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January 19, 2022

Halifax Water
450 Cowie Hill Rd
Halifax, NS B3P 2V3

Re: Mic Mac Mall Lands Redevelopment – Downstream Wastewater Sewer Analysis

Our client is planning to redevelop the existing lands surrounding the Mic Mac Mall in Dartmouth, Nova Scotia. The proposed development will house 2400 residential apartment/senior units and 1 570 000 sq.ft. (14.6 ha.) of new commercial space. Based on a unit density of 2.25 people per unit and a commercial density of 85 people per hectare, we understand an additional 6641 people will be added to the area's population. As per Halifax Water Design and Construction Specifications (2022) Section 4.2.1, SDMM has prepared the following capacity analysis for the wastewater systems immediately downstream of the proposed development site.

Tributary Drainage Areas & Population

The downstream terminus of this analysis was established based on correspondence with Halifax Water Engineering staff who confirmed MH18609 within Brookdale Crescent Park to be the terminus of this analysis (See Figures 1-3). This manhole connects the analyzed sewer reaches to a 1200mm trunk sewer that runs parallel to Lake Banook. Tributary areas for the analyzed sewers are depicted in Figure 1 of the appendix. Wastewater flows from the proposed development have been split into three (3) areas. Areas 1 & 2 discharge to the wastewater system along Micmac Blvd and through Garden Court Terrace to the Lake Banook Trail, while Area 3 discharges into the existing system along Brookdale Crescent as shown in Figure 4. The proposed flow splitting was determined based on the available existing wastewater services to each phase of the project. The two public wastewater systems available converge at the intersection of Brookdale Crescent and the Lake Banook Trail. This required the analysis of twenty-one (21) sections of public gravity wastewater sewer directly downstream of the project site, shown in Figures 2 & 3 of the appendix.

SDMM determined equivalent populations for the existing sewer sheds based on the following resources:

- Halifax Water Design & Construction Specifications (2022)
- Zoning information from the HRM Regional Centre Secondary Municipal Planning Strategy & Regional Centre Land Use By-Law (Package B)
- Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment and Disposal (2006)
- Correspondence with Halifax Water (Population Densities & Terminus Point)

A summary of the density calculations is presented in Table 1. Existing populations were estimated by counting the number of residential properties, townhouses, and apartment units. A density of 3.35 people per unit was applied to residential houses and townhouses while a density of 2.25 people per unit was applied to apartment buildings. Tributary area and population calculations are summarized and presented in Table 2 of the appendix.

Estimated Wastewater Flow Calculations

Estimated wastewater flows were calculated for each reach of sewer based on the hydraulic design formula outlined in Section 4.2.2 of the Halifax Water Design & Construction Specifications (2022). Flows calculated include the Halifax Water safety factor of 1.25 with allowances of 0.30m³ per person per day for residential development and 24m³ per gross hectare per day for infiltration/inflow. A summary of the proposed wastewater flow calculations is presented in Table 3 of the appendix.

Existing Pipe Capacity

Existing pipe capacities were calculated using Manning's Equation for each reach of downstream sewer; utilizing pipe characteristics provided by Halifax Water GIS information. A summary of the existing pipe capacities is presented in Table 4 of the appendix.

Conclusion

Comparisons between the estimated flows and existing pipe capacities for each reach of sewer indicate that the downstream sewer systems have sufficient capacity to accommodate the wastewater flows generated by this proposed development. Based on the flow splitting shown in Figure 4, the sewer reaches analyzed were under 87% of their maximum theoretical capacity (Pipe O).

Calculated flows are based on sending 530 units and 2.09ha of commercial space (1370 people) to the wastewater system in Brookdale Crescent, resulting in a theoretical capacity of 87% in Pipe O. Flows generated by a population of 1595 people can be sent to the Brookdale Crescent sewer before Pipe O exceeds 100% capacity.

For additional information related to this analysis please contact the undersigned.

