

#### 4. 討議議事録



MINUTES OF DISCUSSIONS  
ON  
BASIC DESIGN STUDY  
ON  
THE LILONGWE SEWERAGE PROJECT  
IN  
THE REPUBLIC OF MALAWI

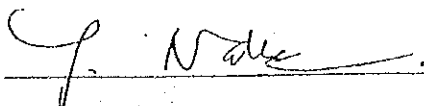
Based on the results of the Preliminary Study, the Japan International Cooperation Agency (hereinafter referred to as "JICA") decided to conduct a Basic Design Study on the Lilongwe Sewerage Project (hereinafter referred to as "the Project").

JICA sent to the Republic of Malawi a study team (hereinafter referred to as "the Team"), which is headed by Mr. Yoshikatsu NAKAMURA, Director, First Basic Design Study Division, Grant Aid Study and Design Department, JICA, and is scheduled to stay in the country from August 26 to September 19, 1993.

The Team held discussions with the officials concerned of the Government of Malawi and conducted field surveys at the study area.

In the course of discussions and field surveys, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study report.

Lilongwe, September 3, 1993

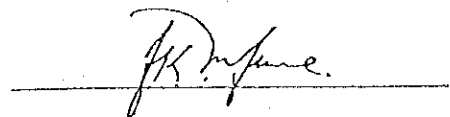


Mr. Yoshikatsu NAKAMURA

Leader

Basic Design Study Team

JICA



Mr. Francis K. Mfune

Town Clerk and Chief Executive

Lilongwe City Council

## ATTACHMENT

### 1. Objective

The objective of the Project is to improve sanitation standard of Lilongwe City and the vicinity area, by means of expanding sewerage facilities in the city.

### 2. Project Area

The area of the Project is a part of Lilongwe City, as shown in Annex I.

### 3. Executing Agency

The Lilongwe City Council (hereinafter referred to as "the LCC"), under the Ministry of Local Government, is responsible for the administration and execution of the Project.

### 4. Project Components

After discussions, the following items were finally agreed in priority order by the both sides as the project components:

#### 1) First Priority

##### (1) Construction of Trunk Mains

The construction of the trunk mains with a length of approximately 18 km linking the existing sewage treatment plants (Area 2, 6, 13, 18A, 18B and 33) with the proposed treatment plant at Kauma.

##### (2) Construction of Treatment Plant at Kauma

Note: The capacity of the plant will be decided based on the expected sewage flow after the completion of the Project. An anticipated increase of sewage flow by

the expansion of the sewer network in the near future, which is not covered by the Project, may be considered in the Project.

(3) Construction of Pumping Station

Note: The need for the pumping station for the trunk mains will be determined after detailed survey.

2) Second Priority

Construction of Sewer Network

The construction of sewer network for the areas of No. 1, 2, 18, 4 and 47 in priority order

- Note: i) Subject areas of the design will be decided by the Team based on the results of further study in Japan.
- ii) The house connections will be laid simultaneously with the construction of the sewer network by the Malawi side.
- iii) In case the Japanese Grant Aid does not cover the work due to the limit of the budget, the Malawi side will try to seek another financing source for the work.

5. Japan's Grant Aid System

- (1) The Government of Malawi has understood the system of Japanese Grant Aid explained by the Team.
- (2) The Government of Malawi will take necessary measures, as described in Annex II, for the smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study

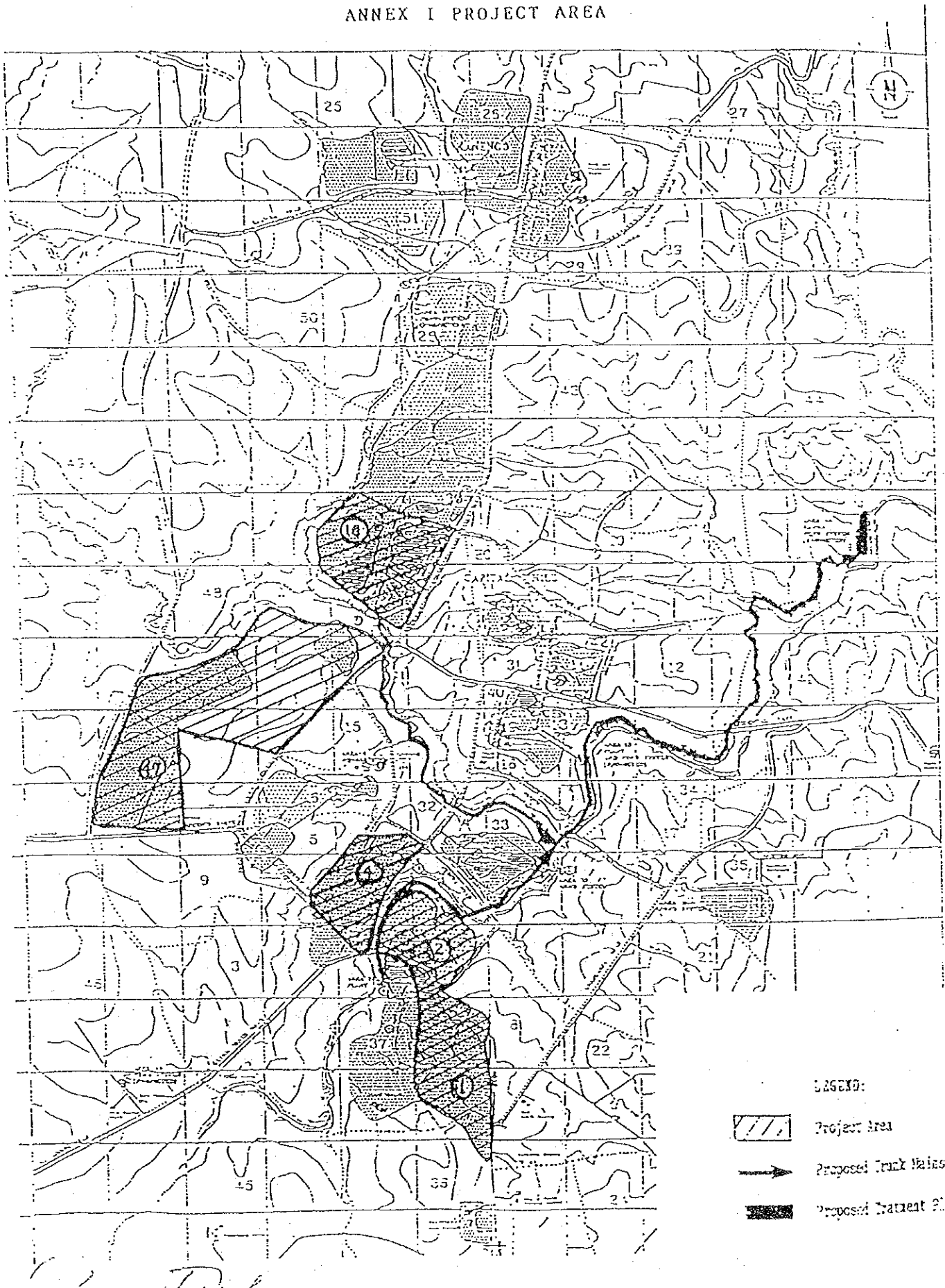
- (1) The Team will proceed to further studies in Malawi until Septem-

ber 19, 1993.




- (2) JICA will prepare the draft report in English and dispatch a mission in order to explain its contents around December, 1993.
- (3) In case that the contents of the report is accepted in principle by the Malawi side, JICA will complete the final report and send it to the Government of Malawi by February, 1994.

*Ln P.S.*

ANNEX I PROJECT AREA



LEGEND:

-  Project Area
-  Proposed Trunk Main
-  Proposed Treatment Plant

ANNEX II NECESSARY MEASURES TO BE TAKEN  
BY THE GOVERNMENT OF MALAWI

Necessary measures to be taken by the Government of Malawi on condition that Japanese Grant Aid Assistance is extended to the country are:

1. To provide data and information necessary for the Project,
2. To secure the sites for the Project,
3. To clear and level the treatment plant site and to construct the access to the site prior to the commencement of the construction,
4. To undertake incidental outdoor works such as gardening, fencing, gates and exterior lighting within and around the site,
5. To provide facilities to the treatment site, such as;
  - 1) water supply,
  - 2) distribution of electricity and telephone line,
  - 3) general furniture such as tables, chairs, and others for the completed facilities,
6. To bear the commission to the Japanese foreign exchange bank for the banking services based upon the banking arrangement,
7. To exempt taxes and to take necessary measures for custom clearance of the materials and equipment brought for the Project at the port of disembarkation,
8. To exempt Japanese nationals from custom duties, internal taxes and other fiscal levies which may be imposed in Malawi with respect to the supply of the products and services under the verified contracts,
9. To bear all the expenses other than those to borne by the Grant, necessary for the construction of the facilities as well as for the transportation and installation of the equipment.

*Fr. Prof*



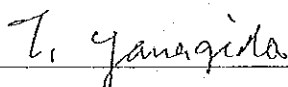
TECHNICAL NOTES  
ON  
BASIC DESIGN STUDY  
ON  
THE LILONGWE SEWERAGE PROJECT  
IN  
THE REPUBLIC OF MALAWI

The Japan International Cooperation Agency (hereinafter referred to as "JICA") sent to the Republic of Malawi a study team (hereinafter referred to as "the Team"), which is headed by Mr. Yoshikatsu NAKAMURA, Director, First Basic Design Study Division, Grant Aid Study and Design Department, to conduct a Basic Design Study on the Lilongwe Sewerage Project (hereinafter referred to as "the Project").

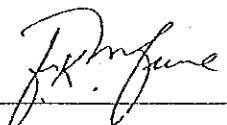
The Team held discussions with the officials concerned of the Government of Malawi and conducted field surveys at the study area from August 26 to September 19, 1993.

Through discussions and field surveys, both parties have confirmed the technical matters described on the attached sheets for further works. The Team will conduct the basic design and prepare the Basic Design Study report in Japan.

Lilongwe, September 17, 1993

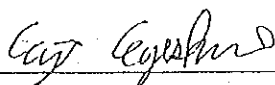


Mr. Tetsuo YANAGIDA  
Chief Consultant  
Basic Design Study Team  
JICA

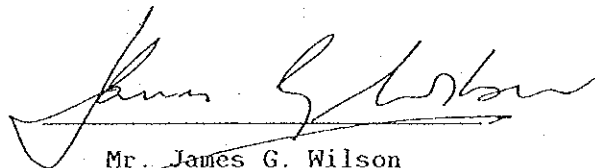


Mr. Francis K. Mfune  
Town Clerk and Chief Executive  
Lilongwe City Council

IN WITNESS WITH:



Mr. Eiji EGASHIRA  
Assist. Resident Representative  
Malawi Office  
JICA



Mr. James G. Wilson  
Chief Technical Adviser  
Ministry of Local Government

## ATTACHMENT

In addition to the confirmed items described in the Minutes of Discussions dated September 3, 1993, following matters were confirmed and agreed by both parties for execution of the planning and design of the Project.

### 1. Service Area

The area to be served by the sewerage system was decided as follows:

Year 2000: Present Served Area, and proposed service areas in Areas 1, 2, 4, and 18.

Year 2005: The service area proposed in the F/S, and Areas 47 and 44.

### 2. Sewage Flow

The total sewage amount was projected as follows:

Year 2000; 8,400 m<sup>3</sup>/day (F/S 8,400 m<sup>3</sup>/day)

Year 2005; 15,600 m<sup>3</sup>/day (F/S 12,900 m<sup>3</sup>/day)  
(daily average basis)

### 3. Principles and Criteria for the Design of Sewer System

#### (1) Pipe Materials

- a. Trunk main and lateral sewer; Asbestos Cement Pipe
- b. House connections (Work to be done by Malawi side); PVC Pipe
- c. At crossings over streams; Ductile Iron Pipe
- d. Sewer bridge; Ductile Iron Pipe on Steel Truss Structure Bridge

#### (2) Minimum Diameter of Sewer

- a. Sewer; 150 mm
- b. House connections; 100 mm

#### (3) Diameter of Trunk Mains

φ500mm - φ900mm (F/S φ600mm - φ800mm) (refer to ANNEX I)

Note: Since the planned route of the trunk main along the Lingadzi river runs through the Nature Sanctuary, the Malawi side shall secure the permission of the authorities concerned for the survey for detailed design and implementation of the Project if the Japanese Grant Aid Assistance is extended to the Project.

