disinfection Tank (For Maximum Daily Flow) | | | |
| (1) Retention (Chlorination) Time | min | 15 | 15 |
| **6** Gravity Thickener (For Maximum Daily Flow) | | | |
| (1) Solids Loading | $kg/m^2/day$ | 60-90 | 75 |
| (2) Water Depth | m | | 4.0 |
| | | | |

## 表 I.5　E3 処理場 容量計算書（4/11）

## 2　CAPACITY CALCULATION

### 2-1 Grit Chamber

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 396,000 |
| (Maximum Hourly Flow) | Q2 | $m^3$/sec | | | 4.583 |
| Water Surface Load | WSL | $m^3/m^2$/day | | | 1,800 |
| Required Surface Area | RSA | $m^2$ | Q1/WSL | | 220.00 |
| Basin Number | BN | basin | | | 4 |
| Average Velocity | AV | m/sec | | | 0.3 |
| Depth | H | m | | | 1 |
| Width | W1 | m | Q2/(AV×H×BN) | | 3.82 |
| *Therefore* | W2 | m | | | 4.0 |
| Length | L1 | m | RSA/(W2×BN) | | 13.75 |
| *Therefore* | L2 | m | | | 14.0 |
| **Dimension (Width)** | W | m | | | **4.0** |
| **(Length)** | L | m | L2 | | **14.0** |
| **(Depth)** | H | m | H | | **1.0** |
| **(Basin Number)** | N | basin | | | **4** |
| **(Check)** | | | | | |
| Water Surface Load | | $m^3/m^2$/day | Q1/(W×L×N) | | 1,768 |
| Average Velocity | | m/sec | Q2/(W×H×N) | | 0.286 |
| | | | | | |

### 2-2 Lift Pump Station

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Vertical shaft Volute type mixed flow pump | | |
| Design Sewage Flow | Q1 | $m^3$/min | Peak Flow | | 275.00 |
| | | | | | |
| Pump Unit -1 Number | UN1 | unit | | | 2 |
| Discharge per Unit | DU1 | $m^3$/min | 1/10×Q1 | | 27.50 |
| Pump Diameter(V=1.5~3.0m/s | D1 | mm | $146\times(DU1/1.5\sim3.0)^{0.5}$ | | 442 ～625 |
| *Therefore* | D1 | mm | | | 500 |
| | | | | | |
| Pump Unit -2 Number | UN2 | unit | | | 2 |
| Discharge per Unit | DU2 | $m^3$/min | 2/10×Q1 | | 55.00 |
| Pump Diameter(V=1.5~3.0m/s | D2 | mm | $146\times(DU2/1.5\sim3.0)^{0.5}$ | | 625 ～884 |
| *Therefore* | D2 | mm | | | 700 |
| | | | | | |
| Pump Unit -3 Number | UN3 | unit | including 1 stand-by | | 2 |
| Discharge per Unit | DU3 | $m^3$/min | 4/10×Q1 | | 110.00 |
| Pump Diameter(V=1.5~3.0m/s | D3 | mm | $146\times(DU3/1.5\sim3.0)^{0.5}$ | | 884 ##### |
| *Therefore* | D3 | mm | | | 1000 |

## 表 I.5　E3 処理場 容量計算書 (5/11)

### 2-3 Primary Sedimentation Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 264,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 11,000.0 |
| Basin Number | BN | basin | | | 16 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 50.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 5,280 |
| | A2 | $m^2$/basin | A1/BN | | 330 |
| Width | W1 | m | 3.0m~4.0m, Max5.0m | | 5.0 |
| Length | L1 | m | A2/W1 | | 66.00 |
| *Therefore* | L2 | m | | | 66.0 |
| Water Depth | WD | m | | | 3.5 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 250 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 66.00 |
| *Therefore* | WL2 | m/basin | | | 66.0 |
| | | | | | |
| **Dimension (Width)** | W | m | | | **5.0** |
| **(Depth)** | D | m | | | **3.5** |
| **(Length)** | L | m | Two-story Sedimentation Tan | | **66.0** |
| | | | Upper Tank | | **26.4** |
| | | | Lower Tank | | **39.6** |
| **(Basin Number)** | N | basin | | | **16** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 50.00 |
| Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 1.68 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 250.00 |

## 表 I.5　E3 処理場 容量計算書 (6/11)

### 2-4 Aeration Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Multi-tank Complete mixing Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 264,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 11,000.0 |
| Hydraulic Retention Time | HRT | hr | | | 6.0 |
| Basin Number | BN | basin | | | 8 |
| Required Volume per basin | RV | $m^3$/basin | Q2×RT/BN | | 8,250 |
| Width | W | m | 1~2H | | 10.5 |
| Water Depth | H | m | Deep Aeration Tank | | 10.0 |
| Length | L1 | m | RV/(W×H) | | 78.6 |
| *Therefore* | L2 | m | | | 78.0 |
| **Dimension (Width)** | W | m | | | **10.5** |
| **(Depth)** | H | m | | | **10.0** |
| **(Length)** | L | m | | | **78.0** |
| **(Basin Number)** | N | basin | | | **8** |
| | | | | | |
| **(Check)** | | | | | |
| Hydraulic Retention Time | HRT | hour | W×H×L×N/Q2 | | 6.0 |
| BOD-SS load | $BSS_L$ | kgBOD/kgSS/d | (Q1×BODin)/(W×H×L×N×Xa) | | 0.24 |
| $BOD_{in}$ : Inflow BOD Concentration | | | 120 mg/L | (Removal Rate in PST : 40%) | |
| Xa : MLSS Concentration | | | 2,000 mg/L | | |
| Aerobic Sludge Retention Time | ASRT | day | HRT/24×Xa / (a×S-BODin + b×SSin - c×HRT/24×Xa) = | | 4.698 |
| $S\text{-}BOD_{in}$ : Inflow S-BOD Concentration | | | 80 mg/L | (S-BOD[Solved BOD]=BODin×0.6 | |
| $SS_{in}$ : Inflow SS Concentration | | | 90 mg/L | (Removal Rate in PST : 50%) | |
| a : Sludge converting ratio of solved BOI | | | 0.5 mgMLSS/mgBOD | (0.4~0.6) | |
| b : Sludge converting ratio of SS | | | 0.95 mgMLSS/mgSS | (0.9~1.0) | |
| c : Sludge reduction ratio caused by endogenous respiration | | | 0.04 | (1/day)(0.03~0.05) | |
| Effluent Quality (C-BOD) | EQ | mg/L | $10.42\times A\text{-}SRT^{(-0.519)}$ (15~20℃) | | 4.668 |
| Water Temperature | | | 20 ℃ | | |
| Effluent Water Quality (C=BOD Maximum) | | | EQ×3　20mg/l > | | 14 |
| | | | | | -OK- |
| | | | | | |
| | | | 1 : 1.5 : 1.5 : 2.25 | | |
| Partition of Aeration Tank | | | No.1 \| No.2 \| No.3 \| No.4 | | |
| | | | | | |
| Total Length of Tank | TL | m | | | 78.0 |
| No.1 Tank Length | L1 | m | TL×1/(1+1.5+1.5+2.25) | | 12.5 |
| No.2 Tank Length | L2 | m | TL×1.5/(1+1.5+1.5+2.25) | | 18.7 |
| No.3 Tank Length | L3 | m | TL×1.5/(1+1.5+1.5+2.25) | | 18.7 |
| No.4 Tank Length | L4 | m | TL×2.25/(1+1.5+1.5+2.25) | | 28.1 |
| | | | **Total** | | **78.0** |
| | | | | | |

