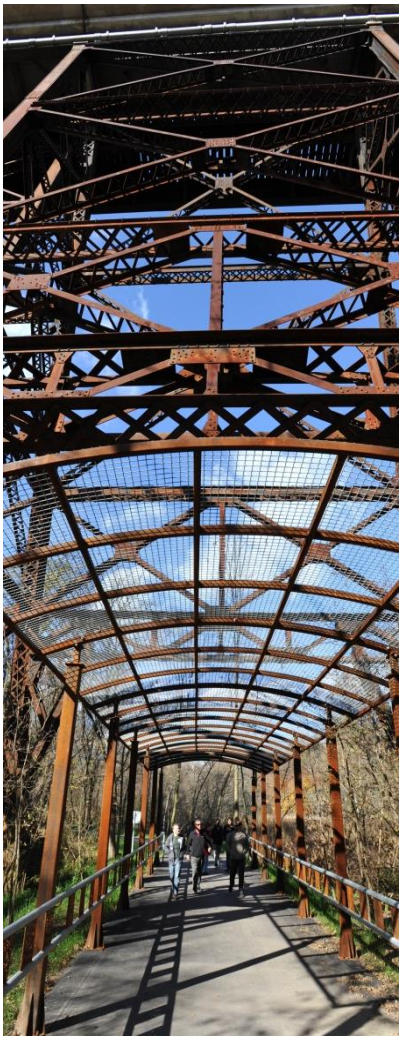

FarSight Sewage Pumping Station and Forcemain Design Development

Conceptual Design Report

Final

December 18, 2024

Prepared for:

FARSIGHT HOMES™

RVA

R.V. Anderson Associates Limited
2001 Sheppard Avenue East, Suite 300
Toronto ON M2J 4Z8 Canada
T 416 497 8600 **F** 855 833 4022
rvanderson.com

December 18, 2024 RVA R237294

FarSight Homes
117 Ringwood Drive, Unit 18
Stouffville, ON L4A 8C1

Attention: Mr. Robert Schickedanz
FarSight Homes
bob@farsight.ca

Re: Conceptual Design Report
FarSight Sewage Pumping Station and Forcemain Design Development

Please find enclosed the Conceptual Design Report including a site plan drawing for the referenced project for your review prior to the submission to the Town of Whitchurch-Stouffville.

Please do not hesitate to contact the undersigned if you have any questions.

Yours very truly,

R.V. ANDERSON ASSOCIATES LIMITED

Evan Toews, P.Eng.
Project Manager

FarSight Sewage Pumping Station and Forcemain Design Development

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Town of Whitchurch-Stouffville

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FarSight Sewage Pumping Station and Forcemain Design Development
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APPENDICES

1.0 INTRODUCTION

R.V. Anderson Associates Limited (RVA) has been retained by FarSight Homes to undertake the Conceptual Design of a sewage pumping station (SPS) and forcemain for a 16-ha parcel located in Ballantrae, Ontario.

The subject land is located in the southeast quadrant of Aurora Road and Highway 48. The land fronts onto Lakeshore Road, which runs east off of Highway 48, south of Aurora Road. The land consists of three parcels with municipal address 5426, 5452 & 5584 Lakeshore Road. FarSight Homes is proposing to build 145 condominium single family dwellings.

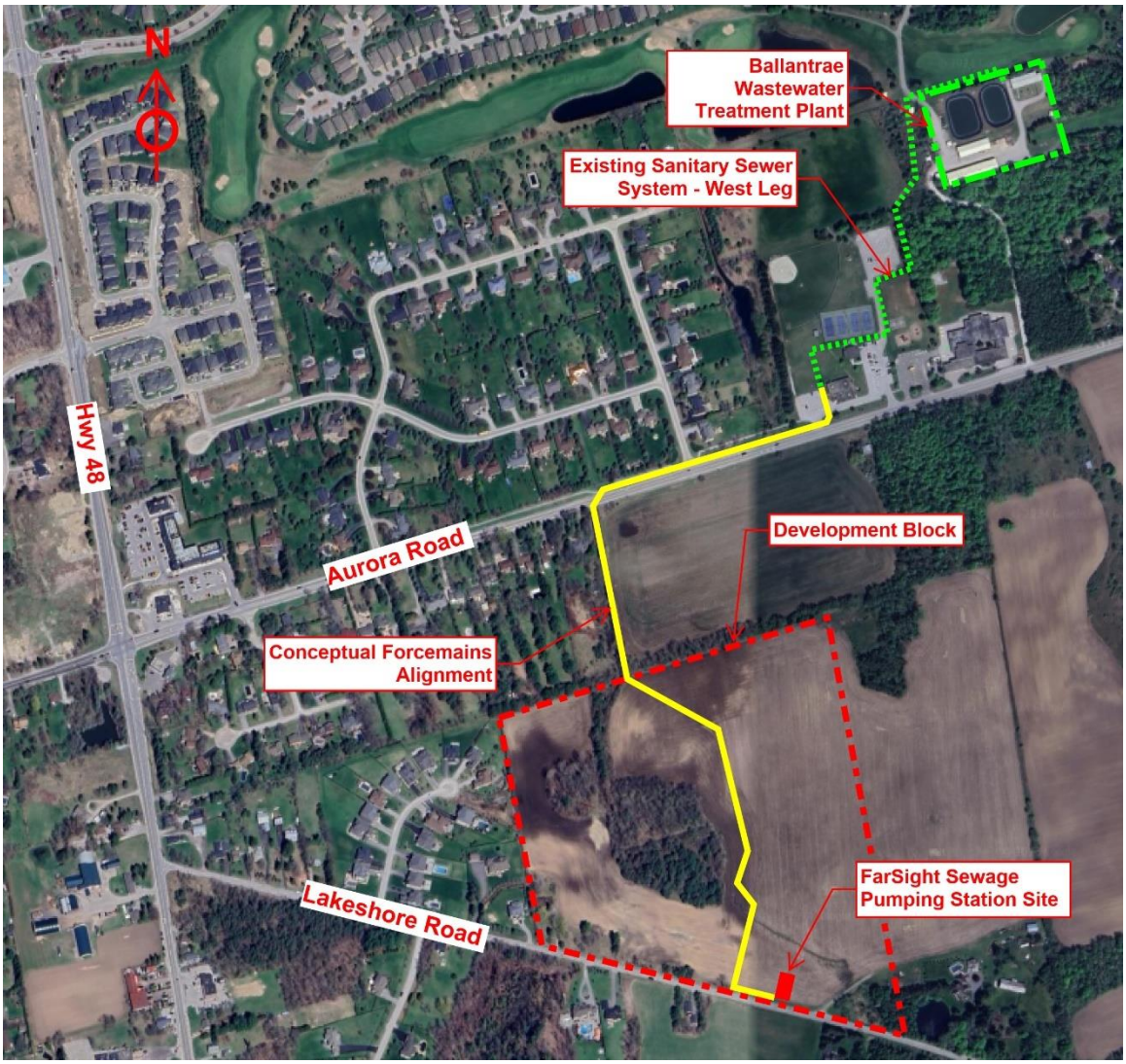


Figure 1.1 FarSight SPS and Forcemain - Key Plan

The SPS will be located at the south side of the development block, north-east of 5451 Lakeshore Road and will serve an approximate population of 478 persons.

This report is provided to summarize the conceptual design of the proposed SPS.

2.0 DATA SOURCES

2.1 External Drawings and Documentation

The following list of drawings and documentation were referenced by RVA in the development of design parameters for the SPS:

- FarSight Homes Functional Servicing and Stormwater Management Report, by Sabourin Kimble & Associates Ltd, dated November 2022,
- FarSight Homes Ballantrae WWTP Capacity Evaluation, Update of Capacity Evaluation for Farsight 141 Unit Subdivision, by Hatch, dated March 2020
- Conceptual FarSight Communal Water System Technical Memo, by RVA, dated November 2024
- Geotechnical Investigation – FarSight Homes, Ballantrae, 5426, 5452 & 5584 Lakeshore Road, Whitchurch-Stouffville, Ontario, by WSP, dated May 5, 2021

2.2 Codes, Standards, & Guidelines

The following list of documents were referenced and are adhered to by RVA in the development of design basis for the PS:

- York Region - Environmental Services Department Capital Planning and Delivery Branch – Design Guidelines, April 2023
- York Region – Communal Water and Wastewater Design Standards, 2023
- Town of Whitchurch-Stouffville, Design Guidelines and Standard Drawings, January 2023
- Design Guidelines for Sewage Works 2008 (Ministry of Environment, Conservation & Parks)
- Hydraulic Institute 9.8 – Rotodynamic Pumps for Pump Intake Design

3.0 PROCESS DESIGN

3.1 Capacity Design Criteria

The station is sized to service a population of 478 persons which results in a total peak flow of 9.99 L/s per sewer design calculations provided by Sabourin Kimble & Associates Ltd (SKA). The SPS services the entire FarSight Homes-Ballantrae development block. The data was referenced from the flow entering the SPS in the sanitary sewer design

sheets (listed in Appendix 1). Table 3-1 below presents the design criteria for the FarSight Sewage Pumping Station.