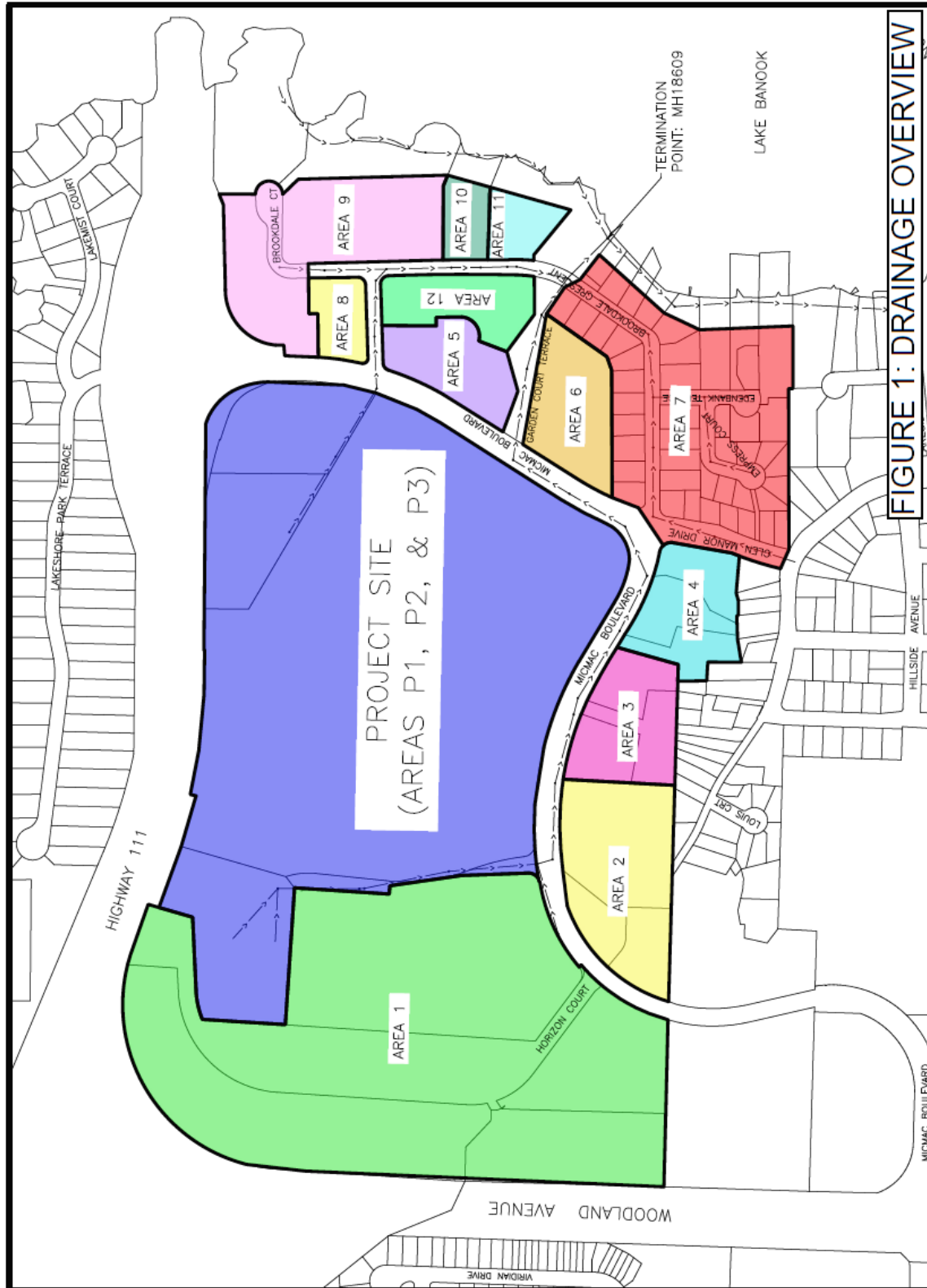
Regards,