## 表 I.5　E3 処理場 容量計算書（7/11）

### 2-5 Final Sedimentation Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 264,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 11,000.0 |
| Basin Number | BN | basin | | | 16 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 25.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 10,560 |
| | A2 | $m^2$/basin | A1/BN | | 660 |
| Width | W1 | m | 3.0m~4.0m, Max5.0m | | 5.0 |
| Length | L1 | m | A2/W1 | | 132.00 |
| *Therefore* | L2 | m | | | 132.0 |
| Water Depth | WD | m | | | 3.5 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 150 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 110.00 |
| *Therefore* | WL2 | m/basin | | | 110.0 |
| | | | | | |
| **Dimension (Width)** | W | m | | | **5.0** |
| **(Depth)** | D | m | | | **3.5** |
| **(Length)** | L | m | Two-story Sedimentation Tan | | **132.0** |
| | | | Upper Tank | | **52.8** |
| | | | Lower Tank | | **79.2** |
| **(Basin Number)** | N | basin | | | **16** |
| 7) **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 25.00 |
| Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 3.36 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 150.00 |

## 表 I.5　E3 処理場 容量計算書 (8/11)

### 2-6 Disinfection Channel

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Chlorination | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 264,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/min | | | 183.3 |
| Retention(Chlorination) Time | RT | min | | | 15.0 |
| Required Volume | RV | $m^3$ | Q2×RT | | 2,750 |
| Width of channel | W | m | | | 3.0 |
| Depth of channel | H | m | | | 3.0 |
| Pass Number | PN | pass | | | 8 |
| Length of channel | L1 | m/pass | RV/(W×H×PN) | | 38.2 |
| *Therefore* | L2 | m/pass | | | 38.5 |
| **Dimension (Width)** | W | m | | | **3.0** |
| **(Depth)** | H | m | | | **3.0** |
| **(Length)** | L | m/pass | | | **38.5** |
| **(Pass Number)** | N | pass | | | **8** |
| **(Check)** | | | | | |
| Retention(Chlorination) Time | RT | min | (W×H×L×PN)/Q2 | | 15.1 |

### 2-7 Sludge Thickening Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Gravity Thickener (Radial Flow Circular Type) | | |
| Generated Sludge Solids | GS | t-DS/day | Refer to Mass Balance Cal. | | 49.21 |
| Generated Sludge Volume | GSV | $m^3$/day | Refer to Mass Balance Cal. | | 6,197 |
| Solid Matter Load | SML | kg/$m^2$/day | | | 75 |
| Required Surface Area | SA | $m^2$ | $(GS\times10^3)/SML$ | | 656.1 |
| Water Depth | H | m | | | 4.0 |
| Basin Number | BN | basin | | | 4 |
| Required Tank Diameter | TD1 | m | $(SA\times4/(3.14\times BN))^{0.5}$ | | 14.46 |
| *Therefore* | TD2 | m | | | 15.0 |
| | | | | | |
| **Dimension (Diameter)** | D | m/basin | | | **15.0** |
| **(Depth)** | H | m | | | **4.0** |
| **(Basin Number)** | BN | basin | | | **4** |
| | | | | | |
| **(Check)** | | | | | |
| Solid Matter Load | SML | kg/$m^2$/day | $GS\times10^3/(3.14\times D^2/4)\times BN$ | | 69.7 |
| Sludge Thickened Time | T | hr | $(3.14\times D^2/4)\times H\times BN\times24/GSV$ | | 10.9 |
| | | | | | |
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## 表 I.5　E3 処理場 容量計算書 (9/11)

### 2-8 Sludge Dewatering

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Mechanical Dewatering (Screw Press Type) | | |
| Thickened Sludge Solids | TS | t-DS/day | Refer to Material Balance | | 44.732 |
| Unit Number | UN | Unit | | | 8 |
| Operating Time | OT | hr/day | | | 24.0 |
| Required Dewatering Capacity | DC | kg/hr/unit | $TS\times10^3/(OT\times UN)$ | | 233.0 |
| Solids Loading | $Q_{100}$ | kg-ds/hr/φ100 | | | 3.0 |
| Screen Diameter | SD1 | mm | $100\times(DC/Q_{100})\text{^}(1/2.2)$ | | 723.1 |
| Therefore | SD2 | mm | | | 800 |
| | | | | | |
| **Dimension (unit)** | UN | Unit | | | **8** |
| **(Screen Diameter)** | SD | mm | | | **800** |
| | | | | | |
| **(Check)** | | | | | |
| Dewatering Capacity | DC | kg/hr/unit | $(SD/100)\text{^}2.2\times Q_{100}$ | | 291.0 |
| Operating Time | OT | hour/day | $TS\times10^3/(DC\times(UN-1))$ | | 19.2 |