Table 3-1: SPS Sizing Criteria

	Population	Drainage Area (ha)	Infiltration (L/s)	Sanitary Flow (L/s)	Total Flow (L/s)
FarSight SPS	**478**	**9.90**	**2.28**	**7.71**	**9.99**

At a peak flow of 9.99 L/s (863 m^3/day), the proposed station is classified as a **Type I facility** (Peak flow less than 9000 m^3/day) per the York Region - Environmental Services Department Capital Planning and Delivery Branch – Design Guidelines. Therefore, the station will consist of a total of two (2) installed pumps (one duty and one standby) and a single duty forcemain.

3.2 Wet Well Sizing

Pump Station Inlet

The pumping station receives sewage from a gravity sewer at invert El. 326.8 m, approximately 5.3 m below grade. As additional measures to mitigate clogging of the pumps, a removable grinder mounted to the inner wall of the wet well may be considered during detailed design stage.

Pump Station Configuration and Sizing

The pumping station is a circular, cast in place type of wet well with 3.6 m internal diameter and 7.2m depth. The wet well is sized to provide sufficient volume for pump placement as well as the required 1-hour emergency storage volume at peak flow. The dimensions and elevations of the wet well is also designed to accommodate the incoming sewer elevation. The wet well is designed as a single cell wet well, as per MECP guidelines.

The pump configuration considers one (1) duty pump operating to provide the ultimate pumping capacity of 10.0 L/s and one (1) standby pump of the same capacity for redundancy. Pump active volume, emergency storage volume, and pump operating level are shown in table below. Detailed design parameters and calculations are shown in Appendix 2.

An external below grade valve chamber is included to house the flowmeter and bypass connection for the forcemain.

Table 3-2: Pump Operating Level, Emergency Storage Volume, and Pump Active Volume

Parameter	Units	Value
Wet Well Plan Area	m^2	10.18
Emergency Response Time	hour	1.00
Emergency Storage Required	m^3	35.97
Height of Emergency Storage	m	3.80
Emergency Storage Volume Available	m^3	36.75
Overflow Invert	mASL	330.3
Inlet Sewer Invert	mASL	326.8
Top of Emergency Storage Zone	mASL	330.0
HHWL (Alarm)	mASL	326.2
HWL of Pump Active Volume	mASL	325.9
Height of Active Zone	m	0.50
LWL of Pump Active Volume	mASL	325.4
LLWL (Alarm)	mASL	325.2
Floor of Station / Wet Well Invert	mASL	324.9
Pump Cycles per hour	-	2.32

3.3 Pump Sizing and Selection

The pump station is designed to be a single-cell wet well with one (1) duty and one (1) standby submersible pumps. Each pump is sized to pump more than the 10.0 L/s the peak flow rate.

System curves were developed using the Hazen-Williams equation for the following three (3) conditions of suction static head conditions and Hazen-Williams 'C' factors.

- Condition A: Low sewage level in the wet well, C=120
- Condition B: Median sewage level, C=130
- Condition C: High sewage level, C=140

The total dynamic head (TDH) for Condition B was used for pump selection, as per MECP guidelines. In addition, the system curve for the overflow condition was also calculated to review the pump operating condition after an overflow event. The pumps will discharge through a single 150 mm HDPE forcemain to the downstream MH, approximately 1050 m away from the pumping station. The system curves are plotted in Figure 3.1.

The system curves and duty points were used for a preliminary selection of Xylem/Flygt pumps as the first-named vendor. The Flygt NP3085 with 116 mm impeller was selected for the primary duty point. The flow of the duty pump is 10.6 L/s under Condition B, and approximately 13.0 L/s under overflow condition. The operating points under normal conditions are within the preferred operating range (POR) of the selected pump.

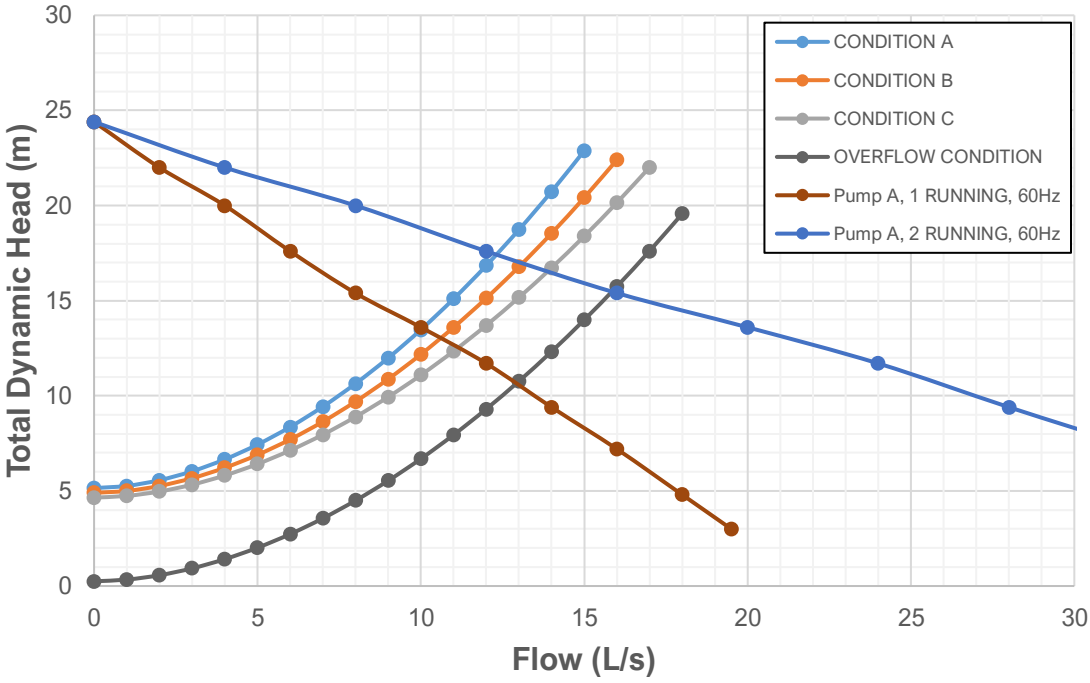


Figure 3.1 System Curves and Selected Pump

The pump configuration and operating conditions are listed in Table 3.3 and detailed hydraulic design calculations are included in Appendix 3.

Table 3.3 Pump Operating Conditions

Parameter	Value
Peak Flow (L/s)	10.0
Pump Configuration	1 duty, 1 standby
Each Pump Capacity Req'd (L/s)	10.0
Total Dynamic Head at duty point, Condition B (m)	12.2
Selected Pump (First-named Vendor)	Flygt NP3085
Pump Best Efficiency Point (BEP)	54.5 % at 11 L/s, 12.0 m
Nominal Motor Rated Speed (RPM)	3600
Motor Size	3 kW (4 HP)

3.4 Valve Chamber

The pumping station includes a 2.0 m by 3.0 m below grade valve chamber adjacent to the wet well structure. The valve chamber is considered a Class 1, Division 2 hazardous area per the National Fire Protection Association (NFPA) 820 guidelines. The below-grade valve chamber houses valves and instrumentation for the forcemain. See Section 8.0 Conceptual Instrumentation & Control Design for a detailed list of instrumentation installed

in the valve chamber. The valve chamber is sized to provide access and removal capability for the valves, flowmeters and other instrumentation equipment necessary for forcemain monitoring.

3.5 Forcemain

One duty forcemain is provided at 150mm diameter and HDPE material (assumed PE4710, IPS DR9, PC252). HDPE is an acceptable pipe material per York Region guidelines with superior cyclic and transient loading resistance compared to PVC and suitable for installation in long fused sections given the small size but relatively long length of the forcemain. HDPE will also be the required material for any trenchless installations to be completed by horizontal directional drilling (HDD). The pipe size and class have been selected to best match the desired internal diameter to optimize the hydraulic characteristics of the forcemain given the peak flow requirements. The pipe class should be reviewed and confirmed upon the completion of a Hydraulic Transient Analysis during detailed design.

The forcemain alignment is shown on Appendix 4, it runs from the SPS wet well to Lakeshore Road and then continues west for 70 m to the future development Street ‘D’, and then north for 120 m to cross future Street ‘B’. From here the forcemain crosses beneath the creek channel and then will be installed north within the open natural area for 320 m, following along the east side of the future creek channel, before bending into the existing 20 m wide Town of Whitchurch-Stouffville drainage property. Next the alignment runs along the east side of the drainage property for 200 m and then crosses Aurora Road, it is anticipated that the crossing of Aurora Road will require trenchless methods to avoid impacting the Regional Road. Finally, the alignment travels along the north side of Aurora Road for 300 m, staying within the Region ROW beneath the existing sidewalk where possible, until bending north to extend 30 m into the property of the Ballantrae Community Centre (5592 Aurora Rd).