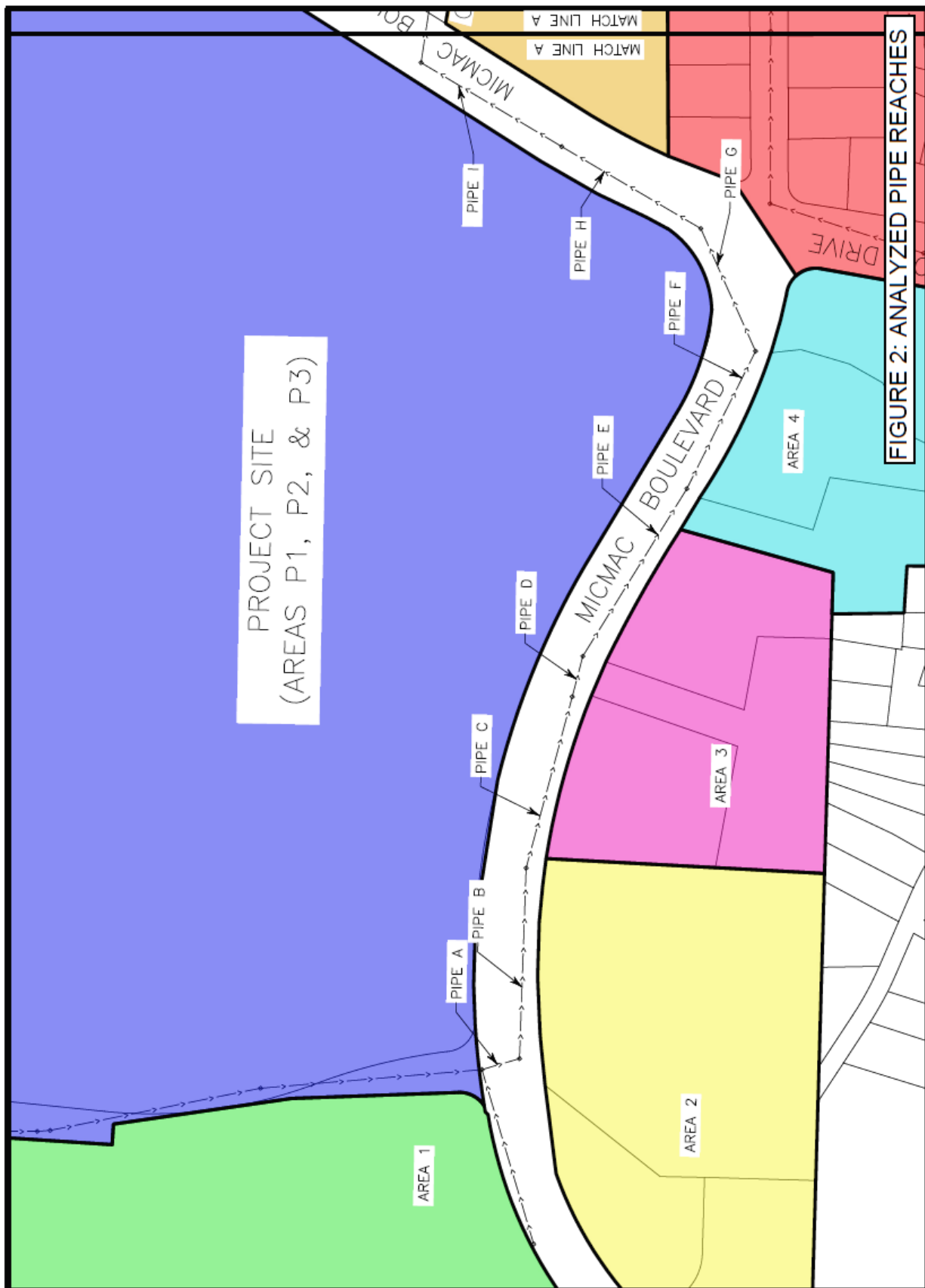
Servant, Dunbrack, McKenzie & MacDonald Ltd.

