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A10.1 INTRODUCTION

Basic data on the analysis of existing collection system and on the design of proposed collection system is presented in this appendix. Design of the proposed collection system includes that of the rehabilitation of existing system and the development of new sewerage system for Luyano-Martin Perez Sewer District included in the Sewerage Master Plan. Further, data on the design of three sewer districts which are not included in the Master Plan is also included. However, the following should be noted in terms of the applicability of the data presented here for future applications.

- (1) The data on the collection system included in the Master Plan are based on the 1:25000 scale digital maps for their routes which are checked against the 1:2000 scale maps where available. Ground levels read from 1:2000 scale maps provided by INRH are used.
- (2) The data on the three sewer districts which are not included in the Master Plan namely, Luyano-arriba, Martin Perez-Arriba and Tadeo are based on 1:25000 scale digital maps for the route of colectors and 1:5000 scale maps provided by DPPF for the ground levels in the Master Plan stage of the Study. Collection system design with this type of information was used to select Luyano-Martin Perez Abajo Sewer District out of the five sewer districts for implementation in the Master Plan. These data is provided as a reference to future studies and should be refined for use in the future.

A10.2 EXISTING SYSTEM (CENTRAL SYSTEM)

A10.2.1 CAPACITY OF EXISTING COLECTORS

Capacity of the existing Colectors are estimated and compared with the estimated wastewater generation in the year 2020. Figure A10.1 shows sub-sewer districts determined based on the existing sewer map. Figure A10.2 and A10.3 show the route and profile of existing Colectors. Figure A10.4 shows the sub-sewer districts for the proposed collection system.

Population and wastewater generation determined to the Sewer Districts are distributed to subsewer districts based on the area. Table A10.1 shows the design flows for the Central System which are used to check the capacity of the existing Colectors. Data of pipe size and levels are obtained from the report titled "Análysis Hidráulico del Sistema de Alcantarillado Principal de Ciudad de La Habana, 1996" and the existing drawings. Design flow for Colector Sur Nuevo during rehabilitation (2,283 L/s) and after rehabilitation without Luyano Left Bank Area (676 L/s) can be inferred from this table.

Table A10.2 shows design flows for the condition when wastewater from Luyano Left Bank is discharged through existing system. Design flow for Sur Nuevo when Luyano Left Bank is discharged through existing system (1,271 L/s) can be inferred.

Table A10.3 is presented to obtain the design flows for rehabilitated Colector Sur that is without the wastewater from S3-1, S3-2 and S2-1. Wastewater from the latter is to be conveyed by Colector Sur Nuevo.

Table A10.4 through Table A10.9 show the capacity of existing Colectors and their comparison to design flows in the year 2020. Length of each Colector which require rehabilitation is also shown in the tables.

Table A101.10 shows the capacity of rehabilitated Colector Sur.

A10.2.2 PROPOSED COLECTORS FOR THE EXISTING SYSTEM

1) Colector Sur A

Figure A10.5 shows the route and Figure A10.6 shows the profile of Colector Sur A. Level of starting point of Colector Sur A is determined from the Luyano Left Colector and drop manhole is used near the crossing of Dren Agua Dulce. Table A10.11 shows the calculation sheet for sewer design.

Design of Sur A if wastewater from Luyano Left Bank Area A is not to be discharged to Central System is shown for reference. In this case, Colector Sur A will start near the junction of existing Colector Sur 3 and Colector Sur 2. Cost included in the M/P is based on this design.

2) By-Pass Pipe for Colector Cerro and Colector Sur

Figure A10.7 and A10.8 show the route and profile of By-pass Colector for Colector Cerro and Colector Sur. As shown in the profile, drop manhole at the crossing with storm drain is used. Table A10.12 shows the calculation sheet for sewer design.

3) Colector Sur Nuevo

Figure A10.9 and A10.10 show the route and profile of Colector Sur Nuevo. Table A10.13 shows the calculation sheet for sewer design.

A10.3 NEW SEWERAGE SYSTEM

In the Luyano-Martin Perez Abajo Sewer District two principal Colectors namely Luyano Left Colector and Luyano Martin Perez Right Colector to convey wastewater from the left bank and right bank of Luyano River is planned.

