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Section 7

Future Sewer Infrastructure

7. Future Sewer Infrastructure

Future sewer infrastructure was designed to service all portions of the City not currently connected to the sanitary sewer system. This plan represents our estimation of the most cost effective means to service the entire City with sanitary sewers. It should be noted that the plan is developed to service every fee-simple property. For strata properties a minimum of one potential connection point is provided rather than servicing every unit within the strata.

It is anticipated that this plan will change when the preliminary and detailed designs are completed for these areas.

7.1 Sewer Layout Methodology

The general tasks completed in preparing the future sewer infrastructure plan were as follows:

- Review of pertinent background studies and reports, and existing sewer infrastructure and potential connection locations;
- Review of topographic information to generate sewer flow directions;
- Review of currently established rights-of-ways and suitability for use by gravity sewer mains;
- Development of preliminary gravity, forcemain and pump station locations and routing;
- Submission of preliminary infrastructure plan to the City, obtain comments and discuss;
- Field truthing in critical areas; and
- Consideration of existing infrastructure capacities.

The sewer routes selected are on property under the control of the City (i.e. within road allowances or existing sanitary sewer right-of-ways). However, for some areas alternative routes requiring a right-of-way may be a more cost effective way of servicing these properties. Additionally in some areas we have identified an alternative(s) for sewer servicing which may be beneficial but will require a detailed analysis to determine if it is feasible or an IMA with the City of Langford will be required. These alternatives should be considered by the designers of the sewers for these areas.

Illustrations of these servicing alternatives along with brief descriptions are provided in Appendix C.

7.2 Design and Assessment Criteria

This section describes the design criteria used in developing the sewer layout as well as assessment of the existing sanitary sewer infrastructure.

7.2.1 Gravity Mains

To assess the gravity mains, the pipe capacity (Q) is calculated using Manning's equation and this is compared with the peak wet weather flow (q). A friction factor of 0.013 was used for this analysis. If $q/Q > 1$, the pipe is considered overloaded. These pipes typically represent the bottlenecks in the system. It is noted that InfoSewer (the software selected for this project) assumes a minimum pipe slope of 0.001% to allow q/Q to be calculated, e.g., a flat pipe.

The maximum d/D ratio for each pipe shows the maximum ratio of depth (d) of flow to full pipe diameter (D). When assessing existing pipe capacity, full pipes (d/D=1.0) indicate a need for the pipe to be upgraded. The gravity sewers have been sized so that the d/D ratio does not exceed 0.7.

The minimum grade for future sewers has been selected based on a minimum velocity of 0.61 m/s (2.0 f/s) when flowing full or half-full. The resulting recommended minimum gradients, with allowance for pipe laying inaccuracy and settlement, are summarized in the following table.

Table 7-1: Recommended Minimum Gravity Pipe Sizes

Pipe Size (mm)	Gradient for 0.61 m/s (%)	Recommended Minimum Gradient (%)
150	0.50	0.60
200	0.34	0.40
250	0.25	0.30
300	0.20	0.25
375	0.15	0.20
450	0.12	0.15
525	0.10	0.15
600+	0.08	0.10

7.2.2 Pump Stations

The pump stations are assessed for capacity by comparing the peak inflow rate with the pumping capacity.

If the pumping rate of a single pump for a duplex pump station or two pumps for a triplex pump station was less than the peak inflow rate, the pump station was identified as not having adequate capacity. This was identified if the water level in the pump station rose above the lead pump start level. For triplex pump stations this was identified if the water level rose above the second pump start level.

The pumps were also checked if they were near capacity. The pump station was identified as near capacity if the peak inflow plus 30% exceeded the pumping rate. The 30% factor was used to simulate the amount of peak hour runtime a pump stays on for. i.e. if the peak inflow plus 30% exceeds the pumping rate, then it is estimated that the pump will run for about 70% of the peak hour (42 minutes) or longer. This was done for inconsistencies in modeled pump operation relative to real world operation.

For future pump stations, the pumping rate was set to match the peak inflow rate.

7.2.3 Forcemains

The forcemains are evaluated and sized for both low and high velocities.

Low velocities are defined as less than 0.9 m/s. The purpose of the minimum forcemain velocity criteria is to maintain minimum scouring velocity to reduce build-up in the forcemain.