The forcemain will terminate at an existing sanitary maintenance hole located west of the Ballantrae Community Centre building. The existing sanitary sewer system conveys this sewage north-east to the Ballantrae Wastewater Treatment Plant (WWTP) which services the Ballantrae Golf and Country Club and associated community. This section of the sanitary sewer system serves as the “west leg” of the overall sanitary system providing the input to the Ballantrae WWTP. Discharging into the “west leg” instead of directly to the Ballantrae WWTP reduces the overall length of the forcemain by more than 500 metres, reduces the impact to the adjacent properties, and improves the hydraulic characteristics of the system.

RVA reviewed whether the existing west leg sanitary sewer system has sufficient capacity to accept the FarSight SPS forcemain flows, however there is no existing flow information available for these sewers. The existing west leg sanitary sewer system maximum pipe capacities were estimated based on pipe flow calculations using the Hazen-Williams equation, these capacities and the pipe system layout are shown in Appendix 7.

The rated capacities noted in the 2020 Hatch - Farsight Homes - Ballantrae WWTP Capacity Evaluation do show that the Ballantrae WWTP and WWTP SPS downstream of the sanitary system have no issues accepting the new FarSight SPS flows:

- Ballantrae WWTP, Average flow capacity = 1,045 m^3/day, 12.1 L/s → Current flow + 94 Ballymore Units + 142 FarSight Units = 78.8% of capacity
- Ballantrae WWTP SPS, Peak WW flow capacity = 5,665 m^3/day, 65.6 L/s → Current flow + 94 Ballymore Units + 142 FarSight Units = 61.7% of capacity

As per discussion with FarSight Homes, RVA has assumed that the flow from the 94 units of the Ballymore development is entering the WWTP site from the north or east sanitary system legs and therefore has no impact on the west leg capacity. We have assumed that the west sanitary sewer leg (which this forcemain will tie-in to) contains flow less than or equal to the existing WWTP/SPS peak wet weather measured flow of 788 m^3/day (9.12 L/s) as stated in the 2020 Hatch - FarSight Homes - Ballantrae WWTP Capacity Evaluation report. The existing sewers which make up the west leg are primarily 200mm diameter HDPE pipes installed at 0.5% slope and have an assumed capacity of 23.2 L/s, which leaves 14 L/s of capacity remaining, sufficient to accept the 9.99 L/s peak flow rate of the FarSight SPS forcemain. The existing sewer leaving the selected discharge maintenance hole is a 150mm diameter PVC pipe at 1.0% slope with an assumed capacity of 15.2 L/s, consideration should be given to upsizing this pipe to 200mm if flow monitoring determines it is required.

Based on this information we have proceeded with the forcemain conceptual design alignment of connecting to the existing MH west of the Ballantrae Community Centre under the assumption the system has sufficient capacity to accept the existing plus new flows. Flow monitoring should be completed during the detailed design phase to confirm these assumptions.

The forcemain should be installed at 1.8 m depth of cover to obvert below the future development road surface, future ground surface elevations, and the existing ground adjacent to Aurora Rd and be continuously rising from the wet well to the discharge point if possible, to ensure that the forcemain will drain back to the SPS. The existing ground surface elevations provided by SKA indicate that there will be several significant rises and falls along the proposed forcemain alignment between the FarSight SPS and Aurora

Road, followed by a nearly flat existing road surface slope along Aurora Road. If the forcemain cannot be continuously rising, then drain valve chambers should be installed at local low points and air/vacuum release valve chambers should be installed at local high points, with exact locations and valve sizing to be determined through transient analysis.

Under normal operating conditions, the forcemain velocity is approximately 0.77 m/s, which is above the minimum scour velocity of 0.6 m/s as per MECP guidelines, and slightly below the preferred velocity of York Region's Design Guidelines of 0.8 – 4.0 m/s. As the normal operating velocity in the forcemain is at the lower range of typical velocities, using both pumps to conduct regular flushing can be considered to mitigate solid deposition. This forcemain size selection also has the ability to accommodate future development which could increase the velocity up to the maximum limit of 3.0 m/s and 4.0 m/s, as per MECP and York Region guidelines, respectively.

3.6 Emergency Overflow

A 300mm diameter emergency overflow pipe is provided at the overflow maintenance hole located immediately north-east of the SPS site with the obvert elevation at the overflow level set 1.8 m below the Assumed Datum for Ground Elevation of the lowest incoming MH to the PS. During detailed design, it should be confirmed that this elevation is 0.5 m below the lowest basement flooding elevation in the wet well. The overflow could be directed to the future creek channel located to the north-east or to the adjacent storm water management system located in the block to the east. We recommend that a backflow prevention device be installed on the overflow pipe to prevent wet weather flow back into the wet well. As per MECP guidelines, a flow monitoring device will be installed on the overflow pipe to track any flow being discharged to the environment.

3.7 Pump Station Initial Operation

At the initial stage of operation, it is understood that only a fraction of the full pump station capacity would be utilized due to phased occupancy. Estimates of the initial built-out flows were developed based on design data provided by SKA. Assuming 10% of the ultimate population serviced and an infiltration flow equal to 40% of the peak dry weather flow, the average dry weather flow and peak wet weather flow are 0.91 L/s and 3.19 L/s, respectively. The minimum operation volume for one constant speed duty pump with 3.19 L/s incoming flow is approximately 1.32 m^3 (max. 6 starts per hour). Operational changes can reduce the operating volume to as low as approximately 2.0 m^3 to reduce the residence time. However, this volume would still result in an exceedance of the recommended 30-minute fill time as per MECP guidelines at the average flow. The reduced flow may result in excess residence time within the wet well or forcemain that can

sulfides generation leading to potential for odours and corrosion. Potential mitigation strategy should be considered once initial flows are confirmed by the client.

4.0 SITE CIVIL DESIGN

The FarSight SPS does not include a dedicated superstructure in addition to the wet well and valve chamber. However, it is anticipated that there will be a building located within the site block for the FarSight Communal Water System. This building will house electrical equipment, control panels, and ancillary building mechanical systems and equipment, and is described within the Conceptual FarSight Communal Water System Technical Memorandum. The site layout is shown on the conceptual site plan drawing in Appendix 5. The FarSight SPS and FarSight Communal Water System civil designs should be considered together during detailed design to achieve efficiencies in both designs.

4.1 Site Location

The SPS site is located within the property limits of 5452 Lakeshore Road, on the south side of the development block, north-east of 5451 Lakeshore Road, at a currently undeveloped farmland lot. Road access is expected to be off Lakeshore Road.

This site location described on the proposed Plan of Subdivision as Block 156 of 0.11 ha in site area was provided by SKA in the FarSight Homes Preliminary Grading Plan, see Appendix 6.

The site block is to contain all systems required for the FarSight SPS and Forcemain, as well as for the FarSight Communal Water System.

4.2 Site Access

The FarSight SPS is proposed to have one site access:

1) A single 7.0m wide driveway access to the site with 7.0m radius tie-in apron to Lakeshore Road.

The pumping station site will be able to accommodate a Single Unit Tanker Trailer, equivalent to a Vacuum Truck with a length of 12 meters. The site will also contain 2 standard-sized parking spaces.

The driveway access will allow vehicles to access parking, the communal water system building and providing maintenance access to inlet bypass chamber and wet well.

The conceptual site plan assumes a typical 1.8 m high chain-link property fence and 7.0 m wide gate will be installed to secure the site. Depending on the permanent site generator selection and noise emission modelling completed during preliminary design, a noise fence could also be installed where around the site property line to ensure noise level requirements are met for the adjacent development units.

4.3 Site Sizing

The required property block for the sanitary pumping station and communal water system site was sized at 20 x 50 meters. This allows sufficient space for the pumping station below ground structures, the communal water system below ground and above ground structures, the inlet chamber, and external generator and transformer, while providing room for a Transport - Single Unit Tanker Trailer to enter the site to service the station and reverse to leave the site. This estimate assumes that minimal site grading will be required.

4.4 Yard Piping

The following sanitary, forcemain, water and storm connections are assumed as required for the SPS:

- 250mm dia. sanitary sewer to receive local sewage and convey to the 3.6 m internal diameter wet well;
- 150mm dia. Forcemain to receive sewage from the 3.6 m internal diameter wet well and covey out of the pumping station site;
- 150mm dia. Drain pipe from the valve chamber (dry well) back to the wet well;
- Domestic water connection and non-freeze post hydrant;
- 300mm dia. overflow pipe connecting to the future creek channel located to the north-east or to the adjacent storm water management system located in the block to the east; and,
- There is substantial additional yard piping required associated with the communal water system within the same site, which is covered in the Conceptual FarSight Communal Water System Technical Memo.