Justin MacCallum, E.I.T.
Junior Engineer

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APPENDIX





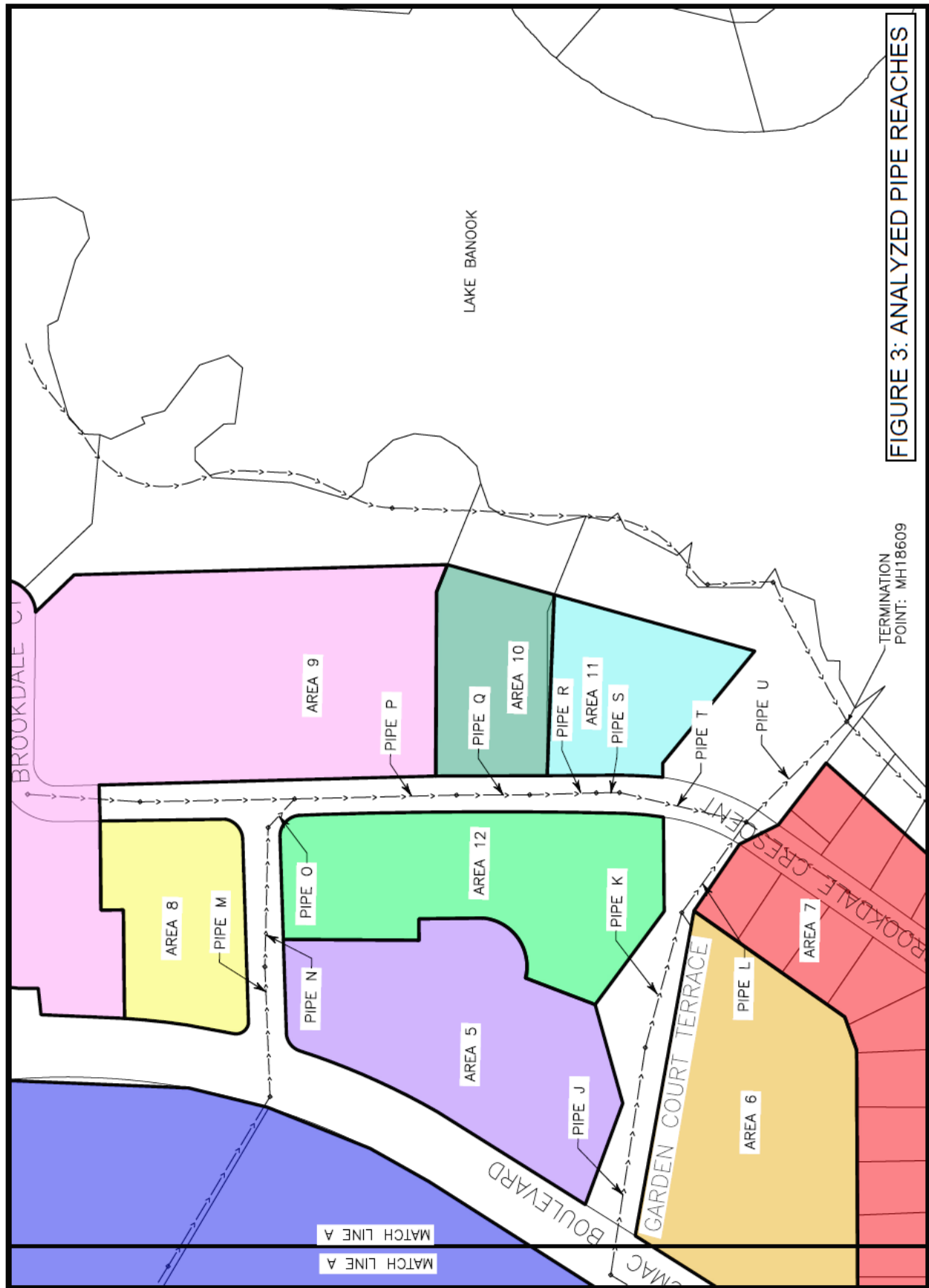


FIGURE 3: ANALYZED PIPE REACHES



Table 1: Regional Center Plan Density Values				
Zoning	Number of Units	People per unit (HW)	Min. Lot Area (m ² Ha)	People per Hectare
Existing & Proposed Commercial & Retail				
	*Atlantic Canada Wastewater Guidelines			85