*Fuly. C. T. Y. Jw.*

- (4) Slope and Flow Velocity of Sewer
- a. Minimum slope; 1m/km (0.1%)
  - b. Flow velocity; 0.5m/s. - 3.0m/s. (same as F/S)
- (5) Structure of Manhole
- a. Structure; Standard design in Japan will be adopted.
  - b. Manhole cover; Cast iron with lock
  - c. Spacing; Sewer with a diameter of  $\phi$ 500 or less - 60m in max.  
Sewer with a diameter of  $\phi$ 600 or more - 80m in max.  
(same as F/S)
- (6) Design Peak Flow Factor
- a. Trunk main; 2.3 (F/S 2.3)
  - b. Others; 3.0 (F/S 2.5, 3.0)
- (7) Unit Sewage Quantities (same as F/S)
- a. High density traditional (HDT); 80 lpcd
  - b. High density permanent (HDP); 125 lpcd
  - c. Medium density permanent (MDP); 150 lpcd
  - d. Low density permanent (LDP); 200 lpcd
- (8) Minimum Covering Depth
- a. Sewer laid under road; approximately 1.5m
  - b. Others; approximately 1.0m

Excavated roads should be restored to their former state.

Note: Lateral sewer pipes will be laid under roads except for busy-traffic roads. In addition, the sewer network and the trunk main will cross many roads and rivers. In this connection, the Malawi side shall secure the permission of the authorities concerned for implementation of the Project if the Japanese Grant Aid Assistance is extended to the Project.

(9) Pumping Station

Based on the results of the field survey, the pumping station will not be required, and therefore will not be provided.

*Prof. G. S. T. J. W.*

4. Principles and Criteria for the Design of Treatment Plant

(1) Basic Parameters

a. Planned Sewage Flow

Phase 1 (JICA): Daily Avg. 8,400 m<sup>3</sup>/day  
 Hourly Max. 19,320 m<sup>3</sup>/day  
 Phase 2 : Daily Avg. 15,600 m<sup>3</sup>/day  
 Hourly Max. 35,880 m<sup>3</sup>/day

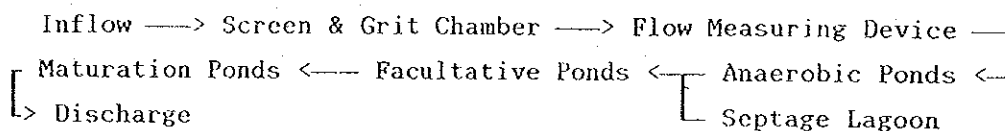
b. Planned Water Quality

Influent;  
 BOD<sub>5</sub> 300 mg/L, SS 350 mg/L, Fecal Coli. G. 2.0x10<sup>7</sup> MPN/100mL  
 Effluent (Target treated water quality);  
 BOD<sub>5</sub> 20 mg/L, SS 30 mg/L, Fecal Coli. G. 1.0x10<sup>3</sup> MPN/100mL

c. Treatment Method

Stabilization Pond System will be adopted.

Flow Diagram:



(2) Design Criteria

The design criteria recommended in the "Wastewater Stabilization Ponds" (WHO EMRO Technical Publication No.10) will be applied for the Basic Design as follows:

Item	Applied Formula / Value
1. Grit Chamber	
Water Surface Loading	1,800 m <sup>3</sup> /m <sup>2</sup> ·day for Q <sub>hmax</sub>
Average Velocity	0.3 m/s
2. Anaerobic Ponds (AP)	
BOD <sub>5</sub> Volumetric Loading	v = 160 g-BOD <sub>5</sub> /m <sup>3</sup> ·day at air temp. 15.2°C
Water Depth	4.0 m
Effective Retention Time	2.0 days or more

*Perf. Cuj*      *T.Y. JW*

Digested Anaerobic Sludge Production	0.04 m <sup>3</sup> /capita year
BOD <sub>5</sub> Reduction in AP	50 %
<b>3. Facultative Ponds (FP)</b>	
Mean Air Temp. during the Coldest Month	T <sub>a</sub> = 15.2 °C
BOD <sub>5</sub> Surface Loading	s = 60.3 x 1.0993 <sup>T<sub>a</sub></sup> x 1/α = 192 (kg-BOD <sub>5</sub> /ha day) where, T <sub>a</sub> =15.2 °C α=Safety Factor (=1.33)
Water Depth	2.0 m
Digested Sludge Production	0.03 m <sup>3</sup> /capita year
<b>4. Maturation Ponds (MP)</b>	
Fecal Coliform Count Permissible in the Final Effluent of the MP	less than 1.0 x 10 <sup>3</sup> MPN/100mL
Bacterial Reduction Models	NR/NO = 1/Σ(K'R <sub>i</sub> +1) where, NR:bacterial population after R days NO:bacterial population in the effluent K':die-off constant (d <sup>-1</sup> ) R: retention time (days) at 15.2 °C K'=2.0 x 1.07 <sup>(15.2-20)</sup> =1.446 (d <sup>-1</sup> )
Water Depth	1.5 m
Retention Time per Pond	3 days
<b>5. Septage Lagoon</b>	
Septage Production	0.001 m <sup>3</sup> /capita day
BOD <sub>5</sub> Concentration	5,000 mg/L
Retention Time	20 days or more
BOD <sub>5</sub> Volumetric Loading	200 g-BOD <sub>5</sub> /m <sup>3</sup> day
Operation	Intermittent
<b>6. Civil Engineering Parameters</b>	
Embankment Slope	Inside 1:3 Outside 1:1.5
Freeboard	0.5 m
Protection	Inside slope :Concrete Block (t=50mm) Bottom :Clay (t=100mm) Walkway :Mainly 3.0 m in width :Brick pavement

Note: At the publication if available, design of wastewater stabilization ponds in the south Africa region would be considered in the design.

*Prof. G. S. ...*

(3) Outlines of Facilities

Applying the recommended design criteria, outlines of each facility were calculated tentatively as follows:

Item	Phase 1 (JICA)	Phase 2 (Total)
1. Grit Chamber		
- Dimension	W1,200 x L9,000	W1,200 x L9,000
- Number	2 basins (1 basin - stand-by)	2 basins
2. Flow Measuring Device		
- Type	Parshall Flume	Parshall Flume
- Number	1 set	1 set
3. Anaerobic Ponds		
- Dimension	area 0.3ha x depth 4.0m	area 0.3ha x depth 4.0m
- Number	3 basins (1 basin - stand-by)	4 basins
- Retention Time	2.2 days	2.2 days
4. Septage Lagoon		
- Dimension	area 800m <sup>2</sup> x depth 3.0m	area 800m <sup>2</sup> x depth 3.0m
- Number	2 basins	3 basins
- Effective Retention Time	2.2 days	2.2 days
5. Facultative Ponds		
- Dimension	area 1.95ha x depth 2.0m	1.95ha x 2.0m    1.5ha x 2.0m
- Number	3 basins	4 basins    4 basins
- Retention Time	about 18 days	about 18 days
6. Maturation Ponds		
- Dimension	A 8,400 m <sup>2</sup> x D 1.5 m	8400m <sup>2</sup> x1.5m    7000m <sup>2</sup> x1.5m
- Number	3 basins x 2 series	3ba. x 2ser.    3ba. x 2ser.
- Retention Time	3 days/basin	3 days/basin

*Prof. C. S. J. S. W.*

5. Provision of Equipment and Materials

Through the discussions, the Malawi side requested that the following equipment and materials be included in the Project.

a. Laboratory equipment

Water quality analysis equipment for effective operation and maintenance of treatment plant

b. Sewer cleaning equipment

Cleaning equipment and vehicles such as:  
manual cleaning equipment, high pressure water jet truck, vacuum tanker (for cleaning of sewer and septic tank)

c. Vehicles for maintenance of treatment plant

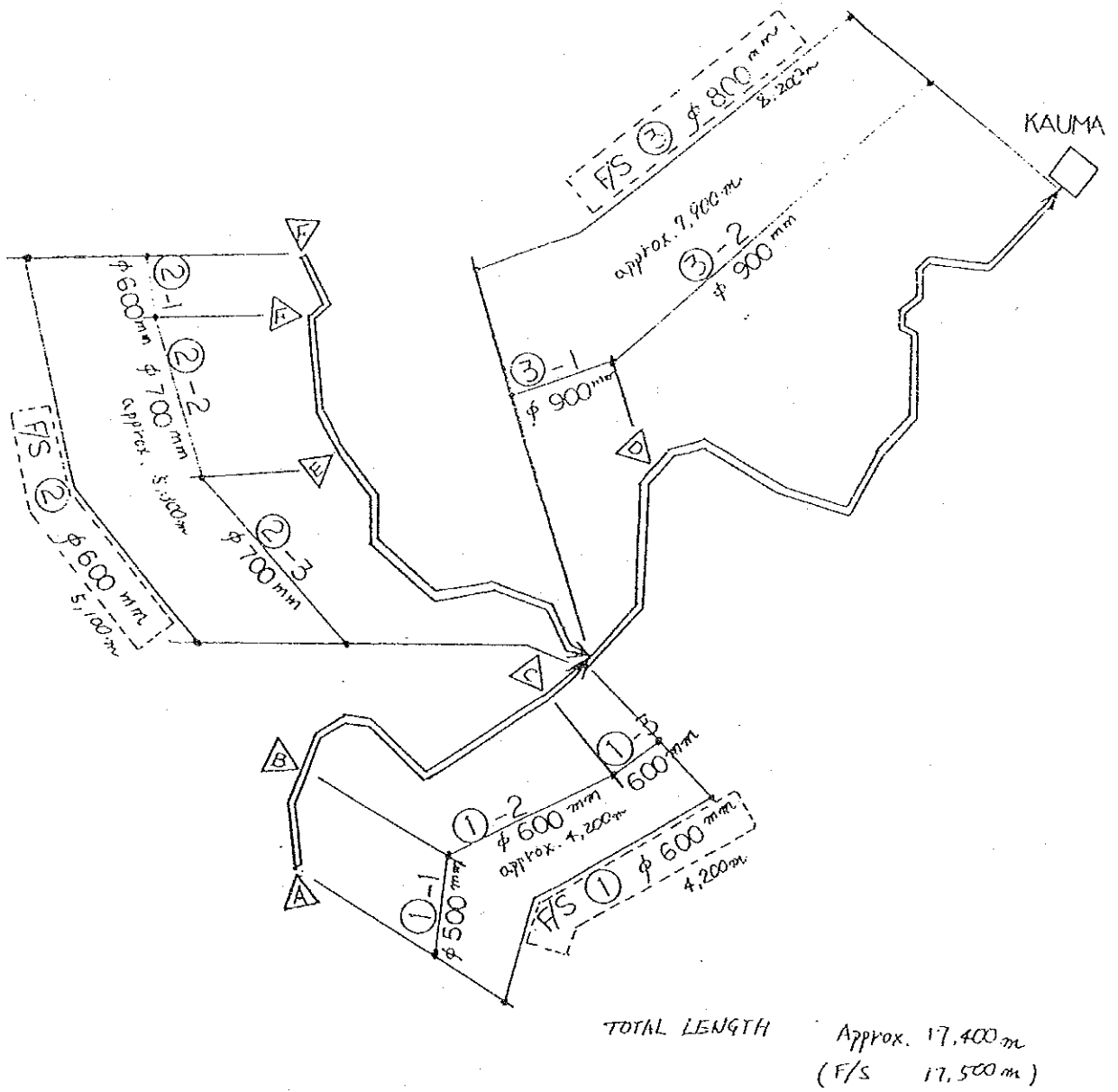
dump truck, plastic boat

d. House connections and fencing

It was agreed that the construction of house connections and fencing of the plant should be undertaken by the Malawi side. However, due to the number of connections (more than 3,000) and the length of the fence (around 2 km), the construction cost for them will be very high. Considering this situation, the Malawi side would like to apply that the construction of these components be included in the Grant Aid.