4.5 Provisions

Influent Flow Monitoring

An inlet bypass site MH is provided immediately upstream of the station along the influent sewer, large enough to house the correct size portable bypass pumps for complete station rehabilitation, maintenance purposes, and/or complete station failure. This MH can be also

used for flow monitoring purposes. It is located within the limits of the pump station property thereby not requiring traffic control in the public ROW in order to gain access.

5.0 CONCEPTUAL MECHANICAL DESIGN

5.1 Heating, Ventilation and Air Conditioning (HVAC) and Odour Control System

The Building Mechanical Systems for the SPS are comprised of HVAC as well as Fire Protection. The SPS is comprised of a Wet Well and a Valve Chamber.

The Building Mechanical Systems of these areas are designed to meet MECP Sewage Work Guidelines, Ontario Building Code (OBC), and Ontario Electrical Safety Code (OESC), and NFPA 820.

5.1.1 Wet Well

The Wet Well is a Class 1 Division 1 area, as prescribed in NFPA 820, and would not be normally ventilated due to the reduced size. It will only be filling and venting air through a simple 150 mm gooseneck(s) with a passive activated carbon cannister for odour control.

5.1.2 Valve Chamber

The Valve Chamber is a Class 1, Division 2 area. It will be is intermittently ventilated via two 150 mm goosenecks, one equipped with a motorized damper for intake and another with an inline exhaust fan. The ventilation system is sized for 12 ACH of unconditioned 100% outside air. During normal day to day operation a controller activates the ventilation to operate for 5 minutes every hour (controlled by a timer) to offset any foul gases and keep an acceptable indoor air quality. During personnel access, a manual switch activates the ventilation system to operate continuously. An explosion proof heater is designed to keep the space just above 4˚C at all conditions. A drain pipe should be installed from the valve chamber sump back to the wet well.

5.1.3 Generator

A proposed packaged generator rated for tier 3 emissions is proposed. Sound levels will be a minimum of 75 dBA at 7 m to comply with O.Reg. 524/98. The fueling system is a proposed packaged built in underground tank designed to comply with TSSA's CSA B139. The generator will be equipped with a noise insulated enclosure, additional noise mitigation equipment can be included if necessary, such as an enhanced muffler or a specialized custom enhanced generator enclosure. We recommend that an acoustic study

be completed during detailed design to ensure that the generator noise generation does exceed the required impact limits on the adjacent houses.

6.0 CONCEPTUAL ELECTRICAL DESIGN

6.1 Power Supply and Distribution System

The power supply requirements for the sewage pumping station (SPS) based on the assumed major loads on site including process equipment (2 x 5HP duty/standby sewage pumps, flow instruments), mechanical equipment (fans and odour control unit), and other small electrical loads (heaters, motorized equipment, and lighting). Assuming these loads we anticipate that the new hydro service of 100A, 208V, 3 phase service will be required. However, the exact load requirements must be determined by performing an Electrical Load Analysis during the preliminary design.

A new Outdoor rated floor mounted enclosure combined with suitable air conditioning system is proposed to inhouse a Main disconnect switch, Hydro Meter, Automatic Transfer Switch (ATS), 120/208V Main distribution panel, surge protection device and pumps/motors starters.

However, if the communal building option is also being constructed then it may be possible to have the power distribution system and starters for the SPS also inside the communal building.

6.2 Generator

A backup power diesel generator is proposed to be provided to supply combined back up power for both SPS and Communal building upon loss of Hydro supply. A 60 to 100 kW, 208V, 3 phase diesel generator is anticipated but the actual size will be determined during the detailed design stage. A load bank connection box would be specified for annual full load testing for maintenance purposes. There are efficiencies gained by providing backup power to both the SPS and Communal building from the same backup generator.

The major load assumed for this backup generator is from the communal water system building consist of pumps, UV system, building loads and the SPS system. Any changes to the loads will impact the generator sizing.

The generator and its fuel tank must be protected from vehicles. Bollard posts or a guardrail system would be required to protect the equipment as per the Installation Code for Oil Burning Equipment, CSA B139.1.0-15, Section 8.6 Protection from Vehicles.

6.3 Lighting and Small Power System

It is proposed to install new energy efficient LED fixtures for the SPS outdoor electrical enclosure along with lighting controls/switches. The area lighting can be provided however this requirement has to be confirmed during preliminary design. General GFCI Receptacles will be provided as part of the outdoor enclosure with while-in-use rain tight covers.

6.4 Area Classification

The Wet Well is Class 1 Division 1 (Zone 1) and the Valve Chamber is Class 1, Division 2 (Zone 2).

7.0 CONCEPTUAL STRUCTURAL DESIGN

The Sewage Pumping Station (SPS) concept design is circular 3.6 m internal diameter 7.0 m deep wet well. The proposed site for the SPS is located within the property limits of 5452 Lakeshore Road, on the south side of the development block, north-east of 5451 Lakeshore Road, at a currently undeveloped farmland lot and is in close proximity to what appears to be an existing creek.

As part of the 'Geotechnical Investigation – FarSight Homes, Ballantrae, 5426, 5452 & 5584 Lakeshore Road, Whitchurch-Stouffville, Ontario', several boreholes and monitoring wells were completed in early 2021 near the proposed FarSight SPS site. These boreholes showed primarily compact sand conditions down at a depth of 8.0 m and groundwater level varying between 0.2 m to 1.5 m below ground surface. These soils and the shallow groundwater table present substantial issues for open cut excavation down to the 7.0 to 8.0 m depth required for the SPS wet well, therefore it is recommended to complete the wet well installation as a shaft using a secant pile shaft or sunken caisson construction. These methods can generally be constructed in challenging ground by use of watertight shoring (secant piles) or constructed in the wet (sunken caissons) to allow for construction without requiring extensive dewatering. The impact of the groundwater table must also be considered for uplift effects on the wet well and valve chamber and may require anchoring of the structures to resist uplift.

The currently available geotechnical and hydrogeological information is insufficient for construction of the SPS, determining shoring and dewatering requirements. Further detailed geotechnical and hydrogeological investigations should be completed during preliminary design. The borehole depths for these investigations should be at least twice the proposed shaft or excavation depth required for construction.

8.0 CONCEPTUAL INSTRUMENTATION AND CONTROL DESIGN

8.1 INSTRUMENTATION

Instrumentation for the sewage pumping station will be installed in the wet well, valve house, Communal Water System building and other necessary site areas as per MECP guidelines.

The wet well will contain an ultrasonic level transmitter, high level floats, and low level floats to monitor and control the level of wastewater inside the wet well.

Electromagnetic flowmeters with flow transmitters will be installed on both the duty and standby forcemains in the valve chamber. In addition, pressure transmitters and pressure indicators will be installed on each forcemain in the valve chamber.

Ancillary instrumentation will be installed in the Communal Water System building to ensure a habitable indoor environment is maintained.

8.2 SCADA & ALARMS

It is assumed that a Communal Water System building will be built that will have a designated electrical room. The electrical room will house a new control panel and new motor control center (MCC). The new control panel will be responsible for controlling and monitoring the wet well level, pump operation and wastewater flow in the forcemain. The new sewage pumping control system could be connected to a connected to an auto dialer that will notify operators of alarm conditions for intervention on site or client-specified SCADA system.

APPENDIX 1

SKA Sanitary Sewer Design Sheet

PROJECT TITLE:	Ballantrae Lands
PROJECT No.:	13:286
CLIENT:	Farsight Developments Ltd.
ISSUED FOR:	Functional Servicing Report (December 2024)

SANITARY SEWER DESIGN SHEET
TOWN OF WHITCHURCH-STOUFFVILLE - REGION OF YORK

ENGINEER'S SEAL

PREPARED BY:

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

NOTES, STANDARDS AND DESIGN INPUT PARAMETERS

Note:

Densities (persons/unit):

Single Family, Semi-Detached Residential	3.2
Townhouse, Multi-Family Residential	2.9
Apartment	2.2
Other	3.0

Harmon Peaking Factor:

Maximum: 4
Minimum: 2.0
Formula: $K_H = 1 + \frac{14}{4 + P^{1/2}}$

where; K_H = Harmon Peaking Factor
P = Population in Thousands

Design Flows:

Residential Flow	350	L/person/day
Infiltration Flow	19.872	m^3/ha/day (0.23L/s/ha)
Commercial Flow	24.192	m^3/ha/day (0.26L/s/ha)
Floor Space Index	1	of gross lot area
Institutional Flow	24.192	m^3/ha/day (0.26L/s/ha)