# 表 I.5　E3 処理場 容量計算書（10/11）

**Material Balance Calculation (Primary and Secondary Sedimentation Tank + Thickening Tank + Mechanical Dewatering)**

**Table-1 Input Data**

| | | | |
|---|---|---|---|
| 1. Calculation Manner | | 1 | 1:Premise that the quality of supernatants are same level removed with inlet sewage<br>2:Premise that the entire supernatants are removed at treatment process |
| 2. Selection of Treatment Efficiency | | 1 | 1:Total Removal Ratio 2:Outlet Water Quality(input 1or2) |
| In case of 1 : input data | | 90 | (%) |
| In case of 2 : input data | | | (mg/l) |
| 3. Excess Sludge Generation | | 1 | 1:Consideration of Solid Matter Only 2:Consideration of Converting of Solved BOD (input 1or2) |
| In case of 1:Input data (Sludge generation) | | 100 | Sludge generation ratio per removal SS(%) |
| In case of 2:Input data | a | | T2=Q2*S2=(a*$S_{BOD}$-b*S1-c*θ*XA)*Q1/10^6** (Excess sludge generation formula) |
| | b | | a:Converting ratio of solved BOD(mgMLSS/mgBOD) |
| | c | | b:Converting ratio of SS(mgMLSS/mgSS) |
| | SBOD | | c:Sludge reduction ratio caused by endogenous respiration of activated sludge(1/day) |
| | XA | | $S_{BOD}$:Solved BOD quality at inlet to reactor |
| | θ | | XA:MLSS concentration(mg/l) |
| | | | θ:Hydraulic retention time(day) |

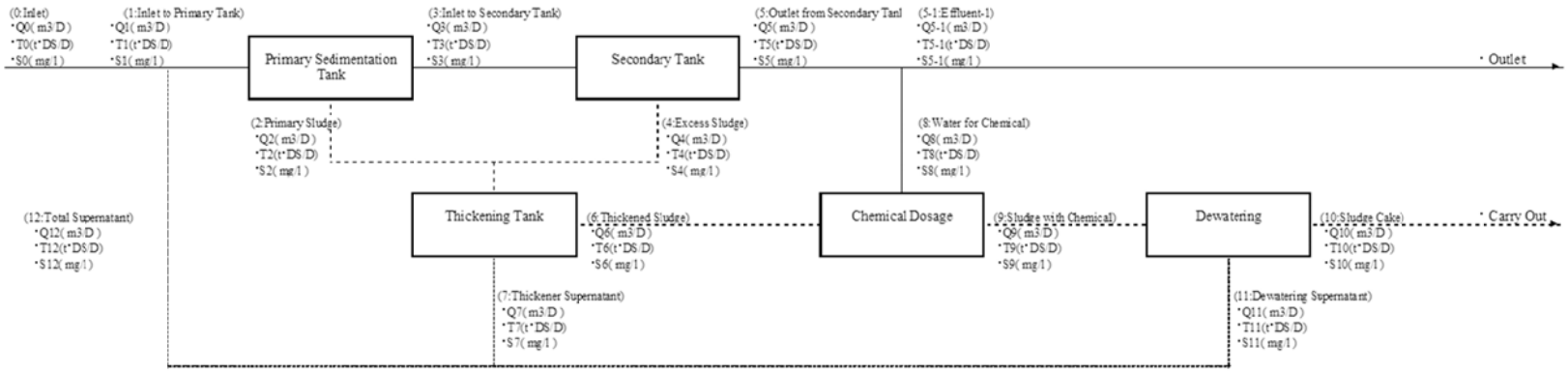
**Table-2 Basic Conditions**

| Water Flow and Quality | | Sludge Moisture and Recovery Ratio | | | | Chemical Conditions for Dewatering | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Inlet flow : Q0(m3/D) | 264000 | *Primary sludge moisture ratio : W1(%) | 98.5 | *Removal ratio in primary tank : A2(%) | 50.0 | *Chemical dosage : A5(%) | 1.0 | | |
| *Inlet quality : S0(mg/l) | 180 | *Excess sludge moisture ratio : W2(%) | 99.5 | *Recovery ratio in sludge thickener : A3(%) | 90.0 | *Chemical dissolve concentration : A6(%) | 0.2 | | |
| *Total removal ratio : A1(%) | 90.0 | *Thickened sludge moisture ratio : W3(%) | 98.0 | *Recovery ratio in dewatering : A4(%) | 95.0 | | | | |
| *Effluent quality: S(mg/l) | - | *Dewatered sludge moisture ratio : W4(%) | 80.0 | | | | | | |
| *Sludge generation ratio per removal SS : Si(%) | 100.0 | | | | | | | | |

**Table-3 Material Balance Calculation**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | 5-1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q(m3/day) | 264,000 | 270,206 | 1,823 | 268,383 | 4,374 | 264,009 | 2,214 | 3,982 | 221 | 2,436 | 212 | 2,225 | 6,206 | | 263,788 | |
| T(t*DS/day) | 47.520 | 54.678 | 27.339 | 27.339 | 21.871 | 5.468 | 44.289 | 4.921 | 0.443 | 44.732 | 42.495 | 2.237 | 7.158 | | 5.025 | |
| S(mg/l) | 180 | 202 | 15,000 | 102 | 5,000 | 21 | 20,000 | 1,236 | 2,000 | 18,364 | 200,000 | 1,006 | 1,153 | | 21 | |
| X(Ti/T0*100) | 100 | 115.1 | 57.5 | 57.5 | 46.0 | 11.5 | 93.2 | 10.4 | 0.9 | 94.1 | 89.4 | 4.7 | 15.1 | | 10.6 | |