*Prof. Coy*      *2.4 JW*

ANNEX I ALIGNMENT OF TRUNK MAINS

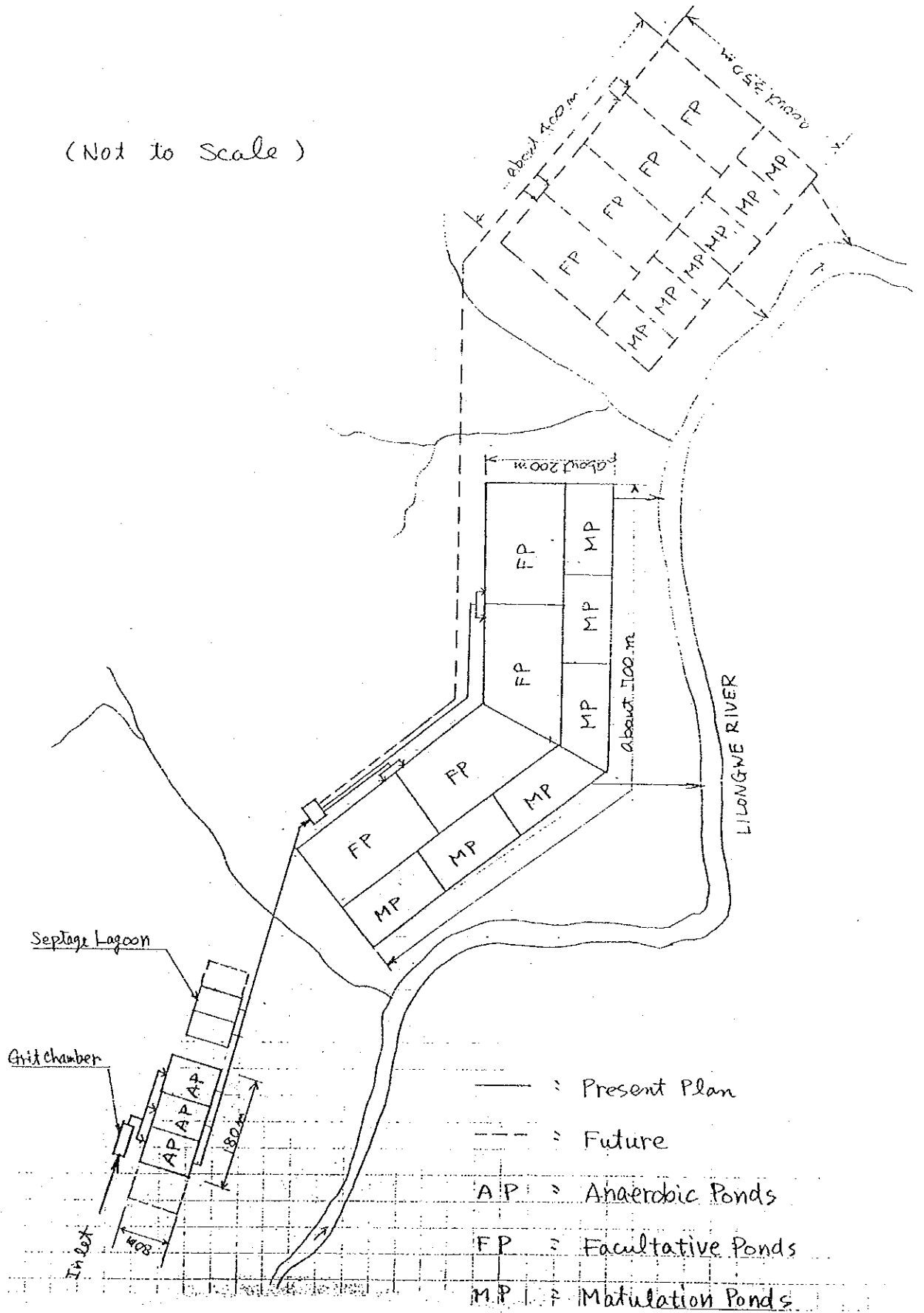


Prof. Gov. 2 of JWS



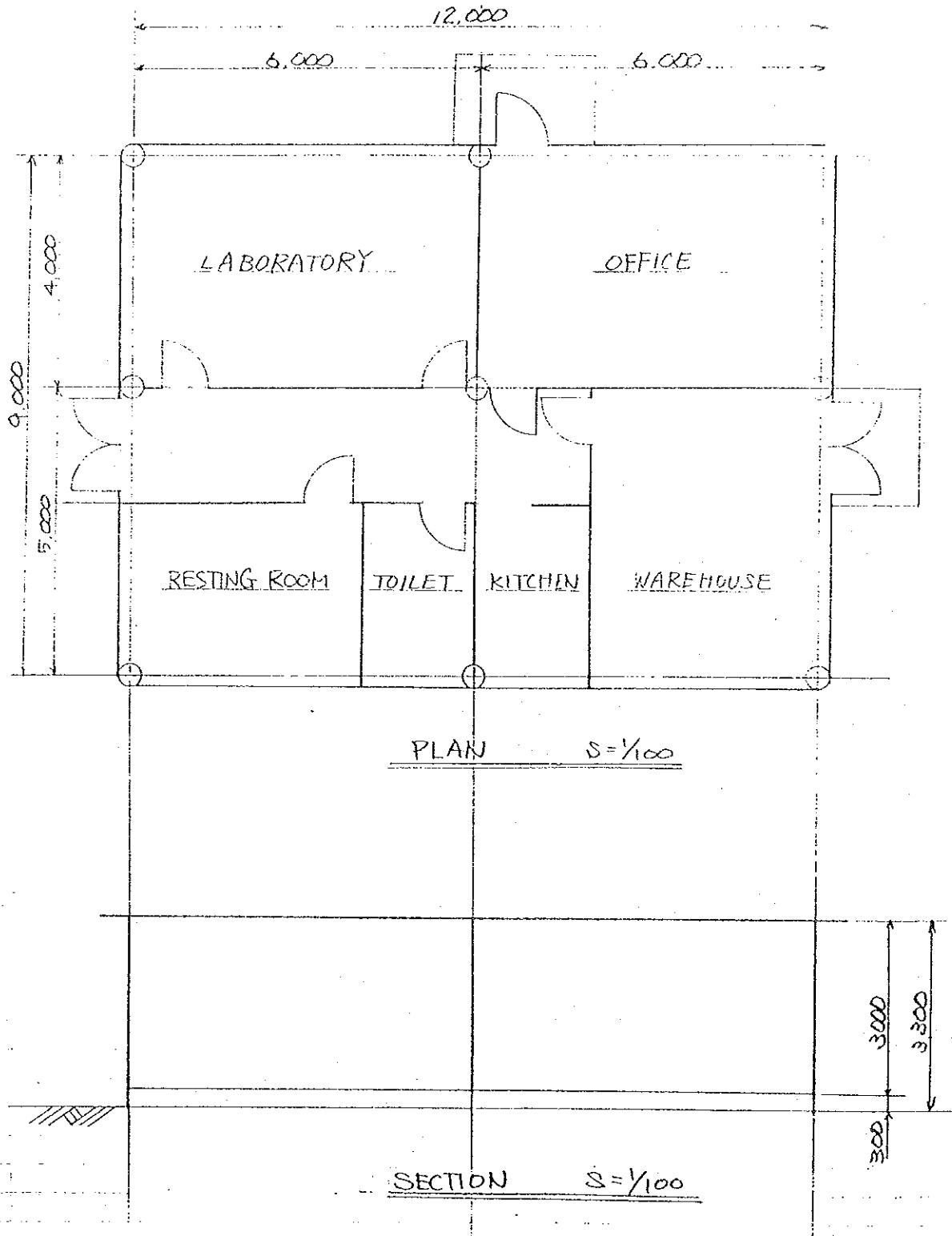
ANNEX II PLAN OF PROPOSED SEWAGE TREATMENT PLANT

(Not to Scale)



*Prof. C. J. J. J.*

ANNEX III PLAN OF ADMINISTRATION OFFICE AT PROPOSED STP  
(TENTATIVE)



*Prof. G. S. 2.9 J.W.*

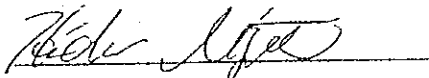
MINUTES OF DISCUSSIONS  
ON  
BASIC DESIGN STUDY  
ON  
THE LILONGWE SEWERAGE PROJECT  
IN  
THE REPUBLIC OF MALAWI  
(CONSULTATION ON DRAFT REPORT)

In August, 1993, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Basic Design Study team on the Lilongwe Sewerage Project (hereinafter referred to as "the Project") to the Republic of Malawi, and through discussions, field survey, and technical examination of the results in Japan, has prepared the draft report of the study.

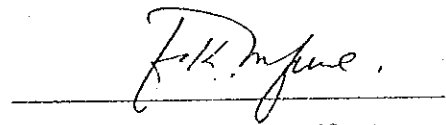
In order to explain and to consult the Malawi side on the components of the draft report, JICA sent to Malawi a study team (herein after referred to as "the Team"), which is headed by Mr. Hideo MIYAMOTO, Deputy Director, First Basic Design Study Division, Grant Aid Study and Design Department, JICA, and is scheduled to stay in the country from November 30 to December 3, 1993.

As the result of discussions, both parties confirmed the main items described on the attached sheets.

Lilongwe, December 3, 1993



Mr. Hideo MIYAMOTO  
Leader  
Basic Design Study Team  
JICA

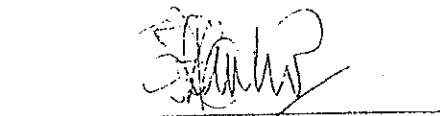


Mr. Francis K. Mfuné  
Town Clerk and Chief Executive  
Lilongwe City Council

IN WITNESS WITH:



Mr. B. S. Phangaphanga  
Principal Secretary  
Ministry of Local Government



Mr. J. M. Mhango  
Senior Assistant Secretary  
Ministry of Finance

## ATTACHMENT

### 1. Components of Draft Report

The Government of Malawi has agreed and accepted in principle the components of the draft report proposed by the Team.

### 2. Project Area

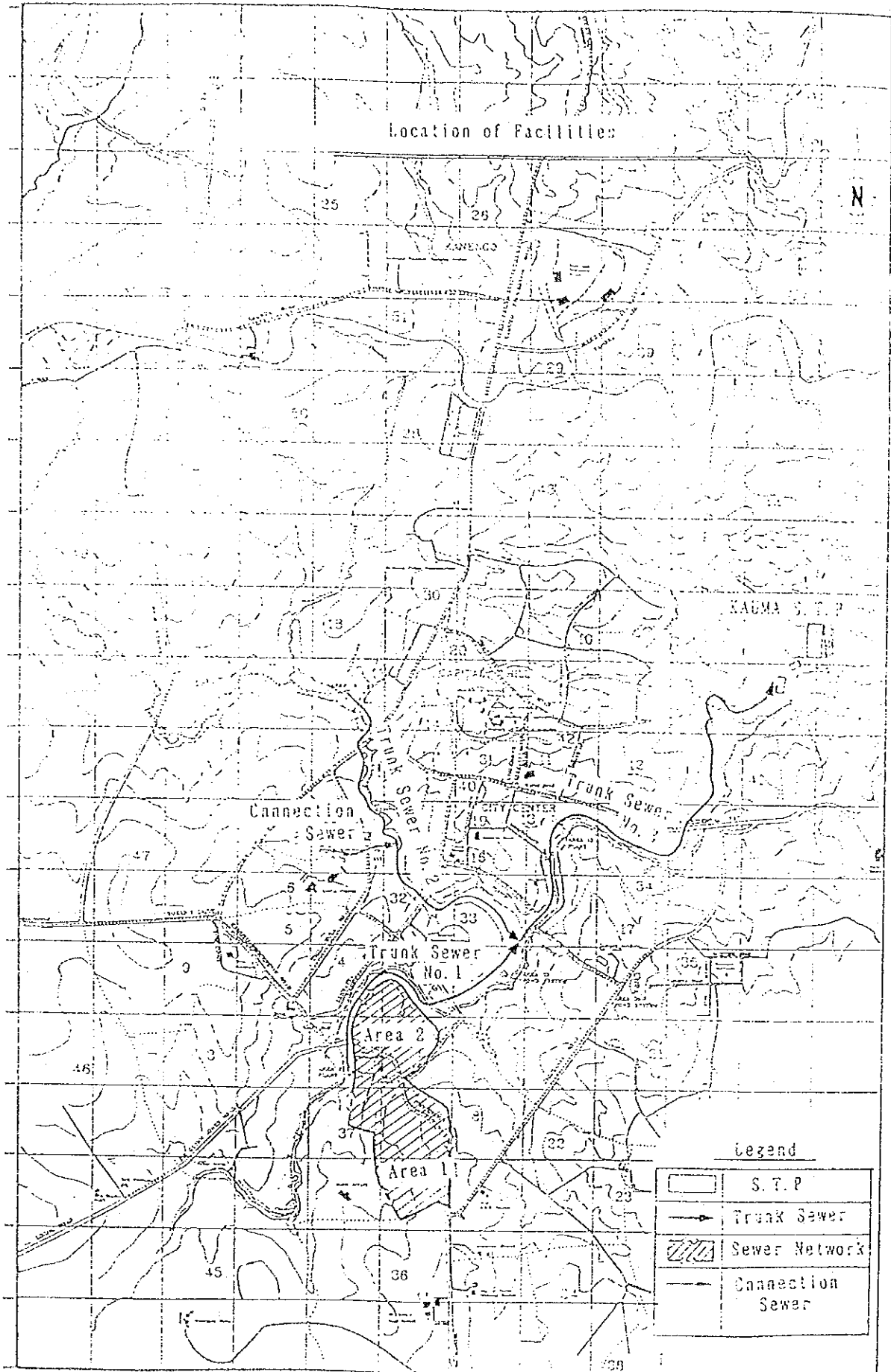
The area of the Project is a part of Lilongwe City, as shown in Annex I.