				RESIDENTIAL										TOTAL AREA		INFILTRATION			PIPE DESIGN							
PROPERTY	**STREET**	**Upstream Manhole**	**Downstream Manhole**	**Section Area (ha)**	**Cummulative Area (ha)**	**Single Family, Semi-Detached Units**	**Townhouse Units**	**High Density Units**	**Other (specified above) Units**	**Unplanned Land (ha)**	**Section Population**	**Cummulative Population (thousands)**	**Harmon Peaking Factor**	**Residential Flow (L/s)**	**Total Section Area (ha)**	**Total Cummulative Area (ha)**	**Applicable Area (ha) (see above)**	**Infiltration Flow (L/s)**	**Total Design Flow (L/s)**	**Type**	**Pipe (mm)**	**Grade (%)**	**Capacity (l/s)**	**Length (m)**	**Velocity (m/s)**	**Down-stream Velocity (m/s)**	**Change in Velocity (m/s)**	**Capacity (%)**
Farsight Homes	Street C	105A	106A	**0.89**	0.89	**10**					32	0.032	4.00	**0.52**	0.89	0.89	0.89	**0.20**	**0.72**	PVC	**200**	**1.00**	32.80	**71.5**	1.04	0.74	0.31	2%
Farsight Homes	Street C	106A	107A	**0.46**	1.35	**7**					23	0.055	4.00	**0.89**	0.46	1.35	1.35	**0.31**	**1.20**	PVC	**200**	**0.50**	23.19	**74.0**	0.74	0.74	0.00	5%
Farsight Homes	Street C	107A	109A	**0.76**	2.11	**12**					39	0.094	4.00	**1.52**	0.76	2.11	2.11	**0.49**	**2.01**	PVC	**200**	**0.50**	23.19	**110.0**	0.74	0.74	0.00	9%
Farsight Homes	Street C	108A	109A	**0.34**	0.34	**6**					20	0.020	4.00	**0.32**	0.34	0.34	0.34	**0.08**	**0.40**	PVC	**200**	**2.00**	46.38	**50.0**	1.48	0.74	0.74	1%
Farsight Homes	Street B	109A	110A	**0.15**	2.60	**2**					7	0.121	4.00	**1.96**	0.15	2.60	2.60	**0.60**	**2.56**	PVC	**200**	**0.50**	23.19	**26.5**	0.74	0.74	0.00	11%
Farsight Homes	Street B	110A	112A	**0.21**	2.81	**3**					10	0.131	4.00	**2.12**	0.21	2.81	2.81	**0.65**	**2.77**	PVC	**200**	**0.50**	23.19	**55.0**	0.74	1.04	0.31	12%
Farsight Homes	Street C	111A	112A	**0.44**	0.44	**7**					23	0.023	4.00	**0.37**	0.44	0.44	0.44	**0.10**	**0.47**	PVC	**200**	**0.50**	23.19	**51.0**	0.74	1.04	0.31	2%
Farsight Homes	Street B	112A	113A	**0.16**	3.41	**2**					7	0.161	4.00	**2.61**	0.16	3.41	3.41	**0.78**	**3.39**	PVC	**200**	**1.00**	32.80	**30.0**	1.04	0.74	0.31	10%
Farsight Homes	Street B	113A	114A	**0.09**	3.50	**1**					4	0.165	4.00	**2.67**	0.09	3.50	3.50	**0.81**	**3.48**	PVC	**200**	**0.50**	23.19	**19.0**	0.74	0.74	0.00	15%
Farsight Homes	Street B	114A	115A	**0.23**	3.73	**3**					10	0.175	4.00	**2.84**	0.23	3.73	3.73	**0.86**	**3.69**	PVC	**200**	**0.50**	23.19	**30.0**	0.74	0.74	0.00	16%
Farsight Homes	Street A	104A	115A	**0.62**	0.62	**10**					32	0.032	4.00	**0.52**	0.62	0.62	0.62	**0.14**	**0.66**	PVC	**200**	**1.00**	32.80	**77.0**	1.04	0.74	0.31	2%
Farsight Homes	Street A	115A	116A	**0.09**	4.44	**0**					0	0.207	4.00	**3.35**	0.09	4.44	4.44	**1.02**	**4.38**	PVC	**200**	**0.50**	23.19	**63.0**	0.74	0.74	0.00	19%
Farsight Homes	Street A	116A	117A	**0.03**	4.47	**0**					0	0.207	4.00	**3.35**	0.03	4.47	4.47	**1.03**	**4.38**	PVC	**200**	**0.50**	23.19	**9.0**	0.74	0.74	0.00	19%
Farsight Homes	Street D	117A	118A	**0.07**	4.54	**1**					4	0.211	4.00	**3.42**	0.07	4.54	4.54	**1.04**	**4.46**	PVC	**200**	**0.50**	23.19	**10.5**	0.74	0.74	0.00	19%
Farsight Homes	Street D	119A	118A	**0.51**	0.51	**8**					26	0.026	4.00	**0.42**	0.51	0.51	0.51	**0.12**	**0.54**	PVC	**200**	**1.00**	32.80	**56.0**	1.04	0.74	0.31	2%
Farsight Homes	Block 147	118A	120A	**0.00**	5.05	**0**					0	0.237	4.00	**3.84**	0.00	5.05	5.05	**1.16**	**5.00**	PVC	**200**	**0.50**	23.19	**38.0**	0.74	0.74	0.00	22%
Farsight Homes	Block 147	120A	13A	**0.00**	5.05	**0**					0	0.237	4.00	**3.84**	0.00	5.05	5.05	**1.16**	**5.00**	PVC	**200**	**0.50**	23.19	**49.0**	0.74	0.74	0.00	22%
Farsight Homes	Street E	1W	2A	**0.29**	0.29	**3**					10	0.010	4.00	**0.16**	0.29	0.29	0.29	**0.07**	**0.23**	PVC	**200**	**1.00**	32.80	**61.5**	1.04	0.74	0.31	1%
Farsight Homes	Street E	2A	3A	**0.15**	0.44	**2**					7	0.017	4.00	**0.28**	0.15	0.44	0.44	**0.10**	**0.38**	PVC	**200**	**0.50**	23.19	**13.0**	0.74	0.00	0.74	2%
Farsight Homes	Street E	3A	4A	**0.14**	0.58	**2**					7	0.024	4.00	**0.39**	0.14	0.58	0.58	**0.13**	**0.52**	PVC	**200**	**0.50**	23.19	**14.0**	0.74	0.74	0.00	2%
Farsight Homes	Street E	4A	5A	**0.57**	1.15	**9**					29	0.053	4.00	**0.86**	0.57	1.15	1.15	**0.26**	**1.12**	PVC	**200**	**0.50**	23.19	**85.0**	0.74	0.74	0.00	5%
Farsight Homes	Street E	5A	7A	**0.84**	1.99	**15**					48	0.101	4.00	**1.64**	0.84	1.99	1.99	**0.46**	**2.09**	PVC	**200**	**0.50**	23.19	**110.0**	0.74	0.74	0.00	9%
Farsight Homes	Street A	7A	9A	**0.32**	2.31	**4**					13	0.114	4.00	**1.85**	0.32	2.31	2.31	**0.53**	**2.38**	PVC	**200**	**0.50**	23.19	**76.0**	0.74	0.74	0.00	10%
Farsight Homes	Street A	13A	1A	**0.21**	0.21	**2**					7	0.007	4.00	**0.11**	0.21	0.21	0.21	**0.05**	**0.16**	PVC	**200**	**1.00**	32.80	**30.0**	1.04	0.74	0.31	0%
Farsight Homes	Street A	1A	8A	**0.77**	0.98	**13**					42	0.049	4.00	**0.79**	0.77	0.98	0.98	**0.23**	**1.02**	PVC	**200**	**0.50**	23.19	**105.0**	0.74	0.74	0.00	4%
Farsight Homes	Street A	8A	9A	**0.83**	1.81	**14**					45	0.094	4.00	**1.52**	0.83	1.81	1.81	**0.42**	**1.94**	PVC	**200**	**0.50**	23.19	**109.0**	0.74	0.74	0.00	8%
Farsight Homes	Street F	9A	10A	**0.53**	4.65	**9**					29	0.237	4.00	**3.84**	0.53	4.65	4.65	**1.07**	**4.91**	PVC	**200**	**0.50**	23.19	**85.7**	0.74	0.74	0.00	21%
Farsight Homes	Street F	10A	11A	**0.20**	4.85	**1**					4	0.241	4.00	**3.91**	0.20	4.85	4.85	**1.12**	**5.02**	PVC	**200**	**0.50**	23.19	**16.0**	0.74	0.74	0.00	22%
Farsight Homes	Block 147	11A	12A	**0.00**	4.85	**0**					0	0.241	4.00	**3.91**	0.00	4.85	4.85	**1.12**	**5.02**	PVC	**200**	**0.50**	23.19	**34.8**	0.74	0.74	0.00	22%
Farsight Homes	Block 147	12A	13A	**0.00**	4.85	**0**					0	0.241	4.00	**3.91**	0.00	4.85	4.85	**1.12**	**5.02**	PVC	**200**	**0.50**	23.19	**35.0**	0.74	0.74	0.00	22%
Farsight Homes	Block 153	13A	PSMH	**0.00**	9.9	0					0	0.478	3.98	**7.71**	0.00	9.90	9.90	**2.28**	**9.99**	PVC	**200**	**0.50**	23.19	**29.0**	0.74	N/A		43%

