Harbourside Waterfront
Preliminary Servicing Design Brief

Rev. 3
File No. 12168
October 2013

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1. INTRODUCTION

Concert Properties and Knightsbridge Properties are proposing to redevelop the Harbourside waterfront lands in North Vancouver. The subject lands include 4 lots (A, B, C, D) at the south end of Fell Ave, fronting the south side of Harbourside Drive, and Harbourside Place loops lot C. The 4 lots are aligned in a west-east (lot A-D) orientation and the lot at the furthest east (lot D) is owned by Knightsbridge Properties while the other 3 are Concert Properties. The proposed development generally consists of 13 residential buildings, 1 rental housing building, 3 office buildings, 1 hotel building, and ground floor commercial components in 5 of the buildings. The project will involve a major redevelopment of the site including re-grading of the existing site roads. The total site area is approximately 4.9ha.

Creus Engineering Ltd. has been retained by Concert Properties to provide a preliminary review of the civil servicing requirements for the above project. This design brief will provide a preliminary review of the neighbouring road system, the existing offsite municipal infrastructure capacity for the proposed development and it will define any special design requirements / offsite upgrades required to service the proposed development.

The following utilities will be reviewed in this report:

- Roads
- Water System
- Sanitary Sewers
- Storm Sewers
- Utilities

It is assumed that all works will be designed and constructed in accordance with the most recent version of the City of North Vancouver's Development Servicing Bylaw 7388.

2. SITE CHARACTERIZATION

The proposed development is located in the Harbourside area of North Vancouver. The subject property is bounded by Harbourside Drive to the north, Bodwell High School to the west, Burrard Yacht club to the east, and the Burrard inlet to the south.
See Figure 1.1 - Site Location Plan.

The subject property currently contains a 3 storey commercial building and Lions Gate Christian Academy with parking areas which front Harbourside Drive and Harbourside Place. The Bruce Street road allowance was previously consolidated with the subject property. The proposed development generally consists of 13 residential towers, 1 rental housing tower, 3 office towers, 1 hotel tower, and ground floor commercial components in 5 of the towers. The project will involve a major redevelopment of the site including re-grading of the existing site roads. The total site area is approximately 4.9ha.

3. ROADS

The Harbourside Village development proposal includes minor changes to the local road network. Generally some location and alignment changes are proposed, along with re-grading sections of Harbourside Drive and Harbourside Place to accommodate future sea level rise. A

flood construction level of 4.5m is proposed with additional allowances for wave effects and freeboard in the design. This elevation change will be achieved by grading the existing Harbourside Place and Fell Avenue roads up at approximately 5% from Harbourside Drive intersections to the onsite lane. Right-of-ways and road dedications for the proposed roadworks on Fell Avenue and Harbourside Place will allow for fire truck access and street parking. Road upgrades are to be constructed per City of North Vancouver / TAC standards. The proposed road geometry is currently being reviewed by CNV staff and this section of the design brief will be updated when the proposed road geometry and standards have been resolved.

4. WATER

The existing water system consists of a series of 200mm and 300mm watermains looped throughout the property. The existing water system was sized to provide a minimum fire flow of 225l/s throughout the property. Subsequent analysis provided by the City confirmed that the system capacity would be well in excess of this requirement. The proposed increase in density should not change the minimum fire flow requirement and the increase in domestic demand is small compared to the total fire and domestic water demand. No impacts to the water system are anticipated.

Apartment Units = approx. 862, including 79 Rental Housing Units (per HCMA)
Total Commercial Space = 24,518m² (per RHA)
Fire Flow (FF) = 225l/s (per CNV Development Bylaw)
Maximum Day Demand (MDD) = 26.7l/s
Peak Hour Demand (PHD) = 40.0/s
Design Flow (greater of MDD+FF / PHD) = 251.7l/s

See Figure 2.1 for detailed calculations, and Figure 1.3 - Preliminary Water Layout

5. SANITARY

The existing sanitary system consists of a series of 250mm and 300mm sanitary mains generally routed from the south extent of the property north to a pump station at the east end of Automall Drive. The existing pump station consists of a Flygt duplex pump system with two 10hp pumps operating alternately. All lots south of the CN tracks and west of Gostick Ave are connected to the existing pump station. The entire sanitary system has been analyzed to assess the impact of the proposed development on the existing sanitary mains and pump station. See Figure 3.1 for detailed calculations.

