# Annex C Replacement Pages of Revised Sewerage Impact Assessment

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# 1. INTRODUCTION

## 1.1. Background

1.1.1. Allied Environmental Consultants Limited ("AEC") has been appointed to conduct a Sewerage Impact Assessment ("SIA") to support of a Section 12A application for the mixed use development at Lot 796 & 1008RP at D.D. 77 and adjoining government land in Ping Che, Ta Kwu Ling, New territories (hereinafter referred to as "Application Site").

1.1.2. According to the approved Ping Che and Ta Kwu Ling Outline Zoning Plan (OZP No.: S/NE-TKL/14) gazette on 12/03/2010, the Application Site is currently zoned as "Open Storage" ("OS") Zone, the southern part of the Application Site is zoned as "Agriculture" ("AGR") and a minor portion of the Application Site is shown as "Road".

## 1.2. Objectives

1.2.1. The objectives of this SIA are to assess whether the capacity of the existing sewerage networking to the Application Site is sufficient to cope with the sewage flow from proposed development.

## 1.3. Report Structure

1.3.1. The remaining chapters of this report are shown below:

Chapter 2 – Site Context
Chapter 3 – Relevant Guidelines & Standards
Chapter 4 – Sewerage Impact Assessment
Chapter 5 – Conclusion

# 2. SITE CONTEXT

## 2.1. Site Location

2.1.1. The proposed development is located at Ping Che Road from the north to northeast, the unnamed village road to the east, village, agricultural land and open storage area to the south and west.

## 2.2. Proposed Development Scheme and Existing Environment

2.2.1. The proposed site area of the subject site is 17,822m$^2$, with a plot ratio of 5.9 for domestic use and 1.1 for non-domestic use. The total GFA for domestic use is 105,145 m$^2$, and the 19,603 m$^2$ for non-domestic use. The proposed development will consist of 5 blocks of residential tower ranging from 47 to 48-storey (excluding basement) in height, provided 2,205 residential unit, and 1 block of commercial tower with 35-storey (excluding basement) in height. The non-domestic use consisted of retail, office, hotel or service apartment, clubhouse, day care centre for the elderly and child care centre.

2.2.2. Drainage information was obtained from the GeoInfo Map services of the Lands Department in Aug 2023 to gather the background information on sewerage infrastructure in the vicinity of the Application Site. A series of rising main public sewers with diameters of 200 mm were found along Ping Che Road, towards Southeast direction and further downstream. Furthermore, there are 2 pumping stations around the Application Site, which are Ng Chow South Road Sewage Pumping Station and Hung Leng Sewage Pumping Station are located 250 m and 1 km away from Application Site respectively.

2.2.3. However, there is no public foul sewer identified along Ping Che Road and around Application Site. Therefore, on-site Sewerage Treatment Plant (STP) are proposed for the proposed development.

2.2.4. The expected completion year and operation year of the Proposed Project is in 2032. ***Figure 2.1*** shows the Site location and its environs. The Master Layout Plan and sectional drawings proposed development are shown in ***Appendix A.***

Sewerage Systems, Inland and Coastal Waters (TM-DSS)";

- "Sewerage Manual Part 1" published by DSD;
- "Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Version 1.0 (Report No.: EPD/TP1/05)" ("GESF") published by Environmental Protection Department ("EPD");
- Water Supplies Department (WSD) Water Quality Criteria; and
- Guidelines for the Design of Small Sewage Treatment Plants issued by EPD.

# 4. SEWERAGE IMPACT ASSESSMENT

## 4.1. Methodology for Estimation of Average Dry Weather Flow

4.1.1. The global unit flow factors as recommended in the *Guideline for Estimating Sewage Flows for Sewage Infrastructure Planning* (hereafter as "GESF") published by EPD in 2005 has been adopted in the assessment to estimate sewage flow. Relative unit flow factors applied for the sewage generation estimation are tabulated in ***Table 4-1*** below.