APPENDIX 2

Design Criteria - Wet Well Sizing Calculations

PUMP SYSTEM DESIGN CALCULATIONS
PROJECT INFORMATION

Project Name:	Farsight-Ballantrae SPS and Forcemain		
Project Number:	R237294		
Description:	Sanitary pumping station servicing new land development		
Designed By:	Tyler Yang	**Date:**	2024-11-11
Checked By:	Anh Nguyen	**Date:**	2024-11-14
Version:	R1	**Updated:**	2024-12-12

Additional Comments

Farsight-Ballantrae SPS and Forcemain
FLOW AND OPERATING SCENARIOS

Parameter	Unit	Value 1	Value 2	Value 3	Notes
Scenarios		**Minimum**	**Average**	**Peak**	
Population Equivalent	persons	48	478	478	
Flow Per Capita	L/cap/d	350	350	350	Per SKA Design Sheet
Average Residential Flow	**L/s**	**0.19**	**1.94**	**1.94**	
Harmon Peaking Factor		4.32	3.98	3.98	
Peak Residential Flow	**L/s**	**0.84**	**7.71**	**7.71**	
Tributary Area	ha	9.90	9.90	9.90	
Rate of Extraneous Flow	L/s/ha	0.092	0.092	0.230	Per SKA Design Sheet
Peak Extraneous Flows	**L/s**	**0.91**	**0.91**	**2.28**	
Other Flows, if applicable	L/s	0.00	0.00	0.00	
Total Design Flow	**L/s**	**1.75**	**8.63**	**9.99**	
No. of Duty Pumps		1	1	1	
No. of Standby Pumps		1	1	1	
Flow Per Pump	L/s	1.75	8.63	9.99	
No. Duty Force Mains		1	1	1	
No. Standby Force Mains		1	1	1	
Flow Per Force Main	L/s	1.75	8.63	9.99	

Farsight-Ballantrae SPS and Forcemain
WET WELL INFORMATION

Parameter	Unit	Value	Unit 2	Value 2
Design Peak Flow	L/s	9.992		
Ground Elevation	m	332.1		
Overflow Invert (if available)	m	330.3		
Inlet Sewer Invert	m	326.8		
Shape of Wet Well		Circular		
Pumping Station Diameter (if Circular)	m	3.6		
Wet Well Portion in Circular Pump Station	%	100%		
Wet Well Length (if Retangular)	m	0		
Wet Well Width (if Retangular)	m	0		
Wet Well Plan Area	**m^2**	**10.18**		

Emergency Storage				
Emergency Response Time	hour	1.00		
Emergency Storage Required	m^3	35.97		
Height of Emergency Storage	m	3.80		
Total Emergency Storage Volume	m^3	38.68		
% Useful Volume in Emergency Storage	%	95%		
Emergency Storage Volume Available	**m^3**	**36.75**		

Required Operating Volume				
Target Starts per Hour		6		
Cycle Time	s	600		
		Pump 1	**1+2**	**1+2+3**
Pumped Flow	L/s	9.99	0.00	0.00
Incoming Flow	L/s	5.0	0.00	0.00
Required Operation Volume	**m^3**	**1.50**	**0.00**	**0.00**
Sum of Required Operating Volume	m^3	1.50		

Submergence			
Flow Per Pump at Duty	L/s	10.0	
Max Flow Per Pump (Assumed)	L/s	10.00	
Suction Bell Mouth Diameter	m	0.1	
Suction Velocity	m/s	1.273	
Submergence Required	m	0.396	N/A

Farsight-Ballantrae SPS and Forcemain
WET WELL INFORMATION

Parameter	Unit	Value	Unit 2	Value 2
Pump Station Elevations				
Overflow Invert	m	330.30		
Inlet Sewer Invert	m	326.80		
Freeboard Below Overflow Invert	m	0.30		
Top of Emergency Storage Zone	m	330.00		
Bottom of Emergency Storage Zone	m	326.20		
HHWL (Alarm)	m	326.20		
Freeboard Above Pump Active Volume		0.30		
HWL of Pump Active Volume		325.90		
Pump Operating Zone		**Pump 1**	**1+2**	**1+2+3**
Pump Start Elevation	m	325.90	325.90	325.90
Height of Operating Zone	m	0.50	0.00	0.00
Pump Stop Elevation	m	325.40	325.90	325.90
LWL of Pump Active Volume	m	325.40		
Freeboard Below LWL	m	0.20		
LLWL (Alarm)	m	325.2		
Allowance for Suction Inlet / Submergence	m	0.20		
Suction Inlet	m	325		
Suction Inlet Clearance Above Floor	m	0.10		
Floor of Station / Wet Well Invert	m	324.9		
Depth of Wet Well (Below Grade)	mBG	7.20		

Farsight-Ballantrae SPS and Forcemain
WET WELL INFORMATION

Parameter	Unit	Value	Unit 2	Value 2
Sump & Operating Volume				
Number of Cells		1		
Sump Bottom Length	m	1.6		
Sump Bottom Width	m	1.6		
Plan Area at Sump Bottom (Per Cell)	m^2	2.56		
		Pump 1	**1+2**	**1+2+3**
Plan Area at Pump Start Elevation	m^2	10.18	0.00	0.00
Plan Area at Pump Stop Elevation	m^2	5.31	0.00	0.00
Operating Volume Per Sump	m^3	3.87	0.00	0.00
Total Operating Volume	m^3	3.87	0.00	0.00
Operating Volume > Required?		**OK**	**NO**	**NO**
Pump Cycles per hour		2.32	N/A	N/A
Fill Time at Average Flow	min	33.33	0.00	0.00
Flow at Low Flow Conditions	L/s	1.90		
Cells in Operation During Low Flow		1		
Non-active Volume in Wet Well	m^3	1.97		
Hyraulic Residence Time at Low Flow Conditions	min	51.22	hr	0.854

Farsight-Ballantrae SPS and Forcemain
FORCE MAINS

Parameter	Unit	Value	Unit 2	Value 2
Number of Duty Forcemains		1		
Force Main Legth	m	1050		
Elevation Leaving Wet Well	m	330		
Discharge Elevation	m	330.55		
Force Main Material		HDPE-IPS-DR9		
Force Main Nominal Size	mm	150		
ID of Forcemain	mm	129		
Inner Area of Duty Force Mains	m^2	0.013		
Pipe Volume	m^3	13.72		
Average Flow in Force Mains	L/s	10.00		
Velocity at Average Flow	m/s	0.77		
Duty Flow	L/s	10.00		
Velocity at Duty Flow	m/s	0.77		
Ratio of Active WW Volume to Pipe Volume		28.21%		

Residence Time				
Design Average Flow	L/s	1.94		
FM Residence Time at Design Average Flow	min	118	hr	1.97
Flow at Low Flow Conditions	L/s	1.90		
FM Residence Time at Low Flow Conditions	min	120	hr	2.01