Acceptable design velocity in a forcemain is normally in the range of 0.9 – 2.5 m/s. The USEPA[8] recommends that maximum forcemain velocity at peak conditions not exceed 3 m/s. 2.5 m/s has been selected as a trigger for further assessment. This could indicate the forcemain is undersized and there is excessive power consumption.

7.2.4 Low-Pressure-Sewer Systems

A low-pressure-sewer system is an alternative to a gravity sewer and municipal pump station system. These systems include multiple grinder pumps, owned and operated by the residents, and a common pressurized main.

These systems will require more long-term maintenance by the property owners of the individual pumps compared with a traditional gravity connection and are therefore not ideal. However, LPS systems have been shown to be an overall cost effective way to provide sewer service to some areas, particularly in undulating topography or areas where a very deep gravity sewer would be required.

The future servicing scenario includes a number of LPS systems for groups of properties that cannot be practically serviced by a gravity system. These property groups are typically less than 20 lots. It is anticipated that the common forcemains for these LPS systems will be less than 75 mm in diameter.

7.3 Sewer Master Plan (SMP)

The proposed sewer plan is illustrated on Figure 7-1 (keyplan plus 8 drawing sheets). This SMP is the proposed servicing strategy for servicing the entire City for the future land-use scenario. The plan includes sizing of future infrastructure as well as identifying required upgrades. These sizes and upgrades are based on the modelling analysis and results described in Section 8.

The plans include the following information:

- The CRD trunk sanitary sewer through the City;
- Existing City of Colwood sanitary sewer infrastructure (gravity mains, pump stations and forcemains);
- Proposed sanitary sewers including elevations, grades and pipe sizes;
- Proposed sanitary sewer pump stations; and
- Proposed pipe sizes for existing sanitary sewer with inadequate capacity.

[8] Wastewater Technology Fact Sheet, Sewers, Forcemain, USEPA 832-F-00-071, Sep, 2000

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SHEET 6

SHEET 4

SHEET 2

SHEET 8

SHEET 1

SHEET 7

SHEET 5

SHEET 3

PLAN

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CITY OF COLWOOD
SEWER MASTER PLAN
KEYPLAN

KWL Project No.	2417.003	**Scale**	AS SHOWN	**7-1**
Sheet	KEYPLAN	**Rev. No.**	0	Figure Number
Client:	CITY OF COLWOOD			