*Table 4-1 Unit Flow factors Adopted for the Assessment*

| **Type of People** | **Unit Flow Factors [2]** | **Category [1]** |
|---|---|---|
| **Within Proposed Development [3]** | | |
| Residents of the Residential Development R2 | 0.270 $m^3$/person/day | Domestic (housing type specific) – R2 |
| Residents of Elderly Day Care Centre | 0.190 $m^3$/person/day | Domestic (housing type specific) – R1 |
| Students of Childcare Centre | 0.040 $m^3$/person/day | School Student |
| Staff of Clubhouse | 0.280 $m^3$/person/day | Commercial Employee + Commercial activities (J11 Community, Social & Personal Services) |
| Staff of Office | 0.080 $m^3$/person/day | Commercial Employee |
| Staff of Retail | 0.280 $m^3$/person/day | Commercial Employee + Commercial activities (J4 Wholesale & Retail) |
| Staff of Hotel/Service apartment | 1.580 $m^3$/person/day | Commercial Employee + Commercial activities (J10 Restaurants & Hotels) |
| Staff of Elderly Day Care Centre | 0.280 $m^3$/person/day | Commercial Employee + Commercial activities (J11 Community, Social & Personal Services) |
| Staff of Childcare Centre | 0.280 $m^3$/person/day | Commercial Employee + Commercial activities (J11 Community, Social & Personal Services) |

*Notes:*
*[1] Environmental Protection Department, HKSARG [EPD] (2005). Guidelines for estimating sewage flows for sewage infrastructure planning (EPD/TP 1/05). Hong Kong*
*[2] UFF for various occupancy types are adopted according to Table T-1 and Table T-2 of the GESF.*
*[3] Type of Residential Development is determined by the average area per flat of the residential development and referred to Table 8 of The Hong Kong Planning Standards and Guidelines (HKPSG) Ch.2 Residential Densities. For Hong Kong & Kowloon area, flat with GFA less than 50 $m^2$ will be categorized as R1; GFA between 50-110 $m^2$ will be categorized as R2; GFA between 110-210 $m^2$ will be categorized as R3; GFA greater than 210 $m^2$ will be categorized as R4.*

## 4.2. Estimation of Sewage Flow from Proposed Developments

4.2.1. The proposed project comprises of 5 blocks of residential tower ranging from 46 to 47-storey in height, provided 2,205 residential unit, 1 block of commercial tower with 35-storey in height, clubhouse, day care centre for elderly and child care centre. The estimated sewerage flow for proposed developments is given in ***Table 4-2*** and ***Appendix B.***

*Table 4-2 Sewage Flow Estimation for the Proposed Development and Existing*

| **Proposed Development** | | |
|---|---|---|
| **Generation from operation** | | **Remark** |
| Generation from Residential – R2 | | |
| Total Number of Residents | 6174 persons | Referred to submitted GBP. |
| Unit Flow Factor | 0.27 $m^3$/person/day | Domestic (housing type specific) – R2 in Table T-1 of GESF. |
| Average Sewage Discharge | 1667.0$m^3$/day | |
| Generation from Residential – Day Care Centre for the Elderly | | |
| Total Number of Residents | 60 persons | Referred to submitted GBP. |
| Unit Flow Factor | 0.15 $m^3$/person/day | Domestic (housing type specific) – Temporary and non-domestic in Table T-1 of GESF. |
| Average Sewage Discharge | 9.0 $m^3$/day | |
| Generation from Residential – Child Care Centre | | |
| Total Number of Residents | 100 persons | Referred to submitted GBP. |
| Unit Flow Factor | 0.04 $m^3$/person/day | School Students in Table T-2 of GESF. |
| Average Sewage Discharge | 4.0 $m^3$/day | |
| Generation from staff (Retail) | | |
| Floor Area | 2400.0 $m^2$ | Referred to submitted GBP. |
| Worker Density | 3.5 person/100$m^2$ | Retail Trade (All Types) in Table 8 of CIFSUS. |
| Total Number of Persons | 84 persons | |
| Unit Flow Factor | 0.28 $m^3$/person/day | Commercial Employee + Wholesale & Retail – J4 in Table T-2 of GESF. |
| Average Sewage Discharge | 23.5 $m^3$/day | |
| Generation from staff (Office) | | |
| Floor Area | 11500.0 $m^2$ | Referred to submitted GBP. |
| Worker Density | 3.4 person/100$m^2$ | All Economic Activities (All Types) in Table 8 of CIFSUS. |
| Total Number of Persons | 391 persons | |
| Unit Flow Factor | 0.08 $m^3$/person/day | Commercial Employee in Table T-2 of GESF. |
| Average Sewage Discharge | 31.3 $m^3$/day | |
| Generation from staff (Hotel/Service Apartment) | | |
| Floor Area | 5703.0 $m^2$ | Referred to submitted GBP. |
| Worker Density | 3.2 person/100$m^2$ | Hotels & Boarding Houses (All Types) in Table 8 of CIFSUS. |
| Total Number of Persons | 183 persons | |
| Unit Flow Factor | 1.58 $m^3$/person/day | Commercial Employee + Restaurants & Hotels - J10 in Table T-2 of GESF. |
| Average Sewage Discharge | 289.1 $m^3$/day | |
| Generation from staff (Clubhouse) | | |
| Floor Area | 3500.0 $m^2$ | Referred to submitted GBP. |