A10.3.1 LUYANO LEFT COLECTOR

Figure A10.11 and A10.12 show the route and profile of Luyano Left Colector. Table A10.14 shows the determination of design flows and Table A10.15 shows the calculation sheet for sewer design.

In the profiles where a drop manhole is shown with high depth for a pipe sector where ground slope is very steep, several drop manholes will be utilized to reduce excavation in the detailed design stage while maintaining the pipe slope as shown in the drawings.

A10.3.2 LUYANO MARTIN PEREZ RIGHT COLECTOR

Figure A10.13 and A10.14 show the route and profile of Luyano Martin Perez Right Colector. Table A10.16 shows the determination of design flows and Table A10.17 shows the calculation sheet for sewer design. There are two river crossings across Martin Perez River and the river bed levels obtained from the topographic survey were used to determine the pipe level. Drop manholes are used at the river crossings to convey wastewater by gravity up to the wastewater treatment plant.

In the profiles where single drop manhole is shown with higher depth for a pipe sector where ground slope is very steep, several drop manholes will be utilized to reduce excavation in the detailed design stage while maintaining the pipe slope as shown.

In Table A10.16, an area of 19.19 ha is shown as pumped to be collected by manhole label NR-1. However, this area can be either included to the sewer system without pumping if the sewer main is laid through the railway yard or need to be excluded and discharged to the Tadeo Sewer District.

A10.4 OTHER SEWER DISTRICTS

As discussed in the introduction, the results presented for these districts need to be refined as these were based on 1:25000 scale maps for the route and 1:5000 scale maps for the levels. Further, internationally available standard pipe sizes were used in the Master Plan stage whereas in the Feasibility Study pipe sizes currently being used by Agua de La Habana is utilized.

A10.4.1 LUYANO ARRIBA COLECTOR

Figure A10.15 shows the route of Luyano Arriba Colector. Table A10.18 shows the determination of design flows and Table A10.19 shows the calculation sheet for sewer design.

A10.4.2 MARTIN PEREZ ARRIBA COLECTOR

Figure A10.16 shows the route of Martin Perez Arriba Colector. Table A10.20 shows the determination of design flows and Table A10.21 shows the calculation sheet for sewer design.

A10.4.3 TADEO COLECTOR

Figure A10.17 shows the route of Tadeo Colector. Table A10.22 shows the determination of design flows and Table A10.23 shows the calculation sheet for sewer design.





Volume III Supporting Report





Appendix A10 Wastewater Collection System



Volume III Supporting Report



Volume III Supporting Report



Figure A10.3 Profile of Existing Colectors

- Colector Sur
- Colector Cerro
- Colector Centro Habana
- Colector Sur 1
- Colector Sur 3

			Sur (1/4)	of Colector \$	Profile	IENT OF HAVANA BAY	OF THE IMPROVEN SYSTEM FOR THE	OPMENT STUDY AND DRAINAGE	THE DEVEL	JAPAN INTERNATIONAL COOPERATION AGENCY
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							s size			-11.00
1 1	E E	1.22 m/					e Length Sito			-9.00
	2 8	T 11-1 115.0					jend for Pipes		E E E	-7.00 -8.00 -8.00 -8.00 -15.01 -8.00 -15.01
		0.30 m/km	0.25 m/km	0.55 m/km	0.40 m/km	1.15 m/km	0.82 m/km	1.22 m/km	1./6 m/km	-6.00 <u>U.89 m/km</u>
		100 0 m 1500 mm	120.0 m 1500 mm	110.0 m 1500 mm	50.0 m 1500 mm	200.0 m 1500 mm	85.0 m 1500 mm	90.0 m 1500 mm	125.0 m 1500 mm	-5.00 1500 mm
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										1.00
										2.00
										9 U0 8
							84 m 1.71 m 1.38 m -1.45 m	242 m -1.27 m		5.00 3.54 m 4.00 -1.01 r
		m 2.42 m m 1.82 n	1.79	m -1.76 m	3 93 m 4 96 1 -1 68 m -1 70		y y y	2 2 2 2 2 2		6.00 -0.97 m 6.00 -0.97 m
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							3	Aanhole Label	3 2 0	00.6
							Se	egend for Manhol		11.00
										12.00
										14.00
										15.00
250	Scale 1	Vertical								Elevation (m)
5000	al Scale 1	Horizont								