The existing gravity system generally has capacity for the proposed density increase with the exception of the existing 250mm sanitary main on Fell Ave directly south of Automall Drive. In this section of the sanitary system, the sanitary main is approximately 53% full during current Peak Wet Weather Flow. With the proposed density increase, the Peak Wet Weather Flow would increase to approximately 79% full. The City of North Vancouver prefers their sanitary mains operate at less than 50% full; therefore we recommend that this section of pipe be upgraded.

At the system head of approximately 6m, the existing pumps have a capacity of approximately 65-70l/s each. The proposed density would increase the peak flow to the pump station from 25.6l/s to 42.0l/s. Therefore, it is expected that no upgrades to the pump station would be required. The pump station should be analyzed in further detail once residential populations are

finalized to confirm these assumptions. Additionally, the City should have SCADA data available for the existing pump station to confirm design flow assumptions.

6. STORM

The existing storm system consists of three separate systems to convey flows from the site to the existing watercourse along the west boundary of the property or south to the ocean. Due to the extents of the proposed buildings, any existing sections of storm main which are currently located within the subject property lines will need to be relocated outside of property lines. See Figure 4.2: Preliminary Storm Catchment Plan

While specific site coverage and grading are unknown at this time, effective impervious areas are expected to be the same as assumed during the original subdivision design. See Figure 4.1 for details.

6.1. HARBOURSIDE FLOOD PLAIN

The subject property is located on the Harbourside flood plain and has been the subject of several City of North Vancouver flood hazard studies. Golder Associates has been retained to review the proposed development plans as they relate to Harbourside. Their report has concluded that the impacts to the proposed development will be limited to utilizing an on-site future sea level rise elevation of 5.24m.

6.2. STORM SYSTEM & STORMWATER MANAGEMENT PLAN

The City of North Vancouver Subdivision & Development Control Bylaw requires that storm drainage systems be designed using conventional systems and stormwater management techniques.

Conventional Systems include:

- The Minor System: pipe conveyance systems which convey flows of a10 year return frequency event.
- The Major System: surface flood paths, roadways and watercourses which convey flows of a 100 year return frequency.

Stormwater Management Techniques include:

- Stormwater Management Systems: lot grading, surface infiltration, detention or other acceptable methods to limit the peak runoff from the development. Refer to Metro Vancouver's *Stormwater Best Management Practices*, 1991 and Provincial reference *Stormwater Planning: A Guidebook for British Columbia*, 2002

The Minor System will be sized to accommodate the 10 year return frequency event as required. The Major System will be designed to accommodate the 100 year return frequency event as required. Due to the proximity of the proposed development to the ocean (Burrard Inlet), the benefits of stormwater management systems based on reduction in rate or quantity of runoff will be negligible. Alternatively, the stormwater management plan will focus on water quality. The BC Ministry of Environment Water Quality Guidelines have been used as a design criteria for water quality discharges from the site. The guidelines include:

- pH: background pH range of 6.5-9.0, unrestricted change permitted within this range.
- Total Suspended Solids (TSS): The water quality guidelines for TSS depend on background conditions:
    - Change from background of 25mg/l at any one time for a duration of 24 hours in all water during clear flows or in clear waters.
    - Change from background of 5mg/l at any one time for a duration of 30 days in all waters during clear flows or in clear waters.
    - Change from background of 10mg/l at any time when background is 25 – 100mg\l during high flows or in turbid waters.
    - Change from background of 10% when background is >100mg/l at any time during high flows or in turbid waters.
- Phosphorus: No limits proposed for aquatic life in streams, estuarine or marine waters.
- Nitrogen: For nitrate (as N), the 30 day average concentration to protect freshwater aquatic life is 3.0mg/l and the maximum concentration is 32.8mg/l. For nitrate (as N), the 30 day average concentration to protect marine aquatic life is 3.7mg/l.