### 3. Japan's Grant Aid System

- (1) The Government of Malawi has understood the system of Japanese Grant Aid explained by the Team.
- (2) The Government of Malawi will take the necessary measures, described in Annex II, for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

### 4. Further Schedule

The Team will make the final report in accordance with the confirmed items, and send it to the Government of Malawi around February, 1994.



2.11 JMM

ANNEX II

NECESSARY MEASURES TO BE TAKEN BY THE GOVERNMENT OF MALAWI  
IN CASE JAPANESE GRANT AID ASSISTANCE IS EXECUTED

Necessary measures to be taken by the Government of Malawi in case Japanese Grant Aid Assistance is executed to the country are:

1. To provide data and information necessary for the Project.
2. To secure the sites for the Project.
3. To clear the treatment plant site and trunk sewer routes, and to construct the access to the site prior to the commencement of the construction.
4. To undertake incidental outdoor works such as gardening, fencing, gates and exterior lighting within and around the site.
5. To provide facilities to the treatment site, such as:
  - 1) water supply,
  - 2) distribution of electricity and telephone line,
  - 3) general furniture such as tables, chairs, and others for the completed facilities.
6. To bear the commission to the Japanese foreign exchange bank for the banking services based upon the banking arrangement.
7. To exempt taxes and to take necessary measures for custom clearance of the materials and equipment brought for the Project at the port of disembarkation.
8. To exempt Japanese nationals from custom duties, internal taxes and other fiscal levies which may be imposed in Malawi with respect to the supply of the products and services under the verified contracts, and
9. To bear all the expenses other than those to be borne by the Grant, necessary for the construction of the facilities as well as for the transportation and installation of the equipment.

64

21.11. J.M.M.

5. 枝線管網流量計算表





※ha当り汚水量の代表値:0.00028453 m<sup>3</sup>/s-ha

管記号	下流側管記号	排水面積		延長		流速時間	雨水流出量			汚水流出量			その他水量		計画下水管きよ			備考					
		各線	追加	各線	追加		ハクター 降水量	流出 係数	流出 面積	雨水 量	人口 密度	人口	汚水 量	各線	追加	総水量	断面		配 %	流速	流量	地盤高	管底高
		ha	ha	m	m	min	m <sup>3</sup> /sec-ha	ha	ha	m <sup>3</sup> /sec	人/ha	人	m <sup>3</sup> /sec	m <sup>3</sup> /sec	m <sup>3</sup> /sec	mm		m/sec	m <sup>3</sup> /sec	M	M	m	
1	3	1358	1858	520	520					00039					00039	150	2340	1318	00233	8200	80331	150	
2		037	037	60	60					00001					00001	150	1690	1110	00196	8300	81327	150	
3	9	135	1591	200	720					00045					00045	150	3080	1505	00266	8200	80331	150	
4	6	319	319	155	155					00009					00009	150	500	0609	00108	8200	80331	150	
5		332	332	110	110					00009					00009	150	500	0609	00108	8200	80331	150	
6	8	030	651	50	205					00019					00019	150	4440	1315	00321	8200	79551	228	
7		030	030	130	130					00002					00002	150	760	0751	00133	8000	76328	150	
8		036	827	188	393					00024					00024	150	1640	1104	00198	7900	77328	150	
9	11	035	2453	57	787					00070					00070	150	4470	1322	00322	7850	74228	150	
10		139	139	205	205					00005					00005	150	2420	1357	00240	7890	76328	150	
11	13	132	2804	210	997					00080					00080	200	3380	1919	00603	7890	71175	150	

下水道流量計算表 ( A I e a I )

※ha当り汚水量の代表値:0.00028453 m<sup>3</sup>/s・ha

管記号	下流側 管記号	排水面積		延長		雨水流出量			汚水流出量			計画下水管		備考									
		各線	透加	各線	最長	ハクタール当り降水量	流出係数	雨水換算面積	雨水量	人口密度	人口	汚水人口	汚水人口		各線	透加	断面	配	流速	流量	地盤高	管底高	土かぶり
		ha	ha	ha	m	m <sup>3</sup> /sec-ha		ha	m <sup>3</sup> /sec	人/ha	人	m <sup>3</sup> /sec	m <sup>3</sup> /sec	%	mm		m/sec	m <sup>3</sup> /sec	M	M	M	m	
12		0.85	0.85		90				0.0002			0.0002			150	6770	2242	0.9396	7190	70227	6380	64131	150
13	22	2.00	30.89		205				0.0058			0.0058			200	2490	1.647	0.9513	6520	64075	6070	58975	150
16	18	2.19	2.19		308				0.0006			0.0006			150	2620	1.395	0.9247	8100	79326	7290	71231	150
17		0.50			65				0.0001			0.0001			150	500	0.609	0.9108	7290	71231	7290	70907	132
18	19	0.54	3.23		85				0.0009			0.0009			150	3250	1.556	0.9275	7290	70907	6980	68131	150
14		1.41	1.41		173				0.0004			0.0004			150	850	0.799	0.9141	7590	74228	7440	72727	150
15		1.04	2.45		338				0.0007			0.0007			150	2780	1.437	0.9254	7440	72727	6980	68131	150
19	21	0.34	6.02		80				0.0017			0.0017			150	5620	2.043	0.9351	6980	68129	6530	63631	150
20		0.73	0.73		70				0.0002			0.0002			150	2140	1.261	0.9223	6680	65130	6530	63631	150
21		0.47	7.22		105				0.0021			0.0021			150	4920	1.804	0.9319	6530	63630	6070	59031	150
22	43	0.86	39.07		120				0.0111			0.0111			200	2600	1.651	0.9519	6070	58975	5770	55975	150

下水道流量計算表 ( A r e a i )

※ha当り汚水量の代表値:0.00028453 m<sup>3</sup>/s-ha

管記号	下流側		管積		延長		雨水流出量				汚水流出量				その他水量		計画面				水・管きよ			備考	
	管記号	ha	ha	ha	ha	m	m	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha	mm	%	m/sec	m <sup>3</sup> /sec	M	M		m
33	35	801	801	220	220									0.0023				150	2810	1310	0.0231	7890	74227	150	
34		0.99	0.99	105	105									0.0003	0.0042	0.0042	0.0042	150	4850	1398	0.0335	7890	74227	150	
35	35	274	1174	300	520									0.0033				200	1830	1412	0.0444	7890	63575	150	
23		0.50	0.50	45	45									0.0001				150	2220	1284	0.0227	8300	81330	150	
24	25	0.51	1.11	130	175									0.0003				150	2070	1240	0.0219	8300	80328	150	
25		0.77	0.77	105	105									0.0002				150	2570	1382	0.0244	8300	83330	150	
26	29	0.42	2.30	70	245									0.0007				150	3420	1594	0.0282	7930	71628	150	
27		1.00	1.00	50	50									0.0003				150	4000	1724	0.0305	8000	80331	150	
28		1.95	2.05	175	225									0.0006				150	1770	1147	0.0203	8000	78330	150	
29	32	0.42	4.77	85	330									0.0014				150	4700	1968	0.0330	7690	71228	150	

※ha当り汚水量の代表値:0.00028453 m<sup>3</sup>/s-ha

管記号	排水面積		延長		雨水流出量			汚水流出口			その他水量		計画下水管きよ			備考				
	各線	追加	m	最長	流出係数	雨水換算面積		人口密度	人口	汚水露	各線	追加	総水量	断面	流速		流量	地盤高	管底高	土かぶり
						ha	ha													
30	180	180	50	50						00005			00005	150	2468	00436	8000	7833	150	
31	155	335	215	265						00010			00010	150	1390	00180	7590	7422	150	
32	117	929	175	505						00026			00026	150	4340	00517	7290	7122	150	
36	330	2133	100	620						00061			00042	200	490	00207	6530	6357	150	
37	075	076	88	88						00002			00002	150	3400	00281	6330	6162	150	
38	010	2219	70	690						00053			00042	200	1640	00420	6330	6207	150	
39	096	096	140	140						00003			00003	150	3210	00273	6330	6213	150	
40	019	2334	75	765						00066			00042	200	2800	00549	6330	6207	150	
41	111	111	145	145						00003			00003	150	2480	00240	6330	6353	150	
42	051	2456	163	928						00071			00042	200	2450	00513	6170	5997	150	
43	064	6457	110	1492						00184			00042	300	1450	01164	5770	5589	150	
44	2394	2394	130	130						00068			00068	150	3530	00286	6070	5927	150	

下水道流況計算表 ( A r e a I )

※ha当り汚水量の代表値:0.00028453m<sup>3</sup>/s·ha

管記号	下流側管記号	排水面積		延長		流速時間		雨水流出量		汚水流出量		その他水量		計画面		水管きよ		備考		
		各線	追加	各線	追加	各線	追加	各線	追加	各線	追加	各線	追加	断面	流量	流速	流量		地盤高	管底高
		ha	ha	m	m	min	m	m <sup>3</sup> /sec·ha	ha	ha	m <sup>3</sup> /sec	m <sup>3</sup> /sec	m <sup>3</sup> /sec	m <sup>3</sup> /sec	mm	m <sup>3</sup> /sec	m/sec	M	M	m
45		000	8681	1000	2432						00252	00042	00294	300	450	0.855	0.0612	5610	54269	139
46	125	000	8681	250	2582						00252	00083	00125	375	1000	1.587	0.1753	3940	33937	210
47		156	156	118	118						00004	00004	00004	150	930	0.831	0.0147	8390	85130	150
48	50	034	190	57	175						00005	00005	00005	150	1050	0.889	0.0156	8570	84029	150
49		233	233	50	50						00007	00007	00007	150	1200	0.944	0.0167	8570	84931	150
50	58	199	532	270	445						00015	00015	00015	150	2650	1.455	0.0257	8510	83431	150
51	53	048	048	100	100						00001	00001	00001	150	2790	1.440	0.0254	8650	80926	150
52		029	029	75	75						00001	00001	00001	150	2530	1.371	0.0242	8380	82131	150
53	55	026	103	58	158						00003	00003	00003	150	2240	1.290	0.0228	8280	82130	150
54		055	055	115	115						00002	00002	00002	150	2260	1.236	0.0229	8510	83830	150
55	57	018	176	56	214						00005	00005	00005	150	3570	1.628	0.0288	8250	80931	150