APPENDIX 3

Hydraulic Design Calculations

Farsight-Ballantrae SPS and Forcemain
HYDRAULIC PROFILE

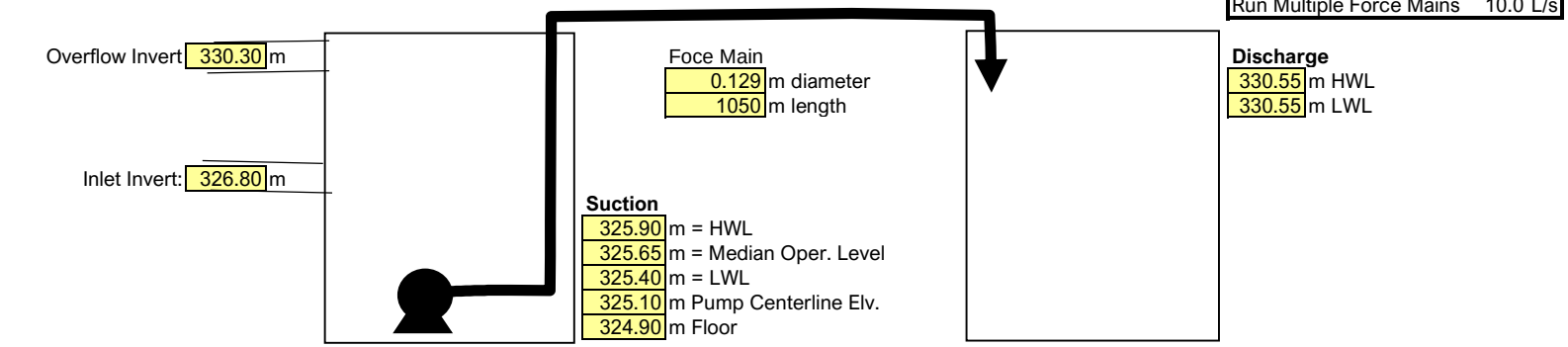
Description of Pumping System		
Hydraulic Profile Summary		
Force Main Inner Diameter	0.1290	m
Force Main Length	1050	m
Max Force Main Velocity	0.77	m/s
Sump High Water Level Elevation	325.9	m
Sump Median Water Level Elevation	325.65	m
Sump Low Water Level Elevation	325.4	m
Elevation of Pump Impeller Centre Line	325.1	m
Pump Station Ground Level (m)	324.9	m
Discharge High Water Level	330.55	m
Discharge Low Water Level	330.55	m
NPSH Summary		
Atmospheric Pressure	9.95	m
Suction Side Static Head (LWL)	0.30	m
Vapour Pressure at t=25°C	0.32	m
Partial pressure of dissolved gasses	0.60	m
Factor of Safety	1.50	m
NPSH Available (not including suction losses)	7.83	m

Hydraulic Profile Schematic

Overflow Condition: 0.25 m Static Head
Condition C: 4.65 m Static Head
Condition B: 4.90 m Static Head
Condition A: 5.15 m Static Head

Q[max] = 10.00 L/s = 0.010 m^3/s

Pump Operation	
No. Pumps	1
No. Force Mains	1
Run Multiple Pumps at:	10.0 L/s
Run Multiple Force Mains	10.0 L/s



Farsight-Ballantrae SPS and Forcemain

TOTAL DYNAMIC HEAD CALCULATIONS

CONDITION: A C= 120 WATER LEVEL (m): 325.4 DISCHARGE ELEVATION (m): 330.55 FLOW : start - 0.000 m^3/s increase increment - 0.001 m^3/s

Roughness Coefficient	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Pumped Flow (L/s)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Pumped Flow (m^3/s)	**0.000**	**0.001**	**0.002**	**0.003**	**0.004**	**0.005**	**0.006**	**0.007**	**0.008**	**0.009**	**0.010**	**0.011**	**0.012**	**0.013**	**0.014**	**0.015**	**0.016**	**0.017**	**0.018**	**0.019**
Total Pumping Station Piping Friction Losses (m)	0.00	0.11	0.39	0.82	1.39	2.10	2.95	3.92	5.02	6.24	7.59	9.05	10.63	12.33	14.14	16.07	18.11	20.26	22.53	24.90
Total Pumping Station Fitting Losses (m)	0.00	0.01	0.03	0.07	0.12	0.18	0.26	0.36	0.46	0.59	0.72	0.88	1.04	1.22	1.42	1.63	1.86	2.09	2.35	2.62
Static Head (m)	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15
Total Dynamic Head Including PS Losses (m)	**5.15**	**5.26**	**5.56**	**6.03**	**6.66**	**7.43**	**8.36**	**9.42**	**10.63**	**11.98**	**13.46**	**15.08**	**16.83**	**18.70**	**20.71**	**22.85**	**25.12**	**27.51**	**30.02**	**32.66**
Net Positive Suction Head Available (m)	7.83	7.83	7.82	7.82	7.82	7.82	7.81	7.81	7.80	7.79	7.78	7.78	7.77	7.76	7.74	7.73	7.72	7.70	7.69	7.67

Design Flow: 0.0100 m^3/s

	Multiple Pumps / FM	FLOW THROUGH SECTIONS (m^3/s)																			
Sec 1: Suction	1	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019
Sec 2: Disharge Piping	1	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019
Sec 3: Forcemain	1	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019

HEAD LOSS THROUGH PIPE [Hazen-Williams formula for Metric Units $h=L*\{V/0.85*C*(D/4)^{0.63}\}^{1/0.54}$]

Pipes	Nominal Pipe Size (mm)	Pipe Size-ID (m)	Pipe Material	Pipe Sectional Area (m^2)	V=Q/A (m/s) (Max)		Pipe Length (m)		HEAD LOSS (m) THROUGH PIPE																			
Section 1: Pumping Station Suction Line																												
Section 1	100	0.1082	SS-SCH10S	0.009	1.09		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Section 2: Pumping Station Discharge Line																												
Section 2	100	0.1082	SS-SCH10S	0.009	1.09		8.00		0.00	0.00	0.01	0.01	0.02	0.03	0.05	0.06	0.08	0.10	0.12	0.14	0.17	0.20	0.22	0.25	0.29	0.32	0.36	0.40
Section 3: Common Discharge/Forcemain																												
Section 3	150	0.1287	HDPE-IPS-DR9	0.013	0.77		1155.00		0.00	0.10	0.38	0.80	1.37	2.07	2.90	3.86	4.94	6.14	7.46	8.91	10.46	12.13	13.92	15.82	17.82	19.94	22.17	24.50
Total Piping Friction Head Loss									**0.00**	**0.11**	**0.39**	**0.82**	**1.39**	**2.10**	**2.95**	**3.92**	**5.02**	**6.24**	**7.59**	**9.05**	**10.63**	**12.33**	**14.14**	**16.07**	**18.11**	**20.26**	**22.53**	**24.90**
Sludge Multiplier for Friction Loss 1% sludge or below = water (multiply by 1)								1	**0.00**	**0.11**	**0.39**	**0.82**	**1.39**	**2.10**	**2.95**	**3.92**	**5.02**	**6.24**	**7.59**	**9.05**	**10.63**	**12.33**	**14.14**	**16.07**	**18.11**	**20.26**	**22.53**	**24.90**

HEAD LOSS FOR PIPE FITTINGS [for Metric Units $h_L=K(v^2/2g)$], based on Table B-6 of "Pumping Station Design", Second Edition, Butterworth Heinemann.

Fittings	Nominal Pipe Size (mm)	Pipe Size-ID (m)	Increaser Smaller ID (m)	Pipe Fitting Type	Pipe Fitting No.	K-Factor	K Correction Factor	HEAD LOSS (m) THROUGH FITTINGS																			
Section 1: Pump Suction																											
1	100	0.1082		Entry, square mouth	1	0.5	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
Section 2: Pump Discharge																											
2	100	0.1082		90 Bend	2	0.25	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
3	100	0.1082		Swing Check	1	2.5	1.40	0.00	0.00	0.01	0.02	0.03	0.05	0.08	0.10	0.14	0.17	0.21	0.26	0.30	0.36	0.41	0.48	0.54	0.61	0.68	0.76
4	100	0.1082		Plug Valve	1	0.5	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
5	100	0.1082		90 Bend	1	0.25	1.40	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.08
6	100	0.1082		Tee, branch flow	1	0.75	1.40	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.12	0.14	0.16	0.18	0.21	0.23
Section 3: Forcemain																											
7	100	0.1082		Magflow	1	1	1.40	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.08	0.10	0.12	0.14	0.17	0.19	0.22	0.24	0.27	0.30
8	100	0.1082		Plug Valve	1	0.5	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
9	150	0.1287	0.1082	Increaser	1		1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04
10	150	0.1287		Tee, line flow	0	0.3	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	150	0.1287		90 Bend (FM)	5	0.25	1.30	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.14	0.16	0.18
12	150	0.1287		45 Bends (FM)	11	0.18	1.30	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.22	0.25	0.28
13	150	0.1287		Exit	1	1	1.30	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.13	0.14
Total Pipe Fitting Head Loss									**0.00**	**0.01**	**0.03**	**0.07**	**0.12**	**0.18**	**0.26**	**0.36**	**0.46**	**0.59**	**0.72**	**0.88**	**1.04**	**1.22**	**1.42**	**1.63**	**1.86**	**2.09**	**2.35**	**2.62**

Farsight-Ballantrae SPS and Forcemain

TOTAL DYNAMIC HEAD CALCULATIONS

CONDITION: B C= 130 WATER LEVEL (m): 325.65 DISCHARGE ELEVATION (m): 330.55 FLOW : start - 0.000 m^3/s increase increment - 0.001 m^3/s