The existing storm sewer system includes API style oil/grit interceptors at each outfall. Each oil/grit interceptor is connected with a 250mm diameter pipe from the main with a full size bypass to allow high flow events to discharge directly. It is expected that the existing interceptors are adequate to achieve the required TSS discharge limits. It is also expected that Phosphorus and Nitrogen levels from the proposed development will meet the discharge guidelines. Due to the possibility of oil in the road runoff, we recommend upgrading the existing oil/grit interceptors with coalescing plates. We also recommend sampling the existing site discharges as part of detailed deign to confirm the above design assumptions.

7. OUTSIDE UTILITIES (BC HYDRO / TELUS / SHAW / FORTISBC)

BC Hydro / Tel has existing underground infrastructure along both sides of Harbourside Drive.

FortisBC has existing 75mm gas mains on each side of Harbourside Drive and a 50mm gas main on Gostick Place. We do not anticipate any issues providing gas service to the proposed development.

Any Utilities located inside of the subject property lines will need to be relocated to accommodate underground parking which will have extents to the property line. We are in early discussions with BC Hydro/Telus/Fortis regarding the relocation of these services and anticipate that the vaults will be located in the proposed road corner bulges. As part of the detailed design for the project, coordination with BC Hydro, Telus, Shaw and FortisBC will be required for their respective utility designs.

8. REPORT SUBMISISON

Prepared By:

CREUS Engineering Ltd

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Fred Ciambrelli, P.Eng.