FINAL

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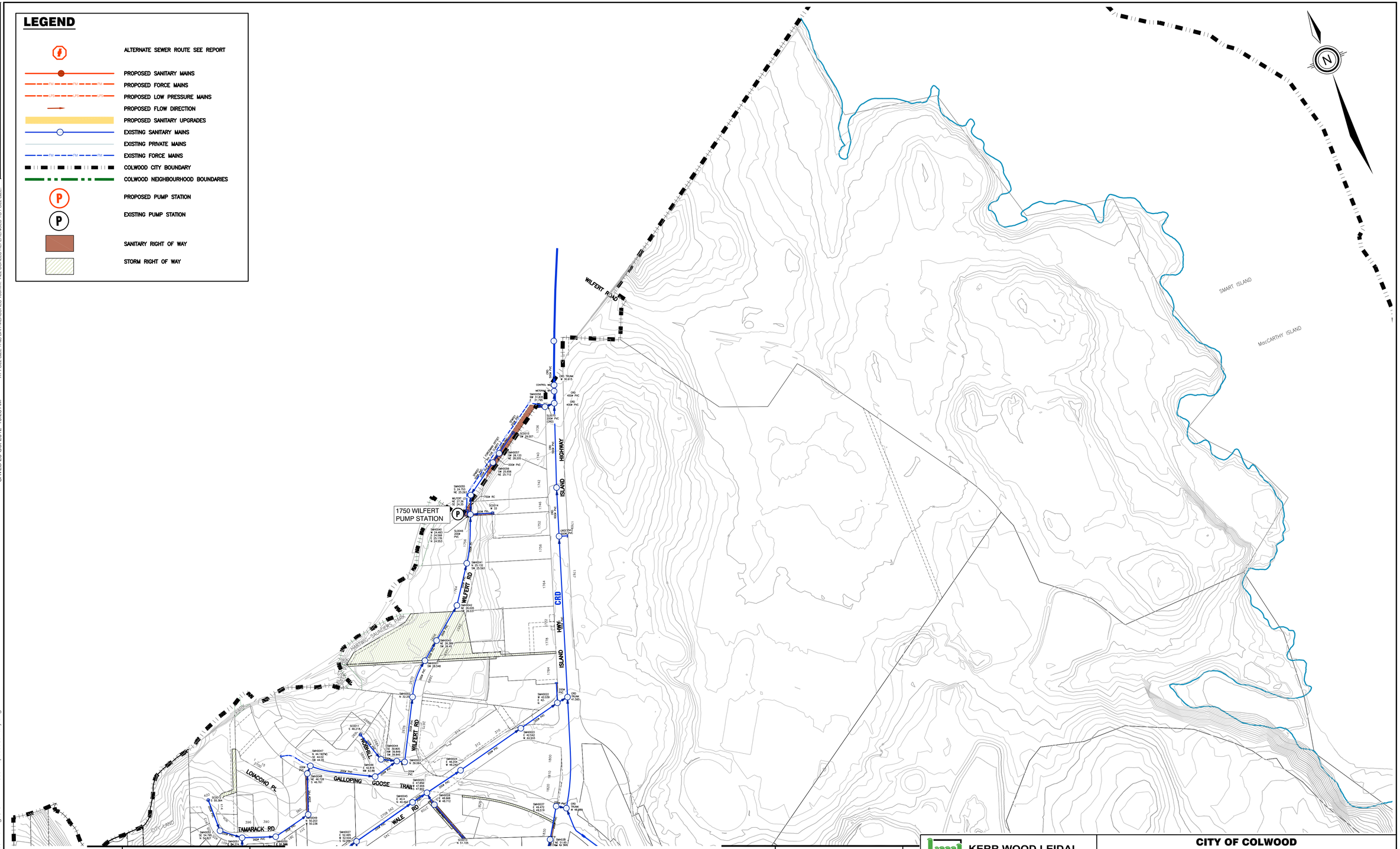
LEGEND

- ALTERNATE SEWER ROUTE SEE REPORT
- PROPOSED SANITARY MAINS
- PROPOSED FORCE MAINS
- PROPOSED LOW PRESSURE MAINS
- PROPOSED FLOW DIRECTION
- PROPOSED SANITARY UPGRADES
- EXISTING SANITARY MAINS
- EXISTING PRIVATE MAINS
- EXISTING FORCE MAINS
- COLWOOD CITY BOUNDARY
- COLWOOD NEIGHBOURHOOD BOUNDARIES
- PROPOSED PUMP STATION
- EXISTING PUMP STATION
- SANITARY RIGHT OF WAY
- STORM RIGHT OF WAY



PLAN

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CITY OF COLWOOD
SEWER MASTER PLAN