| | | |
|---|---|---|
| Worker Density | 3.3 person/100m$^2$ | Community, Social & Personal Services (All Types) in Table 8 of CIFSUS. |
| Total Number of Persons | 116 persons | |
| Unit Flow Factor | 0.28 m$^3$/person/day | Commercial Employee + Community, Social & Personal Services - J11 in Table T-2 of GESF. |
| Average Sewage Discharge | 32.5 m$^3$/day | |
| Generation from staff (Day Care Centre for the Elderly) | | |
| Floor Area | 787.6 m$^2$ | Referred to submitted GBP. |
| Worker Density | 3.3 person/100m$^2$ | Community, Social & Personal Services (All Types) in Table 8 of CIFSUS. |
| Total Number of Persons | 26 persons | |
| Unit Flow Factor | 0.28 m$^3$/person/day | Commercial Employee + Community, Social & Personal Services - J11 in Table T-2 of GESF. |
| Average Sewage Discharge | 7.3 m$^3$/day | |
| Generation from staff (Child Care Centre) | | |
| Floor Area | 1166.0 m$^2$ | Referred to submitted GBP. |
| Worker Density | 3.3 person/100m$^2$ | Community, Social & Personal Services (All Types) in Table 8 of CIFSUS. |
| Total Number of Persons | 39 persons | |
| Unit Flow Factor | 0.28 m$^3$/person/day | Commercial Employee + Community, Social & Personal Services - J11 in Table T-2 of GESF. |
| Average Sewage Discharge | 10.9 m$^3$/day | |
| Generation from Swimming Pool Backflow | | |
| Swimming Pool Volume | 511 m$^3$ | |
| Maximum Backwash Volume | 6 m$^3$/day | |
| **Total Average dry weather flow of the Proposed Development** | **2083.0 m$^3$/day** | |
| **Contributing Population** | **7693** | |
| **Peaking Factor** | **8** | |
| **Peak Flow** | **0.192 L/s** | |

## 4.3. Evaluation of Sewerage Impact

4.3.1. With reference to ***Table 4-2***, the total estimated Average Dry Weather Flow ("ADWF") from the proposed development is 2083.0 m$^3$/day. The population estimated ADWF of proposed development is summarized in ***Appendix B.*** As mentioned in ***Section 2.2.3***, there is no public sewer identified along Ping Che Road and around Application Site. Therefore, on-site STP are proposed for the proposed development. The sewage generated onsite will be treated by the STP and discharged to the public drainage system at the end. Hence, no sewage generated will be discharged to the public sewerage system and impact is not envisaged.

## 4.4. On-site Sewage Treatment Plant

4.4.1. "Guidelines for the Design of Small Sewage Treatment Plants" (The STP Guidelines) and WPCO should be followed in designing the on-site STPs in the later detail design stage. The exact treatment process would be subject to later detailed design. It will be necessary for the

STP to achieve adequate treatment capacity and the necessary discharge standards, as set out in EPD's Technical Memorandum – Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters.

4.4.2. The capacity of the STP shall be designed to cater for the design flow rate from the proposed project, the design flow factor of 3 times of the ADWF is adopted for the proposed project, with provision of equalization tank. Two duty and one standby pump will be provided in equalization tanks as far as practicable to limit the flow through the treatment units to within 1.5 times the daily average flow rate during average flow rate during off-peak periods.