APPENDIX A: FIGURES & CALCULATIONS

Figure 1.1: Site Location Plan

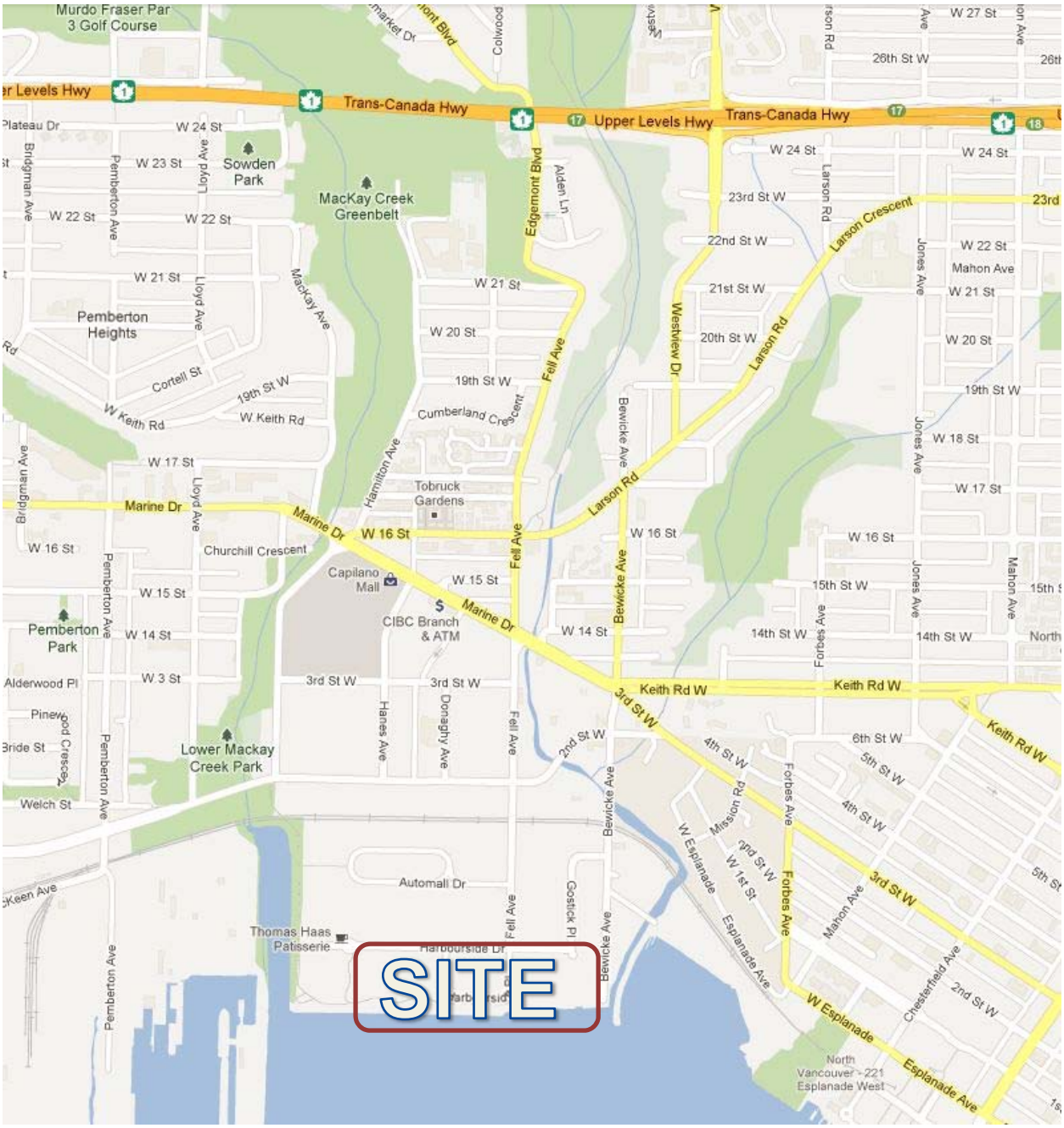

Figure 2.1: Preliminary Water Calculations

Calculations

Project:	Harbourside Village	File:	12168
Subject:	Water Analysis	Date:	24-Oct-12
Section:	Domestic and Fire Flow Estimates	By:	R.A.W.

Fire Flow — FIRE FLOW

Total Estimated Fire Flow		225	l/s	(per CNV Bylaw)
Total Estimated Fire Flow	=	13500	l/min	
Required Duration of Fire Flow		2.88	hrs	(per FUS)

Domestic Flow — DOMESTIC DEMAND

Apartment Units		862		(per D/A Architects)
Persons per unit		1.6		
Total Persons	=	1379	capita	
Commercial Area		6.0	ha	
Equivalent Population		90	l/ha/d	(per MMCD)
Average daily flow	=	540	capita	
Total Persons	=	1919	capita	
Maximum Day Demand		1200	l/capita/d	(per MMCD)
Peak Hour Demand		1800	l/capita/d	(per MMCD)
Total Maximum Day Demand	=	26.66	l/s	
Total Peak Hour Demand	=	39.98	l/s	

Design Flows — DESIGN FLOW

Design Fire Flow (FF)	=	225	l/s	(as above)
Total Maximum Day Demand (MDD)	=	26.66	l/s	(as above)
Total Peak Hour Demand (PHD)	=	39.98	l/s	(as above)
Design Flow	=	251.7	l/s	(MDD+FF / PHD)