**Figure-1 Material Balance Model**

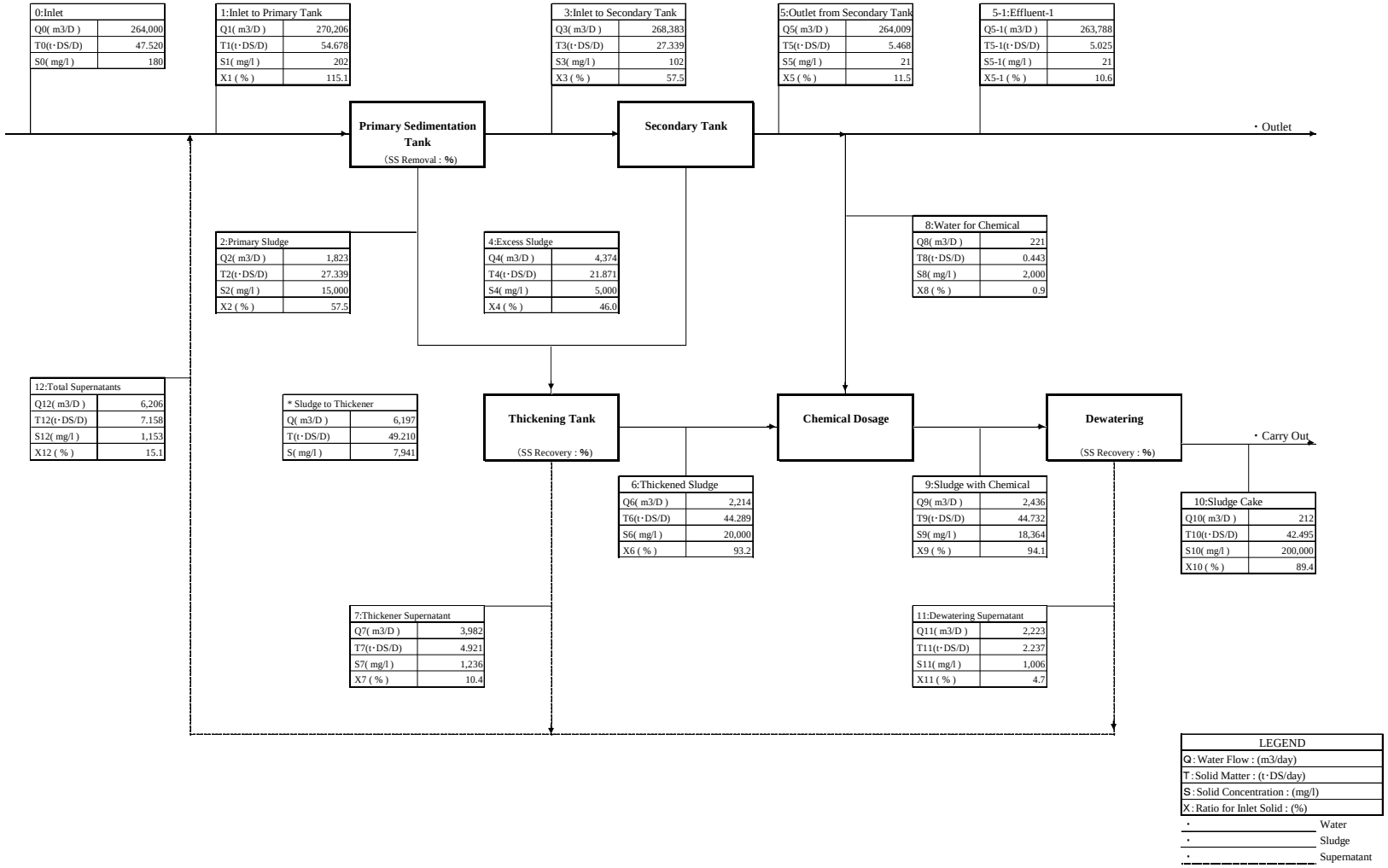



**Calculation Formula**

| | | | | | |
|---|---|---|---|---|---|
| *Q0=Input Data<br>*T0=Q0*S0*10^(-6)<br>*S0=Input Data | *Q3=Q1-Q2<br>*T3=T1*(100-A2)/100<br>*S3=T3*10^6/Q3 | *Q6=T4*100/(100-W3)<br>*T6=(T2+T4)*A3/100<br>*S6=10^6*(100-W3)/100 | *Q9=Q6+Q8<br>*T9=T6+T8<br>*S9=T9*10^6/Q9 | *Q12=Q7+Q11<br>*T12=T7+T11<br>*S11=T11*10^6/Q11 | *Q5-1=Q5-Q8<br>*T5-1=T5-T8<br>*S5-1=S5 |
| *Q1=Q0+Q13<br>*T1=T0+T13<br>*S1=T1*10^6/Q1 | *Q4=T4*100/(100-W2)<br>*T4=((T1-T5)*Si/100)-T2<br>*S4=10^6*(100-W2)/100 | *Q7=(Q2+Q4)-Q6<br>*T7=(T2+T4)-T6<br>*S7=T7*10^6/Q7 | *Q10=T10*100/(100-W4)<br>*T10=T9*A4/100<br>*S10=10^6*(100-W4)/100 | | |
| *Q2=T2*100/(100-W1)<br>*T2=T1-T3<br>*S2=10^6*(100-W1)/100 | *Q5=Q3-Q4*(T3-T5)/T4<br>*T5=T1*(100-A1)/100<br>*S5=T5*10^6/Q5 | *Q8=T6*A5/A6<br>*T8=Q8*S8/10^6<br>*S8=10^4*A6 | *Q11=Q9-Q10<br>*T11=T9-T10<br>*S11=T11*10^6/Q11 | | |

# 表 I.5　E3 処理場 容量計算書（11/11）

**Material Balance Sheet**



# 表 I.6　N1 処理場 容量計算書（1/11）

## 1 BASIC CONDITIONS

### 1-1 Basic Items

(1) Name : **N1 WWTP**

(2) Land Area : Approximately xxxx ha

(3) Ground Level (Elevatio : + 4.00 m (Plan)

(4) Inlet Pipe Invert Level : - 5.82 m

(5) Pipe Diameter : 1,650 mm

(6) Land Use : －

(7) Collection System : ~~Combined System~~ (Separate System)

(8) Treatment Process : Conventional Activated Sludge Process

(9) Effluent Point : Hlaing River

(10) Water Level at the Effluent Poir :
High water leve = 3.70 m
Low water leve = － m

(11) Target Year : 2020 (F/S Stage)
2040 (M/P Stage)

### 1-2 Service Area and Design Population

(1) Service Area : 3,163 ha

(2) Design Population

| Item | | Year 2020 | Year 2040 |
|---|---|---|---|
| Design Population | person | - | 377,200 |

表 I.6　N1 処理場 容量計算書 (2/11)

**1-3 Design Sewage Flow**

**(Year 2020)**

| Item | $m^3$/day | $m^3$/hr | $m^3$/min | $m^3$/sec |
|---|---|---|---|---|
| Maximum Daily Flow | | 0.0 | 0.00 | 0.000 |
| Maximum Hourly Flow | 0 | 0.0 | 0.00 | 0.000 |