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Sheet	1	**Rev. No.**	2

7-1
Figure Number

Client: CITY OF COLWOOD

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LEGEND

- ALTERNATE SEWER ROUTE SEE REPORT
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- COLWOOD NEIGHBOURHOOD BOUNDARIES
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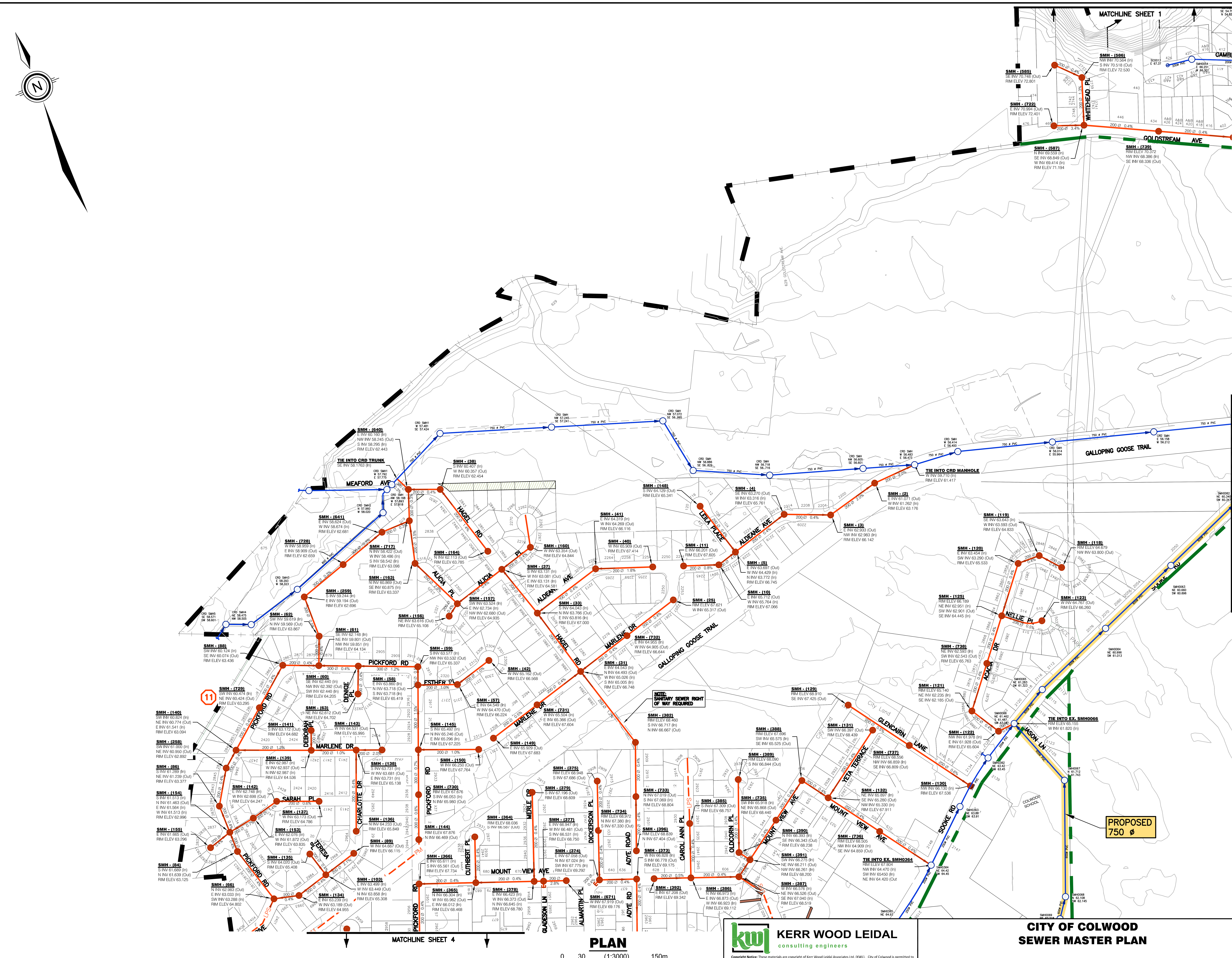
- SANITARY RIGHT OF WAY
- STORM RIGHT OF WAY



PLAN

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CITY OF COLWOOD SEWER MASTER PLAN

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Sheet	2	Rev. No.	2	Figure Number
Client: CITY OF COLWOOD				

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MATCHLINE SHEET 1

MATCHLINE SHEET 2

MATCHLINE SHEET 5

GAMBLE PL

GAMBLE DR

GOLDSTREAM AVE

SOOKE RD

COLWOOD CRES

ALDEANE AVE

ISLAND

OCEAN BOULEVARD

BELMONT RD

ROSEBANK RD

JEROME RD

DND FORCEMAIN

DND BELMONT

340 BELMONT PUMP STATION

PROPOSED 750 ø

TIE INTO EX. SMH0326

SMH - (589)

ROYAL ROADS UNIVERSITY

FORT ROAD HILL

X Island City Land

PLAN

0 30 (1:3000) 150m

LEGEND

- ALTERNATE SEWER ROUTE SEE REPORT
- PROPOSED SANITARY MAINS
- PROPOSED FORCE MAINS
- PROPOSED LOW PRESSURE MAINS
- PROPOSED FLOW DIRECTION
- PROPOSED SANITARY UPGRADES
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CITY OF COLWOOD
SEWER MASTER PLAN

KWL Project No.	2417.003	Scale	1:3000
Sheet	3	Rev. No.	2

7-1
Figure Number

Client: CITY OF COLWOOD