Figure 2.2: Preliminary Waterworks Plan

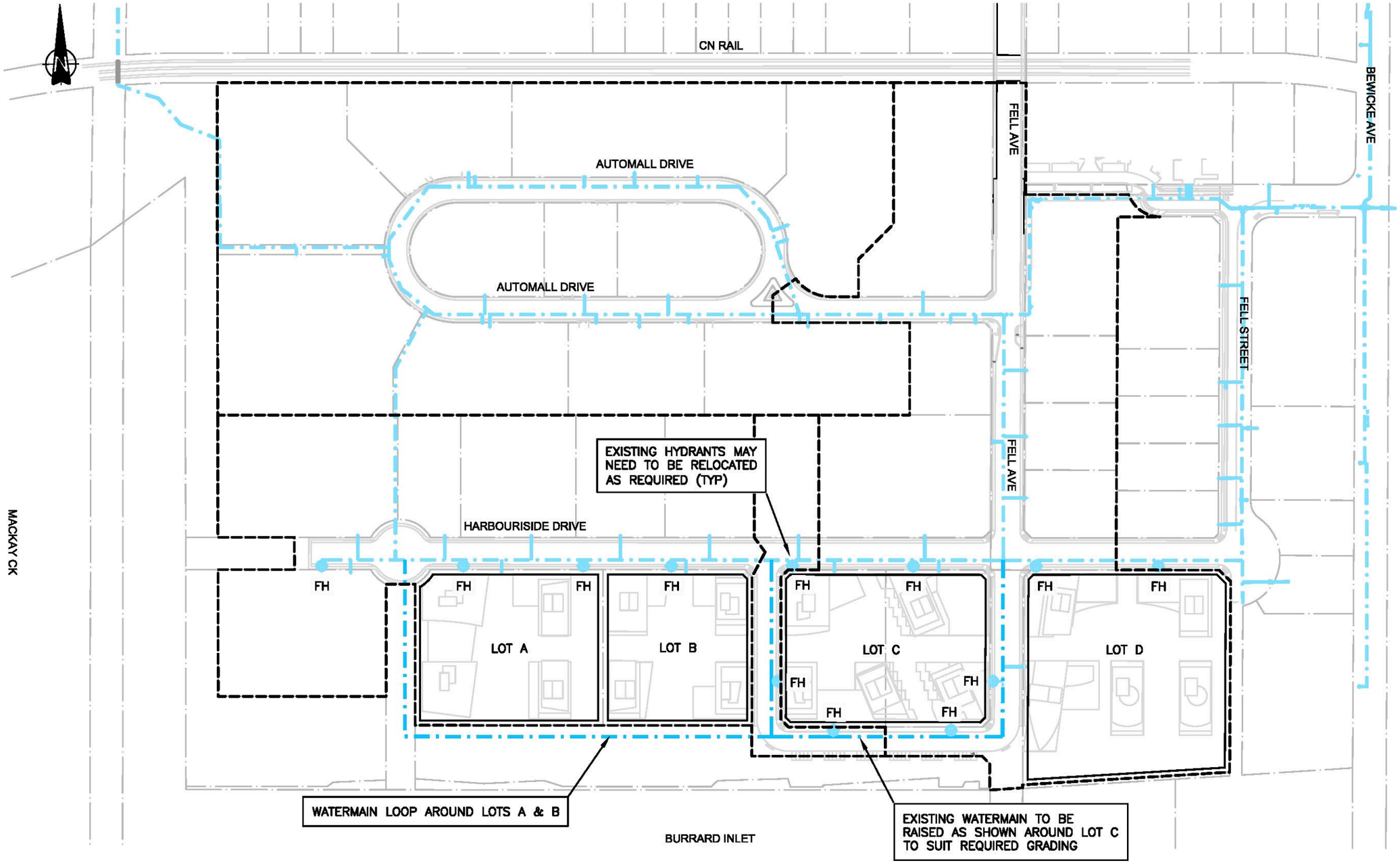

Figure 3.1: Sanitary Calculations

Calculations

Project:	Harbourside Village	File:	12168
Subject:	Sanitary Sewer Analysis	Date:	2-Feb-13
Section:	Existing Condition (CNV Bylaw Density)	By:	R.A.W.

Location		Area								Flow			Pipe		Capacity		Comments
From	To	Serviced Area (ha)	Upstream Area (ha)	Area (ha)	Residential [1]	Commercial Industrial [2]	Serviced Units	Upstream Units	Total Units (capita)	Domestic Flow (l/s) [3]	Infiltration(l/s) [4]	Peak Flow (l/s)	Pipe Size (mm)	Pipe Slope (%)	Velocity (m/s)	Percent Full (%)	
S1	S3	3.9	0.0	3.9	0.00	3.94	217	0	217	5.1	0.4	5.5	250	0.40%	0.55	26%	< 50%
S2	S3	3.8	0.0	3.8	0.00	3.84	211	0	211	5.0	0.4	5.4	250	0.40%	0.54	26%	< 50%
S3	S4	1.8	7.8	9.6	0.00	1.81	99	428	527	12.5	1.0	13.5	250	0.80%	0.90	34%	< 50%
S5	S6	6.1	0.0	6.1	0.00	6.08	335	0	335	7.9	0.6	8.5	250	0.31%	0.56	35%	< 50%
S6	S7	2.0	6.1	8.1	0.00	2.02	111	335	446	10.6	0.8	11.4	250	0.25%	0.57	43%	< 50%
S7	S4	4.2	8.1	12.3	0.00	4.22	232	446	677	16.1	1.2	17.3	250	0.28%	0.66	53%	Okay
S4	S8	0.6	21.9	22.5	0.00	0.56	31	1205	1235	23.4	2.2	25.6	300	0.25%	0.69	52%	Okay