4.4.3. With reference to clause 2.1.2 of Annex 6 of the Technical Memorandum on Environmental Impact Assessment Process, the acceptable sewage treatment level for Deep Bay WCZ is given in ***Table 4-3***. The proposed STP will be designed to meet the acceptable treatment levels. Detailed design of the proposed STP is not yet available subject to feasibility investigation and water quality assessment. Tentatively, the proposed STP will be provided with Membrane Bioreactor (MBR) technology with ultra-filtration to achieve the acceptable sewage treatment level, with following conditions:

- For nitrogen removal, the target is 75% total inorganic nitrogen reduction with respect to the annual average influent nitrogen loads or concentrations;
- For phosphorus removal, the target is 80% phosphorus reduction with respect to the annual average influent phosphorus loads or concentrations; and
- Disinfection may not be required if membrane filtration is provided which can meet the relevant discharge standards for bacteria.

*Table 4-3 Acceptable Sewage Treatment Level of Water Control Zone*

| Water Control Zone/ Waters Receiving the discharge | Acceptable Sewage Treatment Level |
|---|---|
| Tolo Harbour and Channel, Deep bay | Secondary treatment, nitrogen removal, phosphorus removal, and disinfection |
| Other Water Control Zones | Secondary treatment, nitrogen removal, and disinfection |

4.4.4. The capacity of the STP shall be designed to cater for the design flow rate from the Proposed Development, the design flow factor of 3 times of the ADWF is adopted for the Proposed Development, with provision of equalization tank. Two duty and one standby pumps will be provided in equalization tanks as far as practicable to limit the flow through the treatment

units to within 1.5 times the daily average flow rate during off-peak periods.

4.4.5. The on-site STP will be constructed to cater for the design peak flow of 2083.0 $m^3$/d, with the provision of an equalization tank. The calculation is given in ***Table 4-4*** and ***Appendix C***. The preliminary layout plan for the on-site STP is given in ***Figure 4.1***.

*Table 4-4 Estimation of the Required Volume for the Sewage Treatment Plant*

| Average Dry Weather Flow (ADWF) ($m^3$/day) | | Total ADWF ($m^3$/day) | ADWF factor[1] | Design Peak Flow Rate from Proposed Project ($m^3$/day) | Design Flow Rate from Proposed Project ($m^3$/hr) |
|---|---|---|---|---|---|
| Sewage (Residents) | Sewage (Staff) | | | | |
| 1682.4 | 400.6 | 2083.0 | 3 | 6249 | 260.4 |

*Note:*
*[1] The design peak flow factor is reference from EPD's '"Guidelines for the Design of Small Sewage Treatment Plants". For the Proposed Development, 3 times Average Dry Weather Flow (ADWF) is adopted, with equalization tank provided to equalize excess flow.*

4.4.6. Sludge storage tank with deodorization facilities will be provided in the STP. The sludge after having been dewatered and thickened will be tanked away to the landfill for disposal, subject to confirmation with future licensed collector/contractor. All wastewater, if any, generated from the sludge dewatering process should be treated properly by the proposed on-site STP.

4.4.7. As is good practice for STP, measures will be incorporated into the design to minimize the risk of emergency overflow from STP. As the STP is designed to cater for a peak flow of 3 times the daily average flow rate, 2 duty and 1 standby pump should be provided in equalization tanks as far as practicable to limit the flow through the treatment units within 1.5 times the daily average flow rate during off-peak periods. This is to even out the flow as much as possible. Other measures include secure power supplies and appropriate alarms, as well as comprehensive Operation and Maintenance procedures, to keep the facilities in good working order. Holding tank for emergency storage/retention will be included with adequate capacity (e.g. to store 6-hour of ADWF discharge) to minimize need of emergency discharge. In the event of any emergency overflow, on-call crews will follow the overflow emergency response plan and proceed with the best response to correct the problem at once. For example, the alarm system will be activated once overflow occurs. The on-call crews will provide instant response by acknowledging the alarm, to investigate the cause of overflow and correct the problem. The alarm system will be repeated until it is acknowledged. In addition, the on-call crews will ensure the standby pump is switched on and contains the

overflow sewage using temporary weirs or vacuum trucks, where applicable.