Table 2 - Proposed Tributary Areas and Population						
Area	Sub-Area	Number of Units	People per Unit	People per Hectare	Tributary Area (ha)	Equivalent Population
P (PROJECT SITE)						
P1						
	Proposed Commercial			85	2.36	201
	Proposed Residential	600	2.25			1,350
				P1 Sub-Totals	2.36	1,551
P2						
	Existing Commercial			85	4.49	382
	Proposed Commercial			85	10.15	863
	Proposed Residential	1270	2.25			2,858
				P2 Sub-Totals	14.64	4,102
P3						
	Proposed Commercial			85	2.09	178
	Proposed Residential	530	2.25			1,193
				P3 Sub-Totals	2.09	1,370
	Road/Parking Lots			-	0.57	-
				Sub-Totals	19.66	7,023
1						
	HR-2	572	2.25		9.03	1,287
	Existing Commercial			85	4.65	395
	Road			-	-	-
				Sub-Totals	13.68	1,682
2						
	HR-1	132	2.25		1.40	297
	HR-2	150	2.25		0.76	338
	Road			-	0.66	-
				Sub-Totals	2.82	635
3						
	HR-1	65	2.25		1.28	146
	Road	-	-	-	0.40	-
				Sub-Totals	1.68	146
4						
	HR-1	61	2.25		1.22	137
	Road	-	-	-	0.45	-
				Sub-Totals	1.67	137
5						
	HR-1	56	2.25		0.96	126
	Road	-	-	-	0.67	-
				Sub-Totals	1.63	126
6						
	HR-1	42	3.25		1.17	137
	Road	-	-	-	0.19	-
				Sub-Totals	1.36	137

Table 2 - Proposed Tributary Areas and Population						
Area	Sub-Area	Number of Units	People per Unit	People per Hectare	Tributary Area (ha)	Equivalent Population
7						
	ER-1	45	3.35		3.92	151
	Road	-	-	-	0.79	-
				Sub-Totals	4.71	151
8						
	HR-1	34	2.25		0.46	77
	Road	-	-	-	0.35	-
				Sub-Totals	0.81	77
9						
	HR-1	180	2.25		2.41	405
	Road	-	-	-	0.44	-
				Sub-Totals	2.85	405
10						
	HR-1	49	2.25		0.39	110
	Road	-	-	-	0.07	-
				Sub-Totals	0.46	110
11						
	HR-1	48	2.25		0.43	108
	Road	-	-	-	0.08	-
				Sub-Totals	0.51	108
12						
	HR-1	55	2.25	620	0.88	124
	Road	-	-	-	0.02	-
				Sub-Totals	0.90	124
Totals					52.74	10,860