日本上下水道設計株式会社

下水道流量計算表 ( A r e a 1 )

P 6

※ha当り汚水量の代表値:0.00028453 m<sup>3</sup>/s-ha

管記号	下流側管記号	排水面積		延長		流速時間 min	雨水流出量			汚水流出現			その他水量			計画下水管			備考				
		各線 ha	追加 ha	各線 m	追加 m		ハクタリ降水量 m <sup>3</sup> /sec-ha	流出係数	雨水換算面積 ha	雨水 m <sup>3</sup> /sec	人口密度 人/ha	人口各線 人	人口追加 人	汚水量 m <sup>3</sup> /sec	各線 m <sup>3</sup> /sec	追加 m <sup>3</sup> /sec	断面 mm	配 %		流速 m/sec	流量 m <sup>3</sup> /sec	地盤高 M	管底高 M
56		0.54	0.54	115	115							0.0002			0.0002	150	13.10	0.9866	0.0174	8050	8033	150	
57		0.30	2.60	93	307							0.0007			0.0007	150	33.30	1.573	0.0278	8050	7829	150	
58	50	0.15	8.07	40	483							0.0023			0.0023	150	12.50	0.9564	0.0170	7740	7573	150	
59		0.38	0.38	80	80							0.0001			0.0001	150	4.500	1.828	0.0323	8050	7823	150	
60	69	0.16	8.61	55	540							0.0024			0.0024	150	18.10	1.159	0.0205	7690	7526	151	
61		0.95	0.95	95	95							0.0003			0.0003	150	5.00	0.909	0.0108	8680	8513	150	
62	64	0.22	1.17	57	152							0.0003			0.0003	150	21.50	1.264	0.0223	8680	8455	178	
63		0.46	0.46	88	88							0.0001			0.0001	150	5.00	0.809	0.0108	8510	8343	150	
64	66	0.15	1.78	55	207							0.0005			0.0005	150	48.30	1.894	0.0335	8510	8287	194	
65		0.41	0.41	93	93							0.0001			0.0001	150	5.00	0.809	0.0108	8200	8033	150	
66	68	0.14	2.33	56	263							0.0007			0.0007	150	34.50	1.601	0.0283	8200	7986	197	

日本上下水道設計株式会社

※ha当り汚水量の代表値:0.00028483m<sup>3</sup>/s-ha

管記号	排水面積		延長		流速時間	雨水流出量			汚水流出現量			その他水量		計画面下水管きよ		備考				
	各線	透加	各線	最長		流出係数	換算面積	雨量	人口密度	人口	汚水量	各線	透加	断面	配		流量	流量	地盤高	管底高
管記号	ha	ha	ha	m	min	m <sup>2</sup> /sec-ha	ha	m <sup>2</sup> /sec	人/ha	人	m <sup>2</sup> /sec	m <sup>2</sup> /sec	m <sup>2</sup> /sec	mm	%	m <sup>3</sup> /sec	m <sup>3</sup> /sec	M	M	m
67	0.44	0.44	0.44	97	97			0.0001			0.0001	0.0001	0.0001	150	8.20	0.827	0.0146	8050	78827	150
68	0.51	3.28	1.10	378				0.0009			0.0009		0.0009	150	3.360	1.580	0.0279	7960	77931	150
69	0.14	1.03	58	598				0.0034			0.0034		0.0034	150	5.00	0.609	0.0108	7590	74231	150
70	0.81	0.81	155	155				0.0002			0.0002		0.0002	150	1.670	1.114	0.0197	7850	76327	150
71	0.81	1.815	95	693				0.0037			0.0037		0.0037	150	5.00	0.609	0.0108	7590	73941	179
72	0.00	0.00	60	60				0.0000			0.0000		0.0000	150	5.00	0.609	0.0108	8660	84931	150
73	0.37	0.37	50	110				0.0001			0.0001		0.0001	150	3.690	1.633	0.0289	8660	84929	131
74	0.46	0.83	115	225				0.0002			0.0002		0.0002	150	3.040	1.303	0.0266	8450	82331	150
75	0.54	0.54	80	80				0.0002			0.0002		0.0002	150	1.250	0.964	0.0170	8200	80331	150
76	0.99	1.46	35	260				0.0004			0.0004		0.0004	150	1.420	1.027	0.0181	8100	79328	150
77	0.59	0.59	105	105				0.0002			0.0002		0.0002	150	5.00	0.609	0.0108	8050	78831	150

下水道流量計算表 ( A r e a )

※ha当り汚水量の代表値:0.00028453 m<sup>3</sup>/s-ha

管記号	下流側 管記号	排水面積		延長		流送時間 min	雨水流出量		汚水流出量		計画		水 管 ぎ			備 考									
		各線	通加	各線	通加		ハクター 降水量	流出 係数	雨水 換算面積	雨水 通加	人口 密度	人口 各線	汚水 通加	其他 通加	給水 通加		断面	配 %	流送 m/sec	流量 m <sup>3</sup> /sec	流量 m <sup>3</sup> /sec	地盤高	管底高	土か ぶり	
		ha	ha	m	m		m/sec-ha	ha	ha	人/ha	人	m <sup>3</sup> /sec	m <sup>3</sup> /sec	m <sup>3</sup> /sec	mm					M	M	m			
78	80	0.14	2.29	56	316						0.0007		0.0021	0.0028	150	26.30	0.398	0.0247		80.50	78.50	78.50	78.50	203	150
79		0.88	0.88	149	149						0.0003			0.0003	150	5.90	0.609	0.0108		79.20	77.50	76.78	76.78	154	150
80	83	0.21	3.98	65	381						0.0010		0.0021	0.0031	150	22.40	1.290	0.0228		78.50	77.00	76.78	76.78	154	150
81		0.66	0.66	90	90						0.0002			0.0002	150	15.50	1.073	0.0190		78.80	77.40	77.12	77.12	150	150
82		2.23	2.29	200	290						0.0008			0.0008	150	5.90	0.609	0.0108		77.40	77.00	75.73	75.73	150	150
83		0.42	6.69	80	461						0.0019		0.0021	0.0040	150	6.20	0.679	0.0120		77.00	75.90	74.73	74.73	210	150
84	86	2.56	2.50	430	1123						0.0084		0.0021	0.0085	200	27.10	1.719	0.0540		75.90	75.90	73.47	73.47	226	150
85		0.64	0.64	85	85						0.0002			0.0002	150	5.90	0.609	0.0108		83.80	83.50	82.31	82.31	150	150
86		0.13	2.27	50	1173						0.0056		0.0021	0.0087	200	5.90	0.334	0.0138		83.50	81.00	81.75	81.75	150	150
87	95	0.95	2.422	210	1383						0.0059		0.0021	0.0090	200	9.50	1.018	0.0320		81.00	80.00	80.00	80.00	150	150
88	50	3.96	3.96	135	135						0.0011			0.0011	150	14.80	1.048	0.0185		70.00	68.00	68.30	68.30	150	150



※ha当り汚水量の代表値:0.00026453 m<sup>3</sup>/s・ha

管記号	下流側 管記号	排水面積		延長		流速 時間 min	雨水流出量			汚水流出現			計画面			下水管			備考	
		各線	追加	各線	追加		係数	各線	追加	面積	人口	各線	追加	断面	配	流速	流量	地盤高		管底高
		ha	ha	m	m		ha	ha	m <sup>3</sup> /sec	人/ha	人	m <sup>3</sup> /sec	m <sup>3</sup> /sec	mm	%	m/sec	m <sup>3</sup> /sec	M	M	m
89		0.88	0.88	80	80				0.0002			0.0002	0.0002	150	500	0.509	0.0108	6.700	6.331	1.50
90		0.86	5.50	120	255				0.0016			0.0016	0.0016	150	3240	1.551	0.0274	6.800	6.431	2.90
91		2.91	2.91	210	210				0.0008			0.0008	0.0008	150	1.950	1.203	0.0213	6.930	6.560	1.50
92	94	0.09	6.50	35	290				0.0024			0.0024	0.0024	150	5.710	2.059	0.0364	6.270	6.103	1.50
93		0.14	0.14	45	45				0.0001			0.0001	0.0001	150	6.60	0.700	0.0124	6.130	5.936	1.50
94		0.13	8.77	40	330				0.0025			0.0025	0.0025	150	4.240	1.775	0.0314	6.070	5.902	1.50
95		0.62	3.661	70	1453				0.0096			0.0021	0.0117	200	4.860	2.302	0.0723	5.990	5.725	1.50
96	98	0.68	3.429	100	1553				0.0098			0.0021	0.0118	200	4.600	2.239	0.0703	5.580	5.387	1.50
97		0.79	0.79	100	100				0.0002			0.0002	0.0002	150	5.00	0.609	0.0108	5.020	4.853	1.50
98	100	0.20	3.528	40	1593				0.0100			0.0021	0.0121	200	5.60	0.774	0.0243	5.160	4.793	2.79
99		0.31	0.31	40	40				0.0001			0.0001	0.0001	150	5.00	0.609	0.0108	5.160	4.973	1.70
100		0.26	3.585	100	1693				0.0102			0.0021	0.0123	200	2.370	1.574	0.0526	5.160	4.776	3.61

日本上下水道設計株式会社

※ha当り汚水量の代表値:0.00028453m<sup>3</sup>/s-ha

管記号	下流側管記号	排水面積		延長		流達時間	雨水流出量			汚水流出量			計画下水管			備考								
		各線	追加	ha	m		ha	m	ha	m <sup>3</sup> /sec-ha	人口密度	人口	汚水量	各線	追加		総水量	断面	配	流速	流量	地盤高	管底高	土かぶり
101	103	0.32	36.17	75	1768							0.0103	0.0021	0.0124	200	1330	1204	0.0378	4.930	4.930	4.930	4.930	1.50	1.50
102		0.24	0.24	60	60							0.0001	0.0001	0.0001	150	5030	1927	0.0341	4.930	4.930	4.930	4.930	1.50	1.50
103	105	0.17	35.58	65	1833							0.0104	0.0021	0.0125	200	1830	1357	0.0426	4.650	4.650	4.650	4.650	1.50	1.50
104		0.45	0.45	110	110							0.0001	0.0001	0.0001	150	1000	0.62	0.0152	4.650	4.650	4.650	4.650	1.50	1.50
105	124	0.24	37.27	95	1928							0.0106	0.0021	0.0127	200	2000	1476	0.0454	4.480	4.480	4.480	4.480	1.50	1.50
115		0.90	0.90	125	125							0.0003	0.0003	0.0003	150	800	0.71	0.0136	5.580	5.580	5.580	5.580	1.50	1.50
116	118	0.37	127	90	215							0.0004	0.0004	0.0004	150	4430	1316	0.0321	5.460	5.460	5.460	5.460	1.50	1.50
117		0.28	0.28	50	50							0.0001	0.0001	0.0001	150	2000	12.19	0.0215	5.180	5.180	5.180	5.180	1.50	1.50
118	119	1.00	2.55	160	375							0.0007	0.0007	0.0007	150	2860	1237	0.0219	5.050	5.050	5.050	5.050	1.50	1.50
106	103	0.99	0.99	115	115							0.0003	0.0003	0.0003	150	500	0.609	0.0108	6.190	6.190	6.190	6.190	1.50	1.77