1. 230 capita/ha (assumed)
2. 55 capita/ha (equivalent to 22,500 l/ha/day per CNV Bylaw)
3. 410 l/capita/day x Capita x Peaking Factor (per CNV Bylaw)
4. 0.1 l/sa/ha (per CNV Bylaw)

Figure 3.2: Sanitary Calculations

Calculations

Project:	Harbourside Village	File:	12168
Subject:	Sanitary Sewer Analysis	Date:	4-Apr-13
Section:	Postdevelopment Condition (CNV Bylaw Density)	By:	R.A.W.

Location		Area								Flow			Pipe		Capacity		Comments
From	To	Serviced Area (ha)	Upstream Area (ha)	Area (ha)	Residential [1]	Commercial Industrial [2]	Serviced Units	Upstream Units	Total Units (capita)	Domestic Flow (l/s) [3]	Infiltration(l/s) [4]	Peak Flow (l/s)	Pipe Size (mm)	Pipe Slope (%)	Velocity (m/s)	Percent Full (%)	
S1	S3	3.9	0.0	3.9	0.00	3.94	217	0	217	5.1	0.4	5.5	250	0.40%	0.55	26%	< 50%
S2	S3	3.8	0.0	3.8	0.00	3.84	211	0	211	5.0	0.4	5.4	250	0.40%	0.54	26%	< 50%
S3	S4	1.8	7.8	9.6	0	1.81	99	428	527	12.5	1.0	13.5	250	0.80%	0.90	34%	< 50%
S5	S6	6.1	0.0	6.1	2.01	4.07	686	0	686	16.3	0.6	16.9	250	0.31%	0.68	51%	< 50%
S6	S7	2.0	6.1	8.1	1.26	0.76	331	686	1018	19.3	0.8	20.1	250	0.25%	0.65	60%	Upgrade
S7	S4	4.2	8.1	12.3	1.656	2.56	522	1018	1539	29.2	1.2	30.4	250	0.28%	0.73	79%	Upgrade
S4	S8	0.6	21.9	22.5	0	0.56	31	2067	2097	39.8	2.2	42.0	300	0.25%	0.77	72%	Upgrade

1. 230 capita/ha (assumed, equivalent to 862 additional units)
2. 55 capita/ha (equivalent to 22,500 l/ha/day per CNV Bylaw)
3. 410 l/capita/day x Capita x Peaking Factor (per CNV Bylaw)
4. 0.1 l/sa/ha (per CNV Bylaw)