4.4.8. The STP will also be subject to regular maintenance to ensure it functions in designed condition and optimal performance and can minimize any emergency situation. Property Management will be responsible for the construction and maintenance of the STP. In addition, regular self-monitoring will be conducted to ensure the quality of the treated effluent shall meet the applicable standard before discharge. Monitoring program will be devised for Terms & Conditions of the system. A discharge license will be applied prior to the development commencement and monitoring requirements under the license would be strictly followed as per WPCO. Necessary discharge standards, as set out in EPD's Technical Memorandum – Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters will be adopted.

## 4.5. Estimation of Pollutants Loading from Proposed Project

4.5.1. With reference to the EPD's Guidelines, the following unit load factors ("ULFs") for different types of pollutant generated from the Proposed Development as shown in ***Table 4-5*** have been used in calculation of total pollutant loads from the Proposed Development.

*Table 4-5 Unit Load Factors*

| Load Type | Unit Load Factor [1] | |
|---|---|---|
| | Residents | Staff |
| BODs (kg/day/person) | 0.055 | 0.007 |
| SS (kg/day/person) | 0.055 | 0.007 |

*Noted:*
*[1]: The recommended loadings for BOD and SS for Office (not including canteen) refer to Appendix 2 in "Guidelines for the Design of Small Sewage Treatment Plants" by EPD are adopted for the calculation for worst case scenario for pollutant loadings generated from the Application Site*

4.5.2. The loadings of pollutants generated from the raw sewage from the proposed project is summarized in ***Table 4-6***.

*Table 4-6 Estimated Pollutant Loadings from Proposed Project*

| Population | | Unit Load Factor (kg/day/person) | | Pollutant Loadings (kg/day) | |
|---|---|---|---|---|---|
| | | BODs | SS | BODs | SS |
| Residents | 6114 | 0.055 | 0.055 | 348.37 | 348.37 |
| Staff | 839 | 0.007 | 0.007 | 6.11 | 6.11 |
| | | | Total | 354.48 | 354.48 |

# 5. CONCLUSION

5.1.1. A Sewerage Impact Assessment (SIA) has been conducted to evaluate the possible impacts on the public sewerage network due to the proposed development. Since there is no public foul sewer identified at the surrounding of Application Site. Therefore, on-site Sewerage Treatment Plant are proposed for the proposed development. The sewage generated from the proposed development will be collected and treated on-site by STP and discharged into the stormwater manhole (STMH-01). The result showed that 2083.0 $m^3$/day of average sewage discharge are expected to be generated from the proposed development and treated by STP.

5.1.2. The on-site STP provided with the provision of an equalization tank cater for the design peak flow of 260.4 $m^3$/hr is proposed to treat the effluent from daily operation. Details of the proposed STP design and exact treatment process, including emergency discharge, emergency storage/retention arrangement and the sludge disposal arrangement would be subject to later detailed design.

5.1.3. The treated effluent will be collected in the storm water terminal manhole on site and then diverted to the proposed public stormwater drainage system via proper connections. Therefore, adverse sewerage impact due to the proposed project is not anticipated.

# *Appendix B*

## Sewage Flow Calculation

Average Dry Weather Flow Estimation for Proposed Development

**PROJECT SITE**

| Population Description | Type of Development | Estimated Residential Units / Service GFA [1] | | Estimated Population [2] | | Recommeded Design Flow Rate | Dry Weather Flow |
|---|---|---|---|---|---|---|---|
| | | | | | | (m3/persons/day) [b] | (m3/day) |
| Residential | R2 (45-60m2) | Units | 2205 | Population | 6174 | 0.27 | 1667.0 |
| | Elderly care | Person | 60 | Population | 60 | 0.19 | 11.4 |
| | Child care | Person | 100 | Population | 100 | 0.04 | 4.0 |
| Services | Clubhouse | m2 | 3500 | Population | 116 | 0.28 | 32.5 |
| | Commercial | m2 | 11500 | Population | 391 | 0.08 | 31.3 |
| | Retail | m2 | 2400 | Population | 84 | 0.28 | 23.5 |
| | Hotel | m2 | 5703 | Population | 183 | 1.58 | 289.1 |
| | Elderly care | m2 | 788 | Population | 26 | 0.28 | 7.3 |
| | Child care | m2 | 1166 | Population | 39 | 0.28 | 10.9 |
| | Swimming Pool | m2 | - | Population | - | - | 6.0 |
| | | | | | **SUM** 7,173 | **SUM** | 2083.0 |

Notes:

[1] Information referred to development schedule_20230802

[2] Avg household size 2.7 (Refer to Average Domestic Household Size of North District Council in 2021 Population Census: Summary Result, published by Census and Statistics Department)
Worker Density per GFA (person/100 m2) for Commercial/office (3.4); for retail (3.5); for Hotels and Boarding Houses (3.2); for Community, Social & Personal Services (3.3) referred to the worker density of (All Types) in Table 8 of CIFSUS.