※ha当り汚水量の代表値:0.00028453m<sup>3</sup>/s・ha

管記号	下流側 管記号	排水面積		延長		流達時間 min	雨水流出量			汚水流出量			計画下水管さよ			備考	
		各線	追加	ha	ha		ha	ha	ha	ha	ha	mm	%	m/sec	m <sup>3</sup> /sec		M
		ハクダール当り 降水量	流出 係数	雨水換算面積 追加	雨水量 追加	人口 密度	人口 各線	汚水量 追加	汚水量 各線	その他水量 追加	総水量 追加	断面	流速	流量	地盤高	管底高	土かぶり
107		0.88	0.88	105	105			0.0003				150	1.480	0.0262	5.380	52.130	150
108	112	0.64	2.51	125	240			0.0007				150	1.354	0.0345	6.070	58.737	150
109		0.88	0.88	70	70			0.0003				150	0.609	0.0108	5.310	51.431	150
110	112	0.00	0.88	50	120			0.0003				150	0.609	0.0108	5.430	51.001	305
111		0.88	0.88	115	115			0.0003				150	0.621	0.0110	5.450	52.930	150
112	114	0.17	4.44	45	285			0.0013				150	1.219	0.0215	5.400	50.831	300
113		0.30	0.30	40	40			0.0001				150	0.609	0.0108	5.160	49.931	150
114		0.36	5.10	85	370			0.0015				150	1.392	0.0334	5.160	49.731	170
119	121	0.00	7.65	15	390			0.0022				150	0.609	0.0108	4.730	45.556	158
120		0.46	0.46	60	60			0.0001				150	0.721	0.0304	4.970	48.025	151
121	124	0.35	8.46	100	490			0.0024				150	1.770	0.0319	4.730	45.556	158

※ha当り汚水量の代表値:0.00028453m<sup>3</sup>/s・ha

管記号	下流側 管記号	排水面積		雨水流出量				汚水流出口			その他水量			計画下水管きよ				備考					
		各線	追加	各線	追加	流出係数	雨水換算面積	各線	追加	人口密度	人口	汚水量	各線	追加	総水量	断面	さじ		流速	流量	地盤高	管底高	土かさり
		ha	ha	ha	ha	ha	ha	m <sup>3</sup> /sec	m <sup>3</sup> /sec	人/ha	人	m <sup>3</sup> /sec	m <sup>3</sup> /sec	m <sup>3</sup> /sec	mm	mm	m	m/sec	m <sup>3</sup> /sec	M	M	m	
122		0.33	0.33									0.0001			0.0001	150	150	1.490	0.0268	4.970	4.970	1.51	
123		0.32	0.65									0.0002			0.0002	150	150	1.724	0.0305	4.700	4.700	1.50	
124		0.01	4.639									0.0132			250	250	2.441	0.1198	4.390	4.390	1.50		
125	MH 101	0.90	13.500									0.0384			450	450	0.789	0.1175	3.630	3.630	1.50		

※ha当り汚水の代表値:0.00037450 m<sup>3</sup>/s・ha

管記号	下流側管記号	排水面積		延長		流速時間 min	雨水流出量		汚水流出量		計画下水管きよ			備考														
		各線 ha	追加 ha	各線 m	追加 m		流出 係数	雨水 ha	雨水 ha	人口 密度	人口 人	汚水 m <sup>3</sup> /sec	各線 m <sup>3</sup> /sec		追加 m <sup>3</sup> /sec	断面 mm	割合 %	流速 m/sec	流量 m <sup>3</sup> /sec	地盤高 M	管底高 M	土かぶり m						
						ハクタリ m <sup>3</sup> /sec・ha																	降水 m <sup>3</sup> /sec	人口 人/ha	人口 人	汚水 m <sup>3</sup> /sec	雨水 m <sup>3</sup> /sec	雨水 m <sup>3</sup> /sec
1-1		0.93	0.93	120	120							0.0003		0.0003	150	4.430	1.325	0.0323	4.390	4.225	1.51							
1-2	MH 109	0.90	0.93	60	180							0.0003		0.0003	150	5.730	2.063	0.0365	3.850	3.683	1.50							

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下水道流量計算表 ( A r e a 2 )

※ha当り汚水量の代表値:0.00037450m<sup>3</sup>/s-ha

管記号	下流側 管記号	排水面積		延長		流速時間 min	雨水流出量			汚水流出量			その他水量		計画下水管きよ			備考				
		各線	追加	各線	追加		流出係数	ha	ha	ha	ha	ha	ha	ha	ha	ha	断面		配	流速	流量	地盤高
		ha	ha	m	m		m <sup>2</sup> /sec-ha	m <sup>2</sup> /sec	m <sup>2</sup> /sec	m <sup>2</sup> /sec	m <sup>2</sup> /sec	m <sup>2</sup> /sec	m <sup>2</sup> /sec	m <sup>2</sup> /sec	mm	%	m/sec	m <sup>3</sup> /sec	M	M	M	m
2	4	240	240	60	60					0.0009			0.0009	0.150	500	0.609	0.108	6070	59031	6070	59031	150
3		534	534	20	20					0.0029			0.0029	0.150	500	0.609	0.108	6070	59031	6070	59031	150
4	6	236	1080	185	245					0.0040			0.0040	0.150	500	0.609	0.108	6070	59031	6070	59031	150
5		052	052	50	50					0.0002			0.0002	0.150	500	0.609	0.108	5990	58221	5990	58221	150
6		086	1208	90	335					0.0045			0.0045	0.150	1970	1210	0.214	5990	57008	5770	56031	150
7	9	023	1231	48	383					0.0046			0.0046	0.150	3120	1522	0.269	5770	56029	5620	54531	150
8		026	026	60	60					0.0001			0.0001	0.150	830	0.785	0.139	5670	55029	5620	54531	150
9	11	023	1230	50	433					0.0048			0.0048	0.150	2790	1440	0.254	5620	54526	5480	53131	150
10		027	027	60	60					0.0001			0.0001	0.150	1330	0.994	0.176	5590	53929	5600	53929	150
11	12	018	1325	45	478					0.0050			0.0050	0.150	3110	1520	0.259	5480	53130	5340	51731	150
12		022	022	60	60					0.0001			0.0001	0.150	1990	1216	0.215	5460	52925	5460	52925	150

下水道流量計算表 ( A r e a 2 )

※ha当り汚水量の代表値:0.00037450m<sup>3</sup>/s-ha

管記号	排水面積		延長		流速時間 min	雨水流出量			汚水流出量			その他水量			計画下水管きよ			備考				
	各線	追加	各線	追加		ハクター 降水量	流出 係数	雨水 ha	雨水 m <sup>3</sup> /sec	人口 密度	人口 人	汚水量 m <sup>3</sup> /sec	汚水量 m <sup>3</sup> /sec	各線	追加	断面	配		流速	流量	地盤高	管底高
管記号	ha	ha	m	m	m <sup>3</sup> /sec-ha		ha	m <sup>3</sup> /sec	人/ha	人	m <sup>3</sup> /sec	m <sup>3</sup> /sec	m <sup>3</sup> /sec	m <sup>3</sup> /sec	mm	%	m/sec	m <sup>3</sup> /sec	M	M	m	
13	016	1353	42	520				00051			00001				150	3090	1515	00266	5340	51729	150	
14	025	025	60	60				00001			00001				150	1000	0362	00152	5270	51931	150	
15	025	1413	60	580				00053			00053				150	2160	1267	00224	5210	50427	150	
16	023	023	60	60				00001			00001				150	530	0309	00108	5090	49231	150	
17	010	1446	43	623				00054			00054				150	2550	1376	00243	5080	48927	170	
18	360	360	290	290				00013			00013				150	1550	1373	00190	5510	54420	150	
19	042	402	75	365				00015			00015				150	1730	1134	00200	5160	49330	150	
20	194	194	276	275				00007			00007				150	2420	1341	00237	5700	55327	150	
21	030	030	45	45				00001			00001				150	500	0309	00108	4840	47731	150	
22	013	639	50	415				00024			00024				150	500	0309	00108	5030	47506	263	
23	059	2144	148	771				00080			00080				200	1300	1190	00374	4950	47206	207	

※ha当り汚水量の代表値:0.00037450 m<sup>3</sup>/s-ha

管記号	下流側 管記号	排水面積		雨水流出量			汚水流出量			その他水量		計画面		水 管 ぎ よ			備 考		
		各線	追加	ハクタール当り 降水量	流出係数	雨水換算面積 追加	雨水量	人口密度	人口	汚水量	各線	追加	断面	配	流速	流量		地盤高	管底高
		ha	ha	m <sup>3</sup> /sec-ha		ha	m <sup>3</sup> /sec	人/ha	人	m <sup>3</sup> /sec	m <sup>3</sup> /sec	mm	%	m/sec	m <sup>3</sup> /sec	M	M	m	
24		1.06	1.06				0.0004			0.0004		150	20.80	1.234	0.9218	4850	4533	150	
25	40-1	0.48	2.98				0.0086			0.0086		200	43.10	2.167	0.9681	4700	4217	150	
30		0.59	0.59				0.0002			0.0002		150	20.80	1.508	0.9266	5770	5603	150	
31		0.53	1.22				0.0005			0.0005		150	27.00	1.416	0.9250	3310	5142	150	
32	33	0.28	1.30				0.0006			0.0006		150	5.00	0.609	0.0108	4850	4631	150	
26		0.42	0.42				0.0002			0.0002		150	5.00	0.609	0.0108	5770	5603	150	
27		0.46	0.88				0.0003			0.0003		150	1.950	1.203	0.9213	5770	5573	150	
28	33	0.56	1.44				0.0005			0.0005		150	3.930	1.721	0.9304	5460	5293	150	
29		0.22	0.22				0.0001			0.0001		150	8.80	0.785	0.9139	4950	4733	150	
33	35	0.14	3.30				0.0012			0.0012		150	16.20	1.163	0.9205	4900	4640	238	
34		0.24	0.24				0.0001			0.0001		150	2.150	1.267	0.9224	4860	4697	150	



下水道流量計算表 ( A r e a 2 )

※ha当り汚水量の代表値:0.00037450m<sup>3</sup>/s-ha

管記号	下流側管記号	排水面積		延長		流速時間 min	雨水流出量		汚水流出量		その他水量		計画下水道管きよ		備考								
		各線	追加	各線	延長		係数	流出	雨水交換面積	雨水量	人口密度	人口	汚水量	各線		通加	通加	断面	配	流速	流量	地盤高	管底高
		ha	ha	m	m	m <sup>2</sup> /sec-ha	ha	ha	m <sup>3</sup> /sec	人/ha	人	m <sup>3</sup> /sec	m <sup>3</sup> /sec	m <sup>3</sup> /sec	mm	%	m/sec	m <sup>3</sup> /sec	M	M	m		
35	37	0.28	3.32	53	494				0.0014			0.0014		0.0014	150	3.200	1.542	0.3272	4.730	4.5327	1.50		
36		0.25	0.25	60	60				0.0001			0.0001		0.0001	150	3.660	1.649	0.0291	4.730	4.6127	1.50		
37	40-1	0.21	4.28	50	544				0.0016			0.0016		0.0016	150	3.330	1.587	0.0220	4.530	4.3326	1.51		
38		0.69	0.69	116	116				0.0003			0.0003		0.0003	150	3.960	1.715	0.0303	4.830	4.6328	1.50		
39		0.35	1.04	85	201				0.0004			0.0004		0.0004	150	5.00	0.609	0.0108	4.390	4.2331	1.50		
40-1		1.39	2.69	105	948				0.0111			0.0111		0.0111	200	2.450	1.637	0.0514	4.390	4.1758	1.52		
40-2	44	0.00	2.69	45	998				0.0111			0.0111		0.0111	200	3.50	0.618	0.0194	4.090	3.9175	1.50		
41	43-1	0.95	0.95	137	137				0.0004			0.0004		0.0004	150	3.350	1.577	0.0279	5.160	4.9927	1.50		
42		0.98	0.98	80	80				0.0004			0.0004		0.0004	150	1.870	1.179	0.0208	4.850	4.6329	1.50		
43-1		2.21	4.14	170	307				0.0016			0.0016		0.0016	150	3.580	1.691	0.0228	4.730	4.5331	1.50		
43-2		0.00	4.14	65	372				0.0016			0.0016		0.0016	150	5.00	0.609	0.0108	4.090	3.9231	1.50		
44	MH 113	0.52	3.35	100	1093				0.0129			0.0129		0.0129	200	5.830	0.521	0.0752	4.090	3.8257	1.32		

下水道流量計算表 (Area 2)