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m R-17 1.78.m R m -2.76 m - m -2.01 m - m -16-17 m 18-19 m - m -16-17 m 178-19 m - - m -16-17 m 174.0 m - - 0.80 m - - - - 0.80 m - - - - 1-17 m 18-19 m 120-21 m 121-22 m/km - 0.31 m/km - - - - 0.13 m/km 0.130 m/m - - - 0.13 m/m 0.54 m/m	R-19 R-20 R-20 R-21 R-22 3.32 m 6.33 m 5.69 m 3.67 m 3.36 m -2.77 m -2.93 m -2.99 m -2.99 m -2.76 m -2.93 m -2.93 m -2.76 m -2.93 m -2.99 m -2.76 m -2.90 m -2.90 m -2.76 m -2.90 m -2.90 m -2.77 m -2.90 m -2.90 m -17 -18-19 -1.22 m -17 -1.22 m -1.22 m -18 m -1.20 m -1.20 m -190 m -1.20 m -1.20 m -190 m
m 1.78 m 1.78 m -2.76 m -2.77 m -2.76 m -2.777 m -2.76 m -2	R-18 R-19 R-20 R-21 3.2.7 m 2.84 m 3.67 m 2.93 m 2.93 m 2.04 m 3.67 m 2.93 m 2.93 m 2.93 m 2.03 m 2.04 m 3.67 m 2.93 m 2.03 m 2.04 m 2.
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m 1.78 m 1.78 m m -2.76 m	R-18 R-19 R-20 3.32 m 6.33 m 5.69 m R-21 -2.77 m -2.80 m -2.84 m 3.67 m 3.36 m -2.93 m -2.99 m -2.93 m -2.99 m
m 1.78 m 2.76 m	R-18 R-19 R-20 3.32 m 6.33 m 5.69 m R-21 R-22 -2.77 m -2.80 m -2.84 m 3.67 m 3.36 m -2.93 m -2.99 m -2.93 m -2.99 m -2.99 m
	R-18 R-19 R-20 3.32 m 6.33 m 5.69 m R-21 R-22 -2.77 m -2.80 m -2.84 m 3.67 m 3.36 m -2.93 m -2.99 m

A10-11

Appendex 10	Wastewater	Collection System
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5.00					
3.00					
2.00					
00.0					
-1.00					
-2.00			7		
-4.00					
-5.00	CeT-9	CeT-10	CeT-11		
-6.00	165.0 m 1350 mm	132.5 m 1350 mm	81.0 m 1350 mm		
	0.61 m/km	0.38 m/km	12.84 m/km		
00.6-	Legend fo	r Pipes			
-10.00	Pipe Length	-			
-12.00 -13.00	Pipe Size Pipe Slope				
-14.00					
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				-	
JAPAN INTERNATIONAL COOPERATION AGENCY	THE DEVELOPMEN SEWERAGE AND D	IT STUDY OF THE RAINAGE SYSTE	IMPROVEMENT OF M FOR THE HAVANA	BAY	Profile of Colector Cerro (2/2)

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e 1.5000	Horizontal Sca												Elevation (m)

Horizontal Scale 1:500 Vertical Scale 1:250	8	Profile of Colector Sur 1 (3/3)
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00.6-	10+00	- - - -	00	2+00	13+00	14+	00	5+00 1	6+00 17	00+	18+00	19+00	20+00
JAPAN INTERN COOPERATION	ATIONAL I AGENCY	THE DI SEWEF	EVELOPMEN RAGE AND D	IT STUDY OF	- THE IMPF /STEM FO	R THE HAV	г ОF /ANA ВАҮ	Pro	ofile of Colec	ctor Sur 3	(2/3)		