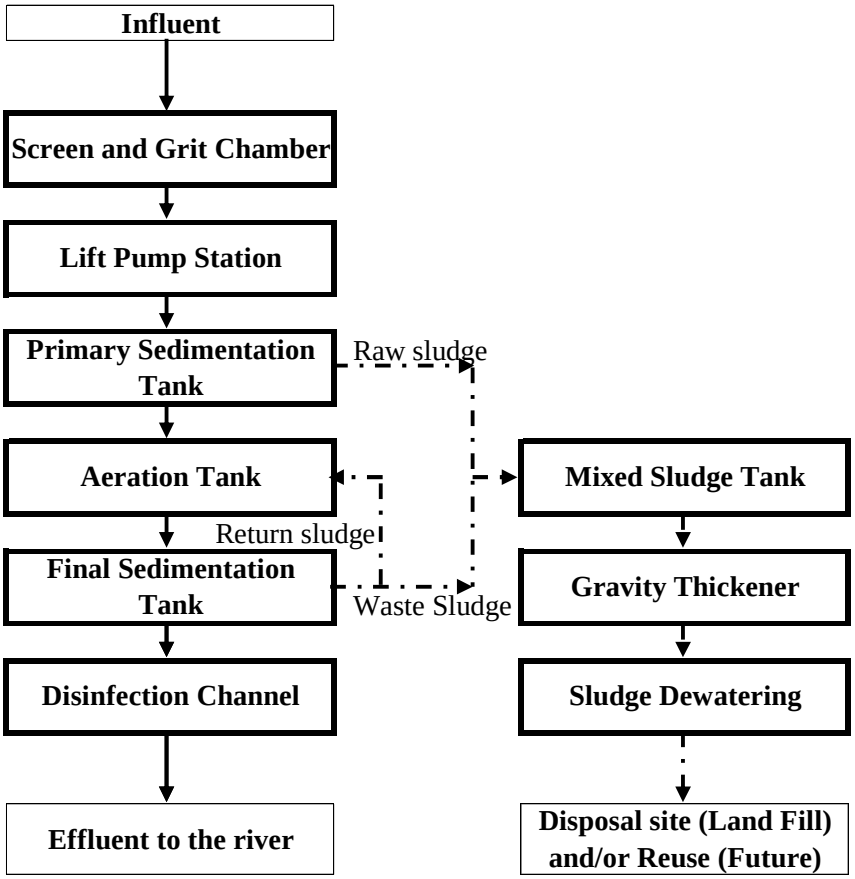
**(Year 2040)**

| Item | $m^3$/day | $m^3$/hr | $m^3$/min | $m^3$/sec |
|---|---|---|---|---|
| Maximum Daily Flow | 140,000 | 5,833.3 | 97.22 | 1.620 |
| Maximum Hourly Flow | 210,000 | 8,750.0 | 145.83 | 2.431 |

**1-4 Design Sewage Quality**

| Item | BOD | SS | T-N | Coli-group | Oil&Greese |
|---|---|---|---|---|---|
| | (mg/l) | (mg/l) | (mg/l) | (MPN/$cm^3$) | (mg/l) |
| Influent | 200 | 180 | - | - | - |
| Effluent | 20 | 30 | - | 3,000 | 5 |

**1-5 Process Flow Diagram**



# 表 I.6　N1 処理場 容量計算書 (3/11)

## 1.6 Design Criteria

| ITEMS | UNIT | Formula or Value | Application |
|---|---|---|---|
| **1** Grit Chamber (For Maximum Hourly Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 1,800 | 1,800 |
| (2) Average Velocity | m/sec | 0.3 | 0.3 |
| **2** Primary Sedimentation Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 35.0-70.0 | 50 |
| (2) Settling Time (Ref.) | hour | 1.5 | 1.5 |
| (3) Water Depth | m | 2.5-4.0 | 3.5 |
| (4) Weir Loading | $m^3/m/day$ | 250 | 250 |
| **3** Aeration Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Retention Time (HRT) | hour | 6 - 8 | 6.0 |
| (2) MLSS Concentration | mg/l | 1,500 -2,000 | 2,000 |
| (3) BOD-SS Load (Reference only) | kg/kg/day | 0.2 - 0.4 | - |
| **4** Final Sedimentation Tank (For Maximum Daily Flow) | | | |
| (1) Hydraulic Load | $m^3/m^2/day$ | 20.0-30.0 | 25 |
| (2) Settling Time (Ref.) | hour | 3.0-4.0 | - |
| (3) Water Depth | m | 2.5-4.0 | 3.5 |
| (4) Weir Loading | $m^3/m/day$ | 150 | 150 |
| **5** Disinfection Tank (For Maximum Daily Flow) | | | |
| (1) Retention (Chlorination) Time | min | 15 | 15 |
| **6** Gravity Thickener (For Maximum Daily Flow) | | | |
| (1) Solids Loading | $kg/m^2/day$ | 60-90 | 75 |
| (2) Water Depth | m | | 4.0 |
| | | | |

## 表 I.6　N1 処理場 容量計算書（4/11）

### 2　CAPACITY CALCULATION

#### 2-1 Grit Chamber

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 210,000 |
| (Maximum Hourly Flow) | Q2 | $m^3$/sec | | | 2.431 |
| Water Surface Load | WSL | $m^3/m^2$/day | | | 1,800 |
| Required Surface Area | RSA | $m^2$ | Q1/WSL | | 116.67 |
| Basin Number | BN | basin | | | 4 |
| Average Velocity | AV | m/sec | | | 0.3 |
| Depth | H | m | | | 1 |
| Width | W1 | m | Q2/(AV×H×BN) | | 2.03 |
| *Therefore* | W2 | m | | | 2.5 |
| Length | L1 | m | RSA/(W2×BN) | | 11.67 |
| *Therefore* | L2 | m | | | 12.0 |
| **Dimension (Width)** | W | m | | | **2.5** |
| **(Depth)** | L | m | L2 | | **12.0** |
| **(Length)** | H | m | H | | **1.0** |
| **(Basin Number)** | N | basin | | | **4** |
| **(Check)** | | | | | |
| Water Surface Load | | $m^3/m^2$/day | Q1/(W×L×N) | | 1,750 |
| Average Velocity | | m/sec | Q2/(W×H×N) | | 0.243 |
| | | | | | |