P 18

※1ha当り汚水量の代表値:0.00037450m<sup>3</sup>/s-ha

管記号	下流側 管記号	排水面積		延長		流速時間 min	雨水流出量		汚水流出口			その他水量		計画下水道管きよ				備考					
		各線 ha	追加 ha	各線 m	最長 m		ハクタール 降水量 m <sup>3</sup> /sec-ha	流出 係数	雨水 m <sup>3</sup> /sec	人口 密度 人/ha	人口 各線 人	汚水量 m <sup>3</sup> /sec	各線 m <sup>3</sup> /sec	透加 m <sup>3</sup> /sec	総水量 m <sup>3</sup> /sec	断面 mm	割合 %		流速 m/sec	流量 m <sup>3</sup> /sec	地盤高 M	管底高 M	土かぶり m
45		192	192	80	80								0.0007	0.0007	150	18.70	1.179	0.0208	4850	46826	150		
46		309	501	148	228								0.0019	0.0019	150	41.20	1.749	0.0309	4700	45330	150		
47	MH 115	402	903	200	428								0.0034	0.0034	150	31.70	1.534	0.0271	4090	39231	150		

※ha当り汚水量の代表値:0.00037450 m<sup>3</sup>/s・ha

管記号	下流側 管記号	排水面積		延長		流 速 時 間 min	雨水流出量		汚水流出量			その他水量		計 画 下 水 管 さ よ						備 考	
		各 線	加 込	各 線	最 長		流出係数	雨水 換算面積	人口 密度	人口 各線	汚水 量	汚水 各線	各線 追加	総水量	断面	配	流速	流量	地盤高		管底高
		ha	ha	ha	m	ha	m <sup>2</sup> /sec・ha	ha	人/ha	人	m <sup>3</sup> /sec	m <sup>3</sup> /sec	m <sup>3</sup> /sec	mm	%	m/sec	m <sup>3</sup> /sec	M	M	m	
48		163	163		150						0.0006		0.0006	150	3050	1508	0.0266	4240	40731	150	
49	MH 123	1359	1522		460						0.0057		0.0057	150	2850	0795	0.0140	3730	36131	150	

※ha当り汚水量の代表値:0.00037450m<sup>3</sup>/s-ha

管記号	下流側	排水面積		延長		流速時間	雨水流出現象		雨水量		汚水流出量		その他水量		計画面下水管きよ		備考					
		各線	追加	各線	追加		ハクタール当り降水量	流出係数	各線	追加	人口密度	人口	汚水量	各線	追加	断面		配	流速	流量	地盤高	管底高
	管記号	ha	ha	m	m	min	m <sup>2</sup> /sec-ha	ha	ha	m <sup>2</sup> /sec	人/ha	人	m <sup>3</sup> /sec	m <sup>3</sup> /sec	mm	%	m/sec	m <sup>3</sup> /sec	M	M	m	
50	54	157	157	180	180					0.0006		0.0006			150	2550	1.376	0.0243	5150	4928	150	
51															150	1700	1.124	0.0199	4850	46829	150	
52	54	040	280	76	164					0.0010		0.0010			150	500	0.609	0.0108	4730	45831	150	
53															150	500	0.609	0.0108	4730	44851	188	
54	56	269	813	210	390					0.0030		0.0030			150	2880	1.463	0.0288	4730	43781	305	
55															150	2840	1.318	0.0283	4240	40729	150	
56	58	167	1155	138	528					0.0043		0.0043			150	2840	1.290	0.0228	3940	37728	150	
57															150	730	0.761	0.0185	3730	36126	151	
58	MH 133	075	1449	100	628					0.0054		0.0054			150	3290	1.563	0.0276	3630	34631	150	

下水道流量計算表 ( A r c a 2 )

※ha当り汚水量の代表値:0.00037450 m<sup>3</sup>/s-ha

管記号	排水面積		延長		流速時間	雨水流出現			汚水流出現			その他水量		計画下水道管				備考					
	各線	追加	ha	m		ハクタリ 降水量	流出係数	ha	ha	ha	人口密度	人口	汚水量	各線	透加	断面	こう配		流速	流量	地盤高	管底高	土かぶり
管記号	ha	ha	m	m	m/min	m <sup>3</sup> /sec-ha		ha	ha	人/ha	人	m <sup>3</sup> /sec	m <sup>3</sup> /sec	m <sup>3</sup> /sec	mm	%	m/sec	m <sup>3</sup> /sec	M	M	m		
59	131	131	110	110	110							00005			03005	150	500	05009	00108	5150	49331	150	
60	131	262	155	265								00010			03010	150	1540	1104	00195	5150	49331	295	
61	140	402	135	400								00015			03015	150	500	05009	00108	5010	49156	372	
62	110	110	113	113								00004			03004	150	3980	1719	00394	5610	54430	150	
63	088	088	80	80								00003			03003	150	3000	1493	00264	5150	49331	150	
64	016	194	40	153								00007			03007	150	3750	1669	00283	5150	49331	150	
65	294	890	250	550								00033			03033	150	2760	1432	00253	5010	46156	379	
66	373	373	318	318								00014			03014	150	4110	1747	00309	5400	51993	184	
67	160	1423	137	787								00053			03053	150	2200	1278	00225	4090	38249	248	
68	490	490	350	350								00018			03018	150	3310	1568	00277	5400	52331	150	
69	306	796	270	620								00030			03030	150	2030	1228	00211	4240	40727	150	
70	MH 136	099	100	887								00087			03087	200	4220	2145	00674	3690	35175	150	

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※ha当り汚水量の代表値:0.00037450 m<sup>3</sup>/s・ha

管記号	下流側	排水面積		延長		流速時間	雨水流出量		汚水流出力		その他水盤		計画下水道		管さよ		備考						
		各線	追加	ha	ha		ha	ha	ha	ha	ha	ha	断面	流速	流量	地盤高		管底高	土かぶり				
管記号	管記号	ha	ha	m	m	min	ハクタール当り降水係数	流出係数	各線	追加	密度	人口	人口	各線	追加	総水盤	断面	流速	流量	地盤高	管底高	土かぶり	
71		1089	1089	380	380						0.0040		0.0040		0.0040	0.0040	150	3210	1544	0.0273	4700	4533	150
72	75	000	1089	10	390						0.0040		0.0040		0.0040	0.0040	150	500	0809	0.0108	3480	3319	150
73		126	126	100	100						0.0005		0.0005		0.0005	0.0005	150	4690	1348	0.0327	6090	5923	150
74		264	390	60	160						0.0015		0.0015		0.0015	0.0015	150	2500	1363	0.0241	6630	6463	150
75	MH 138	096	1555	270	660						0.0058		0.0058		0.0058	0.0058	150	840	0790	0.0140	8480	8303	155

## 6. カウマ処理場容量計算





## 資料6 カウマ下水処理場容量計算

### 1) 計画諸元

#### ① 計画基本事項

- 名 称 : (仮称)カウマ下水処理場  
 位 置 : リロンゲ市エリア44  
 敷 地 面 積 : 約40ha  
 地 盤 高 : 現在地盤高 1,007 ~1030m  
 周囲の土地利用 : 畑耕作、荒地  
 下水の排除方式 : 分流式  
 処理処分方式 : 下水処理 安定化池法(嫌気性池-通性池-熟成池)  
                   汚泥処理 池排水-天日乾燥-投棄  
 放流先及び水位 : 放流先 リロンゲ川  
                   既往洪水位 不明  
                   計画最高水位 HHWL+1,007m  
 計画目標年次 : 2000年(今回計画)、2005年(全体計画)  
 最低月平均気温 : 15.2℃(7月)

#### ② 計画下水量

		全体計画 (m <sup>3</sup> /日)	今回計画 (m <sup>3</sup> /日)
日 平 均	Q1	15,600	6,100
時 間 最 大	Q2	35,880	14,030

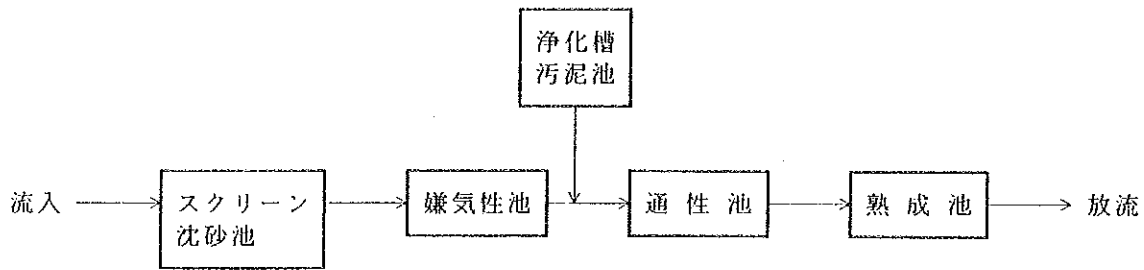
(計画人口 全体約67,000人、今回約22,000人)

#### ③ 計画水質

	流 入 水	処 理 水
BOD <sub>5</sub> (mg/ℓ)	300	20
SS (mg/ℓ)	350	30
大腸菌群数 (MPN/100ml)	2.0 × 10 <sup>7</sup>	1.0 × 10 <sup>3</sup>

\*処理水水質は目標値である。

2) 処理フローシート



・搬出汚泥量について

池内堆積汚泥は含水率97%とし、搬出時は天日乾燥を行うので含水率80%とする。

$$\text{汚泥減量率} = \frac{100-97}{100-80} = 0.15$$

3) 容量計算

項目		全体計画	今回計画
1. 沈砂池			
形式		平行流式	同左
時間最大汚水量	Q2	35,880 m <sup>3</sup> /d = 0.415 m <sup>3</sup> /s	14,030 m <sup>3</sup> /d = 0.162 m <sup>3</sup> /s
水面積負荷	Lg	1,800 m <sup>2</sup> /m <sup>2</sup> /d	同左
必要水面積	Ag	35,880 × 1/1,800 = 19.93 m <sup>2</sup>	14,030 × 1/1,800 = 7.79 m <sup>2</sup>
平均流速	v	0.3 m/s	同左
有効水深	h	約0.6 m	同左
必要池幅	w	0.415 × 1/0.3 × 1/0.6 = 2.31 m → 2.40 m	0.162 × 1/0.3 × 1/0.6 = 0.90 m
必要池長	L	19.93 × 1/2.40 = 8.30 m	7.79 × 1/1.2 = 6.49 m
構造寸法		巾1.2 m × 長8.5 m × 2水路	巾1.2 m × 長8.5 m × 2水路 (内1水路予備)
発生沈砂量		汚水量 1,000 m <sup>3</sup> 当り 0.01 m <sup>3</sup>	同左
発生スクリーンかす量		15,600 × $\frac{0.01}{1,000}$ = 0.156 m <sup>3</sup> /d 発生沈砂量と同量	6,100 × $\frac{0.01}{1,000}$ = 0.061 m <sup>3</sup> /d 同左