Figure 3.2: Preliminary Sanitary Plan

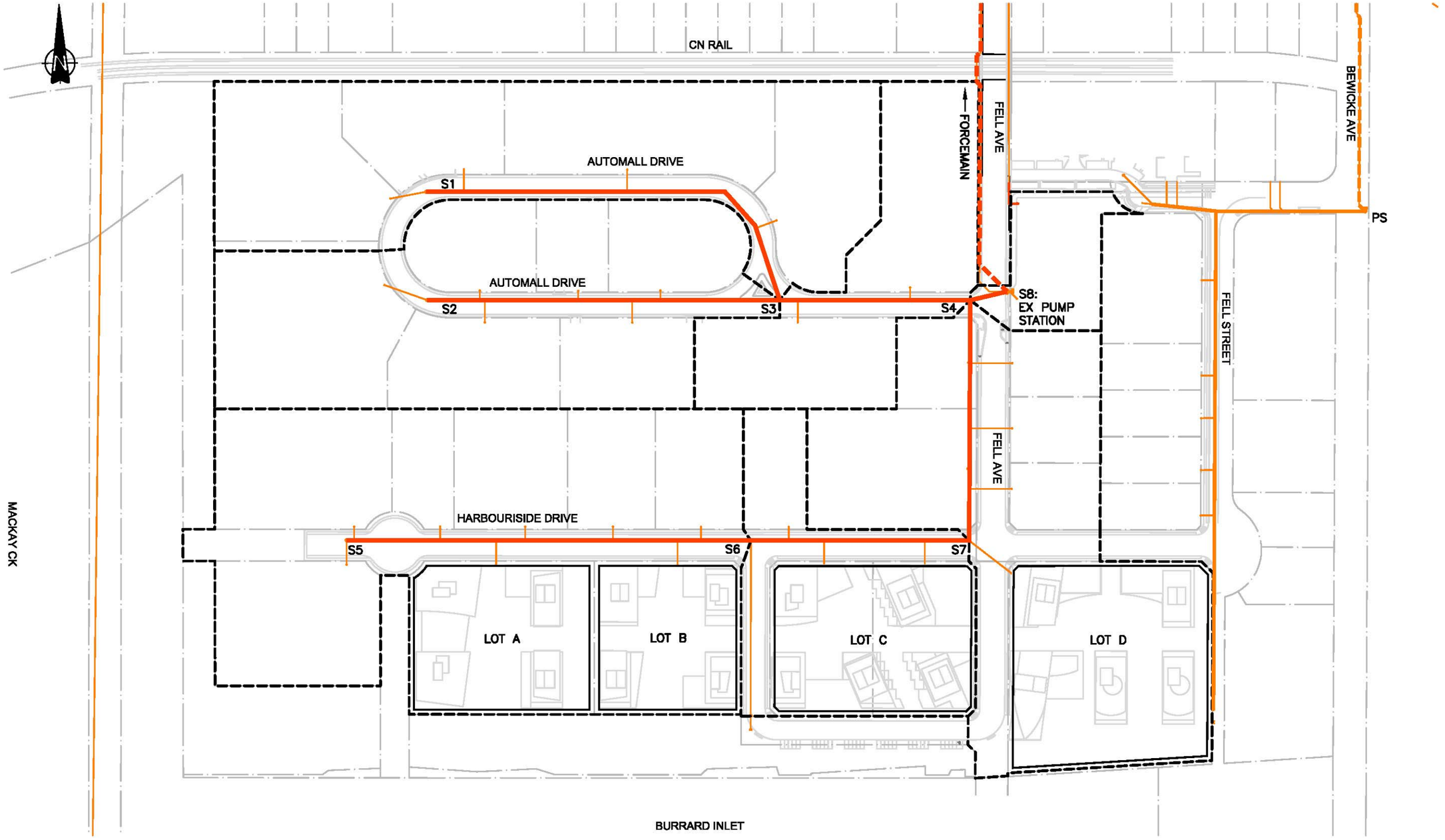

Figure 4.1: Preliminary Storm Calculations

Calculations

Project:	Harbourside Waterfront	File:	12168
Subject:	Storm Sewer Analysis	Date:	2-Feb-12
Section:	Predevelopment / Postdevelopment Condition	By:	R.A.W.

					10 Year Event							
Location		Tributary Area			Flow		Pipe			Capacity		Comments
From	To	Area (ha)	R	Tc (min)	i (mm/hr)	Peak Flow (l/s)	Pipe Size (mm)	Pipe Slope (%)	Length (m)	Velocity (m/s)	Percent Full (%)	
D1		8.5	0.80	12	38.5	725.7	750	0.54%	300	2.09	73%	Okay
D2	D3	0.6	0.80	12	39.5	51.4	375	0.20%	85	0.76	59%	Okay
D3	D4	6.5	0.80	15	34.5	501.0	750	0.55%	365	1.96	56%	Okay
D5	D6	7.5	0.80	14	35.5	592.1	750	0.31%	410	1.60	78%	Okay

Figure 4.2: Preliminary Storm Catchment Plan