#### 2-2 Lift Pump Station

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Vertical shaft Volute type mixed flow pump | | |
| Design Sewage Flow | Q1 | $m^3$/min | Peak Flow | | 145.83 |
| | | | | | |
| Pump Unit -1 Number | UN1 | unit | | | 2 |
| Discharge per Unit | DU1 | $m^3$/min | 1/10×Q1/UN1 | | 14.58 |
| Pump Diameter(V=1.5~3.0m/s | D1 | mm | $146\times(DU1/1.5\sim3.0)^{0.5}$ | | 322 ～455 |
| *Therefore* | D1 | mm | | | 400 |
| | | | | | |
| Pump Unit -2 Number | UN2 | unit | | | 2 |
| Discharge per Unit | DU2 | $m^3$/min | 2/10×Q1/UN2 | | 29.17 |
| Pump Diameter(V=1.5~3.0m/s | D2 | mm | $146\times(DU2/1.5\sim3.0)^{0.5}$ | | 455 ～644 |
| *Therefore* | D2 | mm | | | 500 |
| | | | | | |
| Pump Unit -3 Number | UN3 | unit | including 1 stand-by | | 2 |
| Discharge per Unit | DU3 | $m^3$/min | 4/10×Q1/UN3 | | 58.33 |
| Pump Diameter(V=1.5~3.0m/s | D3 | mm | $146\times(DU3/1.5\sim3.0)^{0.5}$ | | 644 ～910 |
| *Therefore* | D3 | mm | | | 700 |

## 表 I.6　N1 処理場 容量計算書 (5/11)

### 2-3 Primary Sedimentation Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Parallel Flow Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 140,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 5,833.3 |
| Basin Number | BN | basin | | | 16 |
| Hydraulic Load | HL | $m^3/m^2$/day | | | 50.0 |
| Required Surface Area | A1 | $m^2$ | Q1/HL | | 2,800 |
| | A2 | $m^2$/basin | A1/BN | | 175 |
| Width | W1 | m | 3.0m~4.0m, Max5.0m | | 5.0 |
| Length | L1 | m | A2/W1 | | 35.00 |
| *Therefore* | L2 | m | | | 35.0 |
| Water Depth | WD | m | | | 3.5 |
| | | | | | |
| Overflow Weir Load | OWL | $m^3$/m/day | | | 250 |
| Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 35.00 |
| *Therefore* | WL2 | m/basin | | | 35.0 |
| | | | | | |
| **Dimension (Width)** | W | m | | | **5.0** |
| **(Depth)** | D | m | | | **3.5** |
| **(Length)** | L | m | | | **35.0** |
| **(Basin Number)** | N | basin | | | **16** |
| **(Check)** | | | | | |
| Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 50.00 |
| Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 1.68 |
| Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 250.00 |
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## 表 I.6　N1 処理場 容量計算書 (6/11)

### 2-4 Aeration Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Multi-tank Complete mixing Type | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 140,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 5,833.3 |
| Hydraulic Retention Time | HRT | hr | | | 6.0 |
| Basin Number | BN | basin | | | 8 |
| Required Volume per basin | RV | $m^3$/basin | Q2×RT/BN | | 4,375 |
| Width | W | m | 1~2H | | 10.5 |
| Water Depth | H | m | 4.0m~6.0m | | 6.0 |
| Length | L1 | m | RV/(W×H) | | 69.4 |
| *Therefore* | L2 | m | | | 70.0 |
| **Dimension (Width)** | W | m | | | **10.5** |
| **(Depth)** | H | m | | | **6.0** |
| **(Length)** | L | m | | | **70.0** |
| **(Basin Number)** | N | basin | | | **8** |
| | | | | | |
| **(Check)** | | | | | |
| Hydraulic Retention Time | HRT | hour | W×H×L×N/Q2 | | 6.0 |
| BOD-SS load | $BSS_L$ | kgBOD/kgSS/d | (Q1×BODin)/(W×H×L×N×Xa) | | 0.24 |
| $BOD_{in}$ : Inflow BOD Concentration | | | 120 mg/L | (Removal Rate in PST : 40%) | |
| Xa : MLSS Concentration | | | 2,000 mg/L | | |
| Aerobic Sludge Retention Time | ASRT | day | HRT/24×Xa / (a×S-BODin + b×SSin - c×HRT/24×Xa) = | | 4.785 |
| $S\text{-}BOD_{in}$ : Inflow S-BOD Concentration | | | 80 mg/L | (S-BOD[Solved BOD]=BODin×0.6 | |
| $SS_{in}$ : Inflow SS Concentration | | | 90 mg/L | (Removal Rate in PST : 50%) | |
| a : Sludge converting ratio of solved BOI | | | 0.5 mgMLSS/mgBOD | (0.4~0.6) | |
| b : Sludge converting ratio of SS | | | 0.95 mgMLSS/mgSS | (0.9~1.0) | |
| c : Sludge reduction ratio caused by endogenous respiration | | | 0.04 | (1/day)(0.03~0.05) | |
| Effluent Quality (C-BOD) | EQ | mg/L | $10.42\times A\text{-}SRT^{(-0.519)}$ (15~20℃) | | 4.624 |
| Water Temperature | | | 20 ℃ | | |
| Effluent Water Quality (C=BOD Maximum) | | | EQ×3　20mg/l > | | 14 |
| | | | | | -OK- |
| | | | | | |
| | | | 1 : 1.5 : 1.5 : 2.25 | | |
| Partition of Aeration Tank | | | No.1 \| No.2 \| No.3 \| No.4 | | |
| | | | | | |
| Total Length of Tank | TL | m | | | 70.0 |
| No.1 Tank Length | L1 | m | TL×1/(1+1.5+1.5+2.25) | | 11.2 |
| No.2 Tank Length | L2 | m | TL×1.5/(1+1.5+1.5+2.25) | | 16.8 |
| No.3 Tank Length | L3 | m | TL×1.5/(1+1.5+1.5+2.25) | | 16.8 |
| No.4 Tank Length | L4 | m | TL×2.25/(1+1.5+1.5+2.25) | | 25.2 |
| | | | **Total** | | **70.0** |
| | | | | | |