Table 3: Estimated Proposed Wastewater Flow Calculations

Pipe	Area Number(s)	Tributary Area (ha)	Equivalent Population	Average Dry Weather Flow, a (m ³ /d)	Harmon Peaking Factor, M	Infiltration/Inflow Allowance, b*area (m ³ /d)	Peak Dry Weather Flow, a x M (m ³ /d)	Peak Design Flow, (a x M) + b, (m ³ /d)	Safety Factor	*Estimated Flow, Q (m ³ /d)
A	P1+1	16.04	3233	969.9	3.41	385.0	3,311.7	3,696.6	1.25	4,525
B	P1+1+2	18.86	3867	1,160.2	3.35	452.6	3,882.5	4,335.2	1.25	5,306
C	P1+1+2	18.86	3867	1,160.2	3.35	452.6	3,882.5	4,335.2	1.25	5,306
D	P1+1+2+3	20.54	4014	1,204.1	3.33	493.0	4,012.0	4,505.0	1.25	5,508
E	P1+1+2+3	20.54	4014	1,204.1	3.33	493.0	4,012.0	4,505.0	1.25	5,508
F	P1+1+2+3	20.54	4014	1,204.1	3.33	493.0	4,012.0	4,505.0	1.25	5,508
G	P1+1+2+3+4	22.21	4151	1,245.3	3.32	533.0	4,132.9	4,665.9	1.25	5,699
H	P1+1+2+3+4	22.21	4151	1,245.3	3.32	533.0	4,132.9	4,665.9	1.25	5,699
I	P1+1+2+3+4	22.21	4151	1,245.3	3.32	533.0	4,132.9	4,665.9	1.25	5,699
J	P1+P2+1+2+3+4	36.85	8253	2,475.8	3.04	884.4	7,519.1	8,403.5	1.25	10,283
K	P1+P2+1+2+3+4+5	38.48	8379	2,513.6	3.03	923.5	7,617.7	8,541.2	1.25	10,446
L	P1+P2+1+2+3+4+5+6	39.84	8515	2,554.6	3.02	956.2	7,724.2	8,680.4	1.25	10,611
M	P3	2.09	1370	411.0	3.71	50.2	1,524.0	1,574.2	1.25	1,955
N	P3+8	2.90	1447	434.0	3.69	69.6	1,601.8	1,671.4	1.25	2,072
O	P3+8	2.90	1447	434.0	3.69	69.6	1,601.8	1,671.4	1.25	2,072
P	P3+8+9	5.75	1852	555.5	3.61	138.0	2,006.2	2,144.2	1.25	2,646
Q	P3+8+9	5.75	1852	555.5	3.61	138.0	2,006.2	2,144.2	1.25	2,646
R	P3+8+9+10	6.21	1962	588.6	3.59	149.0	2,114.3	2,263.3	1.25	2,792
S	P3+8+9+10+11	6.72	2070	621.0	3.57	161.3	2,219.4	2,380.7	1.25	2,936
T	P3+8+9+10+11+12	7.62	2194	658.1	3.55	182.9	2,339.0	2,521.9	1.25	3,107
U	P(1-3)+1-12	52.17	10860	3,257.9	2.92	1,252.1	9,509.9	10,761.9	1.25	13,139

$$*Q = \frac{[1.25 * (a * M)] + (b * area)}{86.4} \quad \text{where} \quad M = 1 + \frac{14}{4 + P^{0.5}}$$

Table 4: Proposed Pipe Capacity Calculations

Pipe	Sewer Type	Pipe Shape	Pipe Diameter (mm)	Material	Slope (%)	Mannings Coefficient, n	Manning's Capacity, Qc (m ³ /d)	Wastewater % of Capacity
A	Sanitary	Round	250	CONC	1.23	0.013	5,698	79%
B	Sanitary	Round	300	CONC	1.30	0.013	9,526	56%
C	Sanitary	Round	300	CONC	2.42	0.013	12,997	41%
D	Sanitary	Round	300	CONC	2.60	0.013	13,472	41%
E	Sanitary	Round	300	CONC	1.59	0.013	10,535	52%
F	Sanitary	Round	300	CONC	1.38	0.013	9,815	56%
G	Sanitary	Round	300	CONC	1.65	0.013	10,732	53%
H	Sanitary	Round	300	CONC	1.48	0.013	10,164	56%
I	Sanitary	Round	300	CONC	1.38	0.013	9,815	58%
J	Sanitary	Round	300	CONC	3.33	0.013	15,246	67%
K	Sanitary	Round	300	CONC	6.84	0.013	21,851	48%
L	Sanitary	Round	300	CONC	8.26	0.013	24,012	44%
M	Sanitary	Round	200	CONC	1.99	0.013	3,998	49%
N	Sanitary	Round	200	CONC	0.99	0.013	2,820	73%
O	Sanitary	Round	200	CONC	0.70	0.013	2,371	87%
P	Sanitary	Round	200	CONC	3.49	0.013	5,294	50%
Q	Sanitary	Round	200	CONC	4.07	0.013	5,717	46%
R	Sanitary	Round	200	CONC	3.96	0.013	5,639	50%
S	Sanitary	Round	200	CONC	3.31	0.013	5,156	57%
T	Sanitary	Round	200	CONC	2.08	0.013	4,087	76%
U	Sanitary	Round	300	CONC	5.09	0.013	18,850	70%