(検討)			
水面積負荷	Lg	$35,880 \times 1 / (1.2 \times 8.5 \times 2)$ $= 1,759 \text{ m}^3 / \text{m}^2 / \text{d} \dots 0\text{K}$	$14,030 \times 1 / (1.2 \times 8.5 \times 1)$ $= 1,375 \text{ m}^3 / \text{m}^2 / \text{d} \dots 0\text{K}$
平均流速	v	$0.415 \times 1 / (0.6 \times 1.2 \times 2)$ $= 0.29 \text{ m/s} \dots \dots \dots 0\text{K}$	$0.162 \times 1 / (0.6 \times 1.2)$ $= 0.23 \text{ m/s} \dots \dots \dots 0\text{K}$
2. 計量装置			
型式		パーシャルフリューム	同 左
容量		時間最大 $35,880 = 1,495 \text{ m}^3 / \text{hr}$ $\rightarrow 1,800 \text{ m}^3 / \text{hr}$	時間最大 $14,030 = 585 \text{ m}^3 / \text{hr}$ $\rightarrow 1,800 \text{ m}^3 / \text{hr}$
設置数		1基	1基
3. 嫌気性池			
型式		土堰堤式矩形池	同 左
流入BOD 負荷量	Li	$15,600 \times 300 \times 10^{-3}$ $= 4,680 \text{ kg BOD}_5 / \text{d}$	$6,100 \times 300 \times 10^{-3}$ $= 1,830 \text{ kg BOD}_5 / \text{d}$
BOD 容積負荷	v	気温 $T_a = 15.2^\circ\text{C}$ として $v = 160 \text{ g BOD}_5 / \text{m}^3 \cdot \text{d}$	同 左
有効必要容積	V1	$4,680 \times 10^3 \times 1 / 160$ $= 29,250 \text{ m}^3$	$1,830 \times 10^3 \times 1 / 160$ $= 11,440 \text{ m}^3$
汚泥堆積量	V2	5年に1回搬出するものとする $67,000 \text{ 人} \times 0.04 \text{ m}^3 / \text{人} / \text{年}$ $\times 5 \text{ 年}$ $= 13,400 \text{ m}^3$	同 左 $22,000 \text{ 人} \times 0.04 \text{ m}^3 / \text{人} / \text{年}$ $\times 5 \text{ 年}$ $= 4,400 \text{ m}^3$
搬出量 (天日乾燥) 97w% → 80w%		$\frac{100-97}{100-80} \times 13,400 = 2,010 \text{ m}^3 / 5 \text{ 年}$	$\frac{100-97}{100-80} \times 4,400 = 660 \text{ m}^3 / 5 \text{ 年}$
池必要容量	V	$V1 + V2$ $= 42,650 \text{ m}^3$	$V1 + V2$ $= 15,840 \text{ m}^3$
池水深	Da	4.0m	4.0m
所要水面積 U	Aa	$42,650 \times 1 / 4$ $= 10,663 \text{ m}^2$	$15,840 \times 1 / 4$ $= 3,960 \text{ m}^2$
構造寸法		幅(54 ~ 30) × 長(62 ~ 38) × 水深4.0m × 5 池 ( ) は水面バルでの長さ ~ 池底での長さ. 以下同じ	幅(54 ~ 30) × 長(62 ~ 38) × 水深4.0m × 3 池 (内1池予備)
(検討)			
有効容量	V'	$4.0 \times 1/3 \times (54 \times 62 + 30 \times 38$ $+ (54 \times 62 \cdot 30 \times 38)) \times 5$ $- 13,400 = 29,545 \text{ m}^3$	$4.0 \times 1/3 \times (54 \times 62 + 30 \times 38$ $+ (54 \times 62 \cdot 30 \times 38)) \times 2$ $- 4,400 = 12,778 \text{ m}^3$

BOD 容積負荷	v	$4,680 \div 29,545 \times 10^3$ $= 158 \text{g-BOD}^5 / \text{m}^3 / \text{d} \dots 0\text{K}$	$1,830 \div 12,778 \times 10^3$ $= 143 \text{g-BOD}^5 / \text{m}^3 / \text{d} \dots 0\text{K}$
有効滞留日数	Ra	$29,545 \div 15,600$ $= 1.9 \text{d} \dots 0\text{K}$	$12,778 \div 6,100$ $= 2.1 \text{d} \dots 0\text{K}$
流出BOD <sub>5</sub> 濃度	Le	$300 \times (1-0.5)$ $= 150 \text{mg} / \ell$	$300 \times (1-0.5)$ $= 150 \text{mg} / \ell$
4. 浄化槽汚泥池			
型式		土堰堤式矩形池	同 左
処理人口		約120,000 人	約119,000人×60%=71,400人 (処理率)
浄化槽汚泥発生量		0.001 m <sup>3</sup> /人/日	同 左
BOD 濃度	l	5,000 mg/ℓ	同 左
投入汚泥量	S	$120,000 \times 0.001$ $= 120 \text{m}^3 / \text{日}$	$71,400 \times 0.001$ $= 71 \text{m}^3 / \text{日}$
必要容量	Vs	①滞留日数20日以上 $120 \times 20$ $= 2,400 \text{m}^3$  ②容積負荷 200gBOD/m <sup>3</sup> /d $120 \times 5,000 \div 200$ $= 3,000 \text{m}^3$  ①<②..... 3,000m <sup>3</sup>	① $71 \times 20$ $= 1,420 \text{m}^3$  ② $71 \times 5,000 \div 200$ $= 1,775 \text{m}^3$  ①<②..... 1,775m <sup>3</sup>
運転方法		交互運転	同 左
構造寸法・容量		幅(28.2~10.2)×長(42.2~24.2)×水深3.0m×3池 (内1池常時静置)  $3.0 \times 1/3 \times (28.2 \times 42.2 + 10.2 \times 24.2 + (28.2 \times 42.2 \times 10.2 \times 24.2)) \times 2 = 3,958 \text{m}^3 \dots 0\text{K}$	幅(28.2~10.2)×長(42.2~24.2)×水深3.0m×2池 (内1池常時静置)  $3.0 \times 1/3 \times (28.2 \times 42.2 + 10.2 \times 24.2 + (28.2 \times 42.2 \times 10.2 \times 24.2)) = 1,979 \text{m}^3 \dots 0\text{K}$
流出BOD 負荷量		$120 \times 5,000 \times (1-0.5) \times 10^{-3}$ $= 300 \text{kg-BOD}_5 / \text{d}$	$71 \times 5,000 \times (1-0.5) \times 10^{-3}$ $= 178 \text{kg-BOD}_5 / \text{d}$
排出汚泥 (約1回/1月)		投入SS量 SS 50 g/人/日 × 120,000 $= 6.0 \text{トン} / \text{日}$ 池内堆積率50% $6.0 \text{トン} / \text{日} \times 50 \%$ $= 3.0 \text{トン} / \text{日}$ 乾燥汚泥含水率80% $3.0 \text{トン} / \text{日} \times \frac{100}{100-80}$ $= 15.0 \text{トン} / \text{日}$	投入SS量 SS 50 g/人/日 × 71,400 $= 3.6 \text{トン} / \text{日}$ 池内堆積率50% $3.6 \text{トン} / \text{日} \times 50 \%$ $= 1.8 \text{トン} / \text{日}$ 乾燥汚泥含水率80% $1.8 \text{トン} / \text{日} \times \frac{100}{100-80}$ $= 9 \text{トン} / \text{日}$

		= 15.0 m <sup>3</sup> /日 = 450 m <sup>3</sup> /月		= 9 m <sup>3</sup> /日 = 270 m <sup>3</sup> /月
5. 通性池				
型 式		土堰堤式矩形池		同 左
流入BOD 負荷量		15,600 × 150 × 10 <sup>-3</sup> + 300 = 2,640 kg-BOD <sub>5</sub> /d		6,100 × 150 × 10 <sup>-3</sup> + 178 = 1,093 kg-BOD <sub>5</sub> /d
BOD 水面積負荷		s = 60.3 × 1.0993 <sup>T<sub>a</sub></sup> × 1/α T <sub>a</sub> : 最低月平均気温 (15.2°C) α : 安全率 (8池のうち2池 排泥清掃行うものとして 8/6 = 1.33) = 60.3 × 1.0993 <sup>15.2</sup> × 1/1.33 = 192 kg-BOD <sub>5</sub> /ha/d		s = 60.3 × 1.0993 <sup>T<sub>a</sub></sup> × 1/α T <sub>a</sub> : 最低月平均気温 (15.2°C) α : 安全率 (4池のうち1池 排泥清掃行うものとして 4/3 = 1.33) = 60.3 × 1.0993 <sup>15.2</sup> × 1/1.33 = 192 kg-BOD <sub>5</sub> /ha/d
所要水面積		2,640 × 1/192 = 13.8ha		1,093 × 1/192 = 5.7ha
水 深	Df	1.5m		1.5m
構造寸法		幅(105~96) × 長(144~135) × 水深1.5m × 4 池 + 2.1ha × 水深1.5m × 4 池		幅(105~96) × 長(144~135) × 水深1.5m × 4 池
(検討)				
池 容 量	Vl	1.5 × 1/3 × (105 × 144 + 96 × 135 + (105 × 144 × 96 × 135) ) × 4 + 21,000 × 1.5 × 4 = 210,157 m <sup>3</sup>		1.5 × 1/3 × (105 × 144 + 96 × 135 + (105 × 144 × 96 × 135) ) × 4 = 84,157 m <sup>3</sup>
水 面 積		210,157 ÷ 1.5 = 14.01 ha > 13.8ha		84,157 ÷ 1.5 = 5.61 ha = 5.7ha OK
滞留日数	Rf	210,964 ÷ 15,600 = 13.5d		84,157 ÷ 6,100 = 13.8d

流入BOD <sub>5</sub> 負荷に 対する水面積負荷	s	表面積 $1.05 \times 1.44 \times 4 + 2.1 \times 4$ $= 14.45 \text{ ha}$ $2,640 \times 1 / 14.45$ $= 183 \text{ kg-BOD}_5/\text{ha/d}$ OK	$1.05 \times 1.44 \times 4$ $= 6.05 \text{ ha}$ $1,093 \times 1 / 6.05$ $= 181 \text{ kg-BOD}_5/\text{ha/d}$ OK
汚泥堆積量	V2	5年に1回搬出する $67,000 \text{ 人} \times 0.03 \text{ m}^3/\text{人}/\text{年} \times 5 \text{ 年}$ $= 10,050 \text{ m}^3$	$22,000 \text{ 人} \times 0.03 \text{ m}^3/\text{人}/\text{年} \times 5 \text{ 年}$ $= 3,300 \text{ m}^3$
搬出汚泥量		$10,050 \times 0.15 = 1,508 \text{ m}^3 / 5 \text{ 年}$	$3,300 \times 0.15 = 495 \text{ m}^3 / 5 \text{ 年}$
汚泥堆積深	Ds	$10,050 \times 1 / 140,100$ $= 0.072 \text{ m}$	$3,300 \times 1 / 56,100$ $= 0.059 \text{ m}$
6. 熟成池			
型式		土堰堤式矩形池	同 左
滞留日数	Rm	3日/池	3日/池
池数	N	3池/1系 × 4系 = 12池	3池/1系 × 2系 = 6池
処理水細菌固体数の 確認	NR	$\frac{No}{(K' Ra + 1)(K' Rf + 1)(K' Rn + 1)^n}$ $n = 3 \text{ 池}$ $= \frac{2.0 \times 10^7}{(1.446 \times 1.9 + 1) \times (1.446 \times 13.5 + 1) \times (1.446 \times 3 + 1)^3}$ $\approx 1 \times 10^3 \dots \text{OK}$	$No: \text{ 流入水中の細菌固体数}$ $(2.0 \times 10^7 / 100 \text{ ml})$ $k': \text{ 死滅定数}$ $k' \text{ at } 15.2 = 2.0 \times 1.07^{(15.2 - 20)}$ $= 1.446$ $= \frac{2.0 \times 10^7}{(1.446 \times 2.1 + 1) \times (1.446 \times 13.8 + 1) \times (1.446 \times 3 + 1)^3}$ $\approx 1 \times 10^3 \dots \text{OK}$

1系当たり流入量	q	$6,100 \times 1/2 = 3,050 \text{ m}^3/\text{d}$ $9,500 \times 1/2 = 4,750 \text{ m}^3/\text{d}$	$6,100 \times 1/2 = 3,050 \text{ m}^3/\text{d}$
1池当たり所要容量	v	$3,050 \times 3 = 9,150 \text{ m}^3/\text{池}$ $4,750 \times 3 = 14,250 \text{ m}^3/\text{池}$	$3,050 \times 3 = 9,150 \text{ m}^3/\text{池}$
池水深	Dm	1.5m	1.5m
構造寸法		幅 (72~63) × 長 (95~86) × 水深 1.5m × 3 池/1系 × 2 系 + 14,250 m <sup>3</sup> × 3 池/1系 × 2 系	幅 (72~63) × 長 (95~86) × 水深 1.5m × 3 池/1系 × 2 系
(検討)			
池容量		$1.5 \times 1/3 \times (72 \times 95 + 63 \times 86$ $+ (72 \times 95 \cdot 63 \times 86)) \times 6$ $+ 14,250 \times 6$ $= 140,540 \text{ m}^3$	$1.5 \times 1/3 \times (72 \times 95 + 63 \times 86$ $+ (72 \times 95 \cdot 63 \times 86)) \times 6$ $= 55,040 \text{ m}^3$
滞留時間		$140,540 \div 15,600 = 9.01$ $9.01 \div 3 = 3.0 \geq 3.0$	$55,040 \div 6,100 = 9.02$ $9.02 \div 3 = 3.0 \geq 3.0$