## 表 I.6　N1 処理場 容量計算書（7/11）

### 2-5 Final Sedimentation Tank

| | Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|---|
| | Type | - | - | Parallel Flow Type | | |
| | Design Sewage Flow | Q1 | $m^3$/day | | | 140,000 |
| | (Maximum Daily Flow) | Q2 | $m^3$/hr | | | 5,833.3 |
| | Basin Number | BN | basin | | | 16 |
| | Hydraulic Load | HL | $m^3/m^2$/day | | | 25.0 |
| | Required Surface Area | A1 | $m^2$ | Q1/HL | | 5,600 |
| | | A2 | $m^2$/basin | A1/BN | | 350 |
| | Width | W1 | m | 3.0m~4.0m, Max5.0m | | 5.0 |
| | Length | L1 | m | A2/W1 | | 70.00 |
| | *Therefore* | L2 | m | | | 70.0 |
| | Water Depth | WD | m | | | 3.5 |
| | | | | | | |
| | Overflow Weir Load | OWL | $m^3$/m/day | | | 150 |
| | Required Weir Length | WL1 | m/basin | Q1/(BN×OWL) | | 58.33 |
| | *Therefore* | WL2 | m/basin | | | 60.0 |
| | | | | | | |
| | **Dimension (Width)** | W | m | | | **5.0** |
| | **(Depth)** | D | m | | | **3.5** |
| | **(Length)** | L | m | | | **70.0** |
| | **(Basin Number)** | N | basin | | | **16** |
| | **(Check)** | | | | | |
| | Hydraulic Load | HL | $m^3/m^2$/day | Q1/(N×W×L) | | 25.00 |
| 7) | Retention(Settling) Time | T | hour | (N×W×D×L)/Q2 | | 3.36 |
| | Overflow Weir Load | OWL | $m^3$/m/day | Q1/(N×WL2) | | 145.83 |

## 表 I.6　N1 処理場 容量計算書 (8/11)

### 2-6 Disinfection Channel

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Chlorination | | |
| Design Sewage Flow | Q1 | $m^3$/day | | | 140,000 |
| (Maximum Daily Flow) | Q2 | $m^3$/min | | | 97.2 |
| Retention(Chlorination) Time | RT | min | | | 15.0 |
| Required Volume | RV | $m^3$ | Q2×RT | | 1,458 |
| Width of channel | W | m | | | 2.0 |
| Depth of channel | H | m | | | 2.5 |
| Pass Number | PN | pass | | | 8 |
| Length of channel | L1 | m/pass | RV/(W×H×PN) | | 36.5 |
| *Therefore* | L2 | m/pass | | | 37.0 |
| **Dimension (Width)** | W | m | | | **2.0** |
| **(Depth)** | H | m | | | **2.5** |
| **(Length)** | L | m/pass | | | **37.0** |
| **(Pass Number)** | N | pass | | | **8** |
| **(Check)** | | | | | |
| Retention(Chlorination) Time | RT | min | (W×H×L×PN)/Q2 | | 15.2 |

### 2-7 Sludge Thickening Tank

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Gravity Thickener (Radial Flow Circular Type) | | |
| Generated Sludge Solids | GS | t-DS/day | Refer to Mass Balance Cal. | | 26.096 |
| Generated Sludge Volume | GSV | $m^3$/day | Refer to Mass Balance Cal. | | 3,286 |
| Solid Matter Load | SML | kg/$m^2$/day | | | 75 |
| Required Surface Area | SA | $m^2$ | $(GS\times10^3)/SML$ | | 347.9 |
| Water Depth | H | m | | | 4.0 |
| Basin Number | BN | basin | | | 4 |
| Required Tank Diameter | TD1 | m | $(SA\times4/(3.14\times BN))^{0.5}$ | | 10.53 |
| *Therefore* | TD2 | m | | | 10.5 |
| | | | | | |
| **Dimension (Diameter)** | D | m/basin | | | **10.5** |
| **(Depth)** | H | m | | | **4.0** |
| **(Basin Number)** | BN | basin | | | **4** |
| | | | | | |
| **(Check)** | | | | | |
| Solid Matter Load | SML | kg/$m^2$/day | $GS\times10^3/(3.14\times D^2/4)\times BN$ | | 75.4 |
| Sludge Thickened Time | T | hr | $(3.14\times D^2/4)\times H\times BN\times24/GSV$ | | 10.1 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## 表 I.6　N1 処理場 容量計算書 (9/11)

### 2-8 Sludge Dewatering

| Item | Sign | Unit | Calculation | F/S | M/P |
|---|---|---|---|---|---|
| Type | - | - | Mechanical Dewatering (Screw Press Type) | | |
| Thickened Sludge Solids | TS | t-DS/day | Refer to Material Balance | | 23.721 |
| Unit Number | UN | Unit | | | 4 |
| Operating Time | OT | hr/day | | | 24.0 |
| Required Dewatering Capacity | DC | kg/hr/unit | $TS\times10^3/(OT\times UN)$ | | 247.1 |
| Solids Loading | $Q_{100}$ | kg-ds/hr/φ100 | | | 3.0 |
| Screnn Diameter | SD1 | mm | $100\times(DC/Q_{100})\text{^}(1/2.2)$ | | 742.7 |
| Therefore | SD2 | mm | | | 800 |
| | | | | | |
| **Dimension (unit)** | UN | Unit | | | **4** |
| **(Screen Diameter)** | SD | mm | | | **800** |
| | | | | | |
| **(Check)** | | | | | |
| Dewatering Capacity | DC | kg/hr/unit | $(SD/100)\text{^}2.2\times Q_{100}$ | | 291.0 |
| Operating Time | OT | hour/day | $TS\times10^3/(DC\times(UN-1))$ | | 20.4 |

# 表 I.6　N1 処理場 容量計算書（10/11）

**Material Balance Calculation (Primary and Secondary Sedimentation Tank + Thickening Tank + Mechanical Dewatering)**

**Table-1 Input Data**

| | | | |
|---|---|---|---|
| 1. Calculation Manner | | 1 | 1:Premise that the quality of supernatants are same level removed with inlet sewage<br>2:Premise that the entire supernatants are removed at treatment process |
| 2. Selection of Treatment Efficiency | | 1 | 1:Total Removal Ratio 2:Outlet Water Quality(input 1or2) |
| In case of 1 : input data | | 90 | (%) |
| In case of 2 : input data | | | (mg/l) |
| 3. Excess Sludge Generation | | 1 | 1:Consideration of Solid Matter Only 2:Consideration of Converting of Solved BOD (input 1or2) |
| In case of 1:Input data (Sludge generation) | | 100 | Sludge generation ratio per removal SS(%) |
| In case of 2:Input data | a | | T2=Q2*S2=(a'$S_{BOD}$+b'S1-c'θ'XA)'Q1/10^6'' (Excess sludge generation formula) |
| | b | | a:Converting ratio of solved BOD(mgMLSS/mgBOD) |
| | c | | b:Converting ratio of SS(mgMLSS/mgSS) |
| | SBOD | | c:Sludge reduction ratio caused by endogenous respiration of activated sludge(1/day) |
| | XA | | Sbod:Solved BOD quality at inlet to reactor |
| | θ | | XA:MLSS concentration(mg/l) |
| | | | θ:Hydraulic retention time(day) |