[2] The Recommended Design Flow Rate of the Proposed House reference to Appendix 3 of Guidelines for the Design of Small Sewage Treatment Plants by EPD.

**Table 8 Initial Flat Size Assumptions**

GFA per flat ($m^2$)

| | Hong Kong & Kowloon | Tsuen Wan, Kwai Chung & Tsing Yi | Other New Towns |
|---|---|---|---|
| R1 | 50 | 45 | 45 |
| R2 | 110 | 60 | 60 |
| R3 | 210 | 130 | 130 |

# *Appendix C*

## Pollutants Load and Required Volume for Proposed STP

**Proposal for Sewage Treatment Plant with Equalisation Tank**

Estimation of the Required Volume for the Sewage Treatment Plant

| Dry Weather Flow (DWF) (m3/day) Sewage (Residents and Service) | DWF factor [1] | Minimum Sewage Treatment Plant Capacity Required (m3) |
|---|---|---|
| 2083 | 3 | 6249 |

Estimation of the Required Volume for the Equalisation Tank

| Dry Weather Flow (DWF) (m3/day) Sewage (Residents and Service) | DWF factor [1] | Time Required to Hold Excess Flow (hrs) [3] | Minimum Equalisation Tank Capacity Required (m3) |
|---|---|---|---|
| 2083 | 3 | 2 | 521 |

Remarks:

[1]: With reference from EPD's "Guidelines for the Design of Small Sewage Treatment Plants". For the Proposed Development, the factor of 3 x DWF is adopted for development with population of under 1000, with the use of equalisation tank.

[2]: This is reference from section 12 of the Guidance Notes on Discharges from Village Houses from the EPD. A maximum of 30 cm of sludge, or 1/4 of the sewage holding tank's volume of sludge is allowed, before desludging is required.

[3]: With reference to EPD's "Guidelines for the Design of Small Sewage Treatment Plants", if an equalisation tank is used, the equalisation tank shall be designed to hold excess flow for a period of 2 hours.

3.3 The design peak flow arriving at the STP as a proportion of dry weather flow (DWF) shall be taken as:

- 6 DWF for population equal to or under 1 000
- 4 DWF for population over 1 000 but not less than that based on 1 000 population.

Either the STP can be designed for the above peak flow rate or it can be designed to cater for a peak flow of 3 DWF, excess flow over 3 DWF being equalized in an equalization tank. In the latter case the feed pumps must be sized accurately to avoid excessive peak flow rate production.

Equalization tanks should be designed to hold the excess flow for a period of two hours. Only the tank volume above the duty pump cut-in level should be considered as effective equalization volume. Air ejectors should be provided to prevent septicity of sewage.

Estimation of the Loading Requirements for the Sewage Treatment Plant

BODs

| Population Description | Estimated Population | | Recommeded Loading Rate for BODs [4] | Loading Rate for BODs |
|---|---|---|---|---|
| | | | (g/persons/day) [b] | (kg/day) |
| Residential | Person | 6334 | 55 | 348.37 |
| Services | Person | 839 | 7 | 6.11 |
| | **SUM** | 7,173 | **SUM** | 354.48 |

SS

| Population Description | Estimated Population | | Recommeded Loading Rate for SS [4] | Loading Rate for SS |
|---|---|---|---|---|
| | | | (g/persons/day) [b] | (kg/day) |
| Residential | Person | 6334 | 55 | 348.37 |
| Services | Person | 839 | 7 | 6.11 |
| | **SUM** | 7,173 | **SUM** | 354.48 |

Remarks:

[4]: With reference to Appendix 2 of EPD's "Guidelines for the Design of Small Sewage Treatment Plants", the BODs and SS loads for Services shall be pro-rata to equivalent residential population