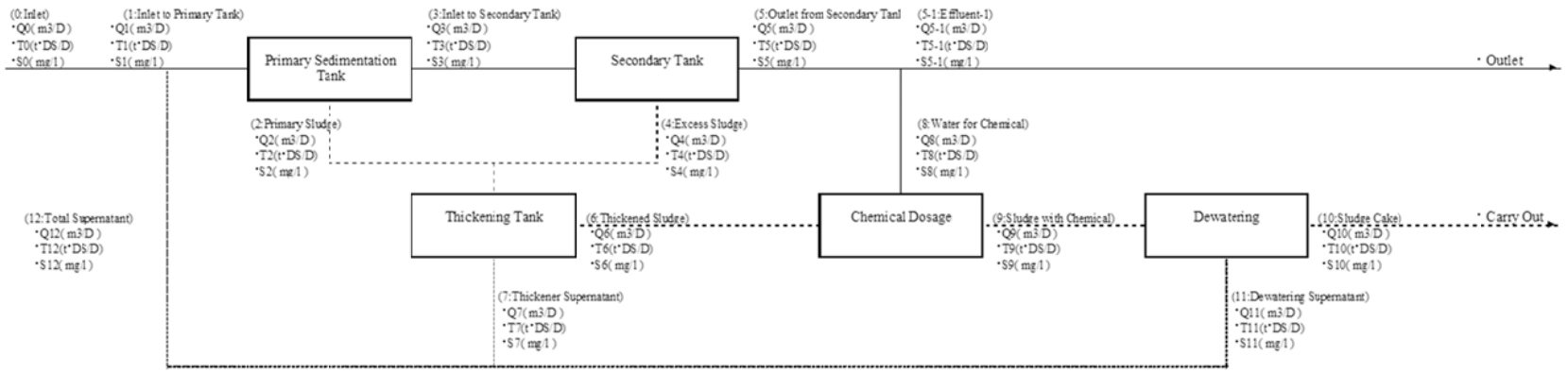
**Table-2 Basic Conditions**

| Water Flow and Quality | | Sludge Moisture and Recovery Ratio | | | | Chemical Conditions for Dewatering | | | |
|---|---|---|---|---|---|---|---|---|---|
| ・Inlet flow : Q0(m3/D) | 140000 | ・Primary sludge moisture ratio : W1(%) | 98.5 | ・Removal ratio in primary tank : A2(%) | 50.0 | ・Chemical dosage : A5(%) | 1.0 | | |
| ・Inlet quality : S0(mg/l) | 180 | ・Excess sludge moisture ratio : W2(%) | 99.5 | ・Recovery ratio in sludge thickener : A3(%) | 90.0 | ・Chemical dissolve concentration : A6(%) | 0.2 | | |
| ・Total removal ratio : A1(%) | 90.0 | ・Thickened sludge moisture ratio : W3(%) | 98.0 | ・Recovery ratio in dewatering : A4(%) | 95.0 | | | | |
| ・Effluent quality: St(mg/l) | | ・Dewatered sludge moisture ratio : W4(%) | 80.0 | | | | | | |
| ・Sludge generation ratio per removal SS : Si(%) | 100.0 | | | | | | | | |

**Table-3 Material Balance Calculation**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | 5-1 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q(m3/day) | 140.000 | 143.291 | 967 | 142.324 | 2.320 | 140.005 | 1.174 | 2.112 | 117 | 1.292 | 113 | 1.179 | 3.291 | | | 139.887 | | |
| T(t*DS/day) | 25.200 | 28.996 | 14.498 | 14.498 | 11.598 | 2.900 | 23.487 | 2.610 | 0.235 | 23.721 | 22.535 | 1.186 | 3.796 | | | 2.665 | | |
| S(mg/l) | 180 | 202 | 15.000 | 102 | 5.000 | 21 | 20.000 | 1.236 | 2.000 | 18.364 | 200.000 | 1.006 | 1.153 | | | 21 | | |
| X(Ti/T0*100) | 100 | 115.1 | 57.5 | 57.5 | 46.0 | 11.5 | 93.2 | 10.4 | 0.9 | 94.1 | 89.4 | 4.7 | 15.1 | | | 10.6 | | |

**Figure-1 Material Balance Model**




**Calculation Formula**

| | | | | | |
|---|---|---|---|---|---|
| ・Q0=Input Data | ・Q3=Q1-Q2 | ・Q6=T4*100/(100-W3) | ・Q9=Q6-Q8 | ・Q12=Q7+Q11 | ・Q5-1=Q5-Q8 |
| ・T0=Q0*S0*10^(-6) | ・T3=T1*(100-A2)/100 | ・T6=(T2+T4)*A3/100 | ・T9=T6+T8 | ・T12=T7+T11 | ・T5-1=T5-T8 |
| ・S0=Input Data | ・S3=T3*10^6/Q3 | ・S6=10^6*(100-W3)/100 | ・S9=T9*10^6/Q9 | ・S11=T11*10^6/Q11 | ・S5-1=S5 |
| ・Q1=Q0+Q13 | ・Q4=T4*100/(100-W2) | ・Q7=(Q2+Q4)-Q6 | ・Q10=T10*100/(100-W4) | | |
| ・T1=T0+T13 | ・T4=((T1-T5)*Si/100)-T2 | ・T7=(T2+T4)-T6 | ・T10=T9*A4/100 | | |
| ・S1=T1*10^6/Q1 | ・S4=10^6*(100-W2)/100 | ・S7=T7*10^6/Q7 | ・S10=10^6*(100-W4)/100 | | |
| ・Q2=T2*100/(100-W1) | ・Q5=Q3-Q4*(T3-T5)/T4 | ・Q8=T6*A5/A6 | ・Q11=Q9-Q10 | | |
| ・T2=T1-T3 | ・T5=T1*(100-A1)/100 | ・T8=Q8*S8/10^6 | ・T11=T9-T10 | | |
| ・S2=10^6*(100-W1)/100 | ・S5=T5*10^6/Q5 | ・S8=10^4*A6 | ・S11=T11*10^6/Q11 | | |

# 表 I.6　N1 処理場 容量計算書（11/11）

**Material Balance Sheet**