Roughness Coefficient	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
Pumped Flow (L/s)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Pumped Flow (m^3/s)	**0.000**	**0.001**	**0.002**	**0.003**	**0.004**	**0.005**	**0.006**	**0.007**	**0.008**	**0.009**	**0.010**	**0.011**	**0.012**	**0.013**	**0.014**	**0.015**	**0.016**	**0.017**	**0.018**	**0.019**
Total Pumping Station Piping Friction Losses (m)	0.00	0.09	0.33	0.70	1.20	1.81	2.54	3.38	4.33	5.38	6.54	7.80	9.17	10.63	12.20	13.86	15.62	17.47	19.42	21.47
Total Pumping Station Fitting Losses (m)	0.00	0.01	0.03	0.07	0.12	0.18	0.26	0.36	0.46	0.59	0.72	0.88	1.04	1.22	1.42	1.63	1.86	2.09	2.35	2.62
Static Head (m)	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90
Total Dynamic Head Including PS Losses (m)	**4.90**	**5.00**	**5.26**	**5.67**	**6.21**	**6.89**	**7.70**	**8.63**	**9.69**	**10.87**	**12.16**	**13.58**	**15.11**	**16.76**	**18.52**	**20.39**	**22.37**	**24.47**	**26.67**	**28.98**
Net Positive Suction Head Available (m)	7.83	7.83	7.82	7.82	7.82	7.82	7.81	7.81	7.80	7.79	7.78	7.78	7.77	7.76	7.74	7.73	7.72	7.70	7.69	7.67

Design Flow: 0.0100 m^3/s

	Multiple Pumps / FM	FLOW THROUGH SECTIONS (m^3/s)																			
Sec 1: Suction	1	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019
Sec 2: Disharge Piping	1	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019
Sec 3: Forcemain	1	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019

HEAD LOSS THROUGH PIPE [Hazen-Williams formula for Metric Units $h=L*\{V/0.85*C*(D/4)^{0.63}\}^{1/0.54}$]

Pipes	Nominal Pipe Size (mm)	Pipe Size-ID (m)	Pipe Material	Pipe Sectional Area (m^2)	V=Q/A (m/s) (Max)		Pipe Length (m)		HEAD LOSS (m) THROUGH PIPE																			
Section 1: Pumping Station Suction Line																												
Section 1	100	0.1082	SS-SCH10S	0.009	1.09		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Section 2: Pumping Station Discharge Line																												
Section 2	100	0.1082	SS-SCH10S	0.009	1.09		8.00		0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.09	0.10	0.12	0.15	0.17	0.19	0.22	0.25	0.28	0.31	0.34
Section 3: Common Discharge/Forcemain																												
Section 3	150	0.1287	HDPE-IPS-DR9	0.013	0.77		1155.00		0.00	0.09	0.33	0.69	1.18	1.78	2.50	3.33	4.26	5.30	6.44	7.68	9.02	10.46	12.00	13.64	15.37	17.20	19.11	21.13
Total Piping Friction Head Loss									**0.00**	**0.09**	**0.33**	**0.70**	**1.20**	**1.81**	**2.54**	**3.38**	**4.33**	**5.38**	**6.54**	**7.80**	**9.17**	**10.63**	**12.20**	**13.86**	**15.62**	**17.47**	**19.42**	**21.47**
Sludge Multiplier for Friction Loss 1% sludge or below = water (multiply by 1)								1	**0.00**	**0.09**	**0.33**	**0.70**	**1.20**	**1.81**	**2.54**	**3.38**	**4.33**	**5.38**	**6.54**	**7.80**	**9.17**	**10.63**	**12.20**	**13.86**	**15.62**	**17.47**	**19.42**	**21.47**

HEAD LOSS FOR PIPE FITTINGS [for Metric Units $h_L=K(v^2/2g)$], based on Table B-6 of "Pumping Station Design", Second Edition, Butterworth Heinemann.

Fittings	Nominal Pipe Size (mm)	Pipe Size-ID (m)	Increaser Smaller ID (m)	Pipe Fitting Type	Pipe Fitting No.	K-Factor	K Correction Factor	HEAD LOSS (m) THROUGH FITTINGS																			
Section 1: Pump Suction																											
1	100	0.1082		Entry, square mouth	1	0.5	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
Section 2: Pump Discharge																											
2	100	0.1082		90 Bend	2	0.25	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
3	100	0.1082		Swing Check	1	2.5	1.40	0.00	0.00	0.01	0.02	0.03	0.05	0.08	0.10	0.14	0.17	0.21	0.26	0.30	0.36	0.41	0.48	0.54	0.61	0.68	0.76
4	100	0.1082		Plug Valve	1	0.5	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
5	100	0.1082		90 Bend	1	0.25	1.40	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.08
6	100	0.1082		Tee, branch flow	1	0.75	1.40	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.12	0.14	0.16	0.18	0.21	0.23
Section 3: Forcemain																											
7	100	0.1082		Magflow	1	1	1.40	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.08	0.10	0.12	0.14	0.17	0.19	0.22	0.24	0.27	0.30
8	100	0.1082		Plug Valve	1	0.5	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
9	150	0.1287	0.1082	Increaser	1		1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04
10	150	0.1287		Tee, line flow	0	0.3	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	150	0.1287		90 Bend (FM)	5	0.25	1.30	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.14	0.16	0.18
12	150	0.1287		45 Bends (FM)	11	0.18	1.30	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.22	0.25	0.28
13	150	0.1287		Exit	1	1	1.30	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.13	0.14
Total Pipe Fitting Head Loss								**0.00**	**0.01**	**0.03**	**0.07**	**0.12**	**0.18**	**0.26**	**0.36**	**0.46**	**0.59**	**0.72**	**0.88**	**1.04**	**1.22**	**1.42**	**1.63**	**1.86**	**2.09**	**2.35**	**2.62**

Farsight-Ballantrae SPS and Forcemain

TOTAL DYNAMIC HEAD CALCULATIONS

CONDITION: C | C= 140 | WATER LEVEL (m): 325.9 | DISCHARGE ELEVATION (m): 330.55 | FLOW : start - 0.000 m^3/s | increase increment - 0.001 m^3/s

Roughness Coefficient	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140
Pumped Flow (L/s)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Pumped Flow (m^3/s)	**0.000**	**0.001**	**0.002**	**0.003**	**0.004**	**0.005**	**0.006**	**0.007**	**0.008**	**0.009**	**0.010**	**0.011**	**0.012**	**0.013**	**0.014**	**0.015**	**0.016**	**0.017**	**0.018**	**0.019**
Total Pumping Station Piping Friction Losses (m)	0.00	0.08	0.29	0.61	1.04	1.58	2.21	2.95	3.77	4.69	5.70	6.80	7.99	9.27	10.63	12.08	13.61	15.23	16.93	18.72
Total Pumping Station Fitting Losses (m)	0.00	0.01	0.03	0.07	0.12	0.18	0.26	0.36	0.46	0.59	0.72	0.88	1.04	1.22	1.42	1.63	1.86	2.09	2.35	2.62
Static Head (m)	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65
Total Dynamic Head Including PS Losses (m)	**4.65**	**4.74**	**4.97**	**5.33**	**5.81**	**6.41**	**7.12**	**7.95**	**8.89**	**9.93**	**11.08**	**12.33**	**13.68**	**15.14**	**16.70**	**18.36**	**20.12**	**21.98**	**23.93**	**25.98**
Net Positive Suction Head Available (m)	7.83	7.83	7.82	7.82	7.82	7.82	7.81	7.81	7.80	7.79	7.78	7.78	7.77	7.76	7.74	7.73	7.72	7.70	7.69	7.67

Design Flow: 0.0100 m^3/s

	Multiple Pumps / FM	FLOW THROUGH SECTIONS (m^3/s)																			
Sec 1: Suction	1	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019
Sec 2: Disharge Piping	1	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019
Sec 3: Forcemain	1	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019

HEAD LOSS THROUGH PIPE [Hazen-Williams formula for Metric Units $h=L*\{V/0.85*C*(D/4)^{0.63}\}^{1/0.54}$]

Pipes	Nominal Pipe Size (mm)	Pipe Size-ID (m)	Pipe Material	Pipe Sectional Area (m^2)	V=Q/A (m/s) (Max)		Pipe Length (m)		HEAD LOSS (m) THROUGH PIPE																			
Section 1: Pumping Station Suction Line																												
Section 1	100	0.1082	SS-SCH10S	0.009	1.09		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Section 2: Pumping Station Discharge Line																												
Section 2	100	0.1082	SS-SCH10S	0.009	1.09		8.00		0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.22	0.24	0.27	0.30
Section 3: Common Discharge/Forcemain																												
Section 3	150	0.1287	HDPE-IPS-DR9	0.013	0.77		1155.00		0.00	0.08	0.28	0.60	1.03	1.55	2.18	2.90	3.71	4.62	5.61	6.69	7.86	9.12	10.46	11.89	13.40	14.99	16.66	18.42
Total Piping Friction Head Loss									**0.00**	**0.08**	**0.29**	**0.61**	**1.04**	**1.58**	**2.21**	**2.95**	**3.77**	**4.69**	**5.70**	**6.80**	**7.99**	**9.27**	**10.63**	**12.08**	**13.61**	**15.23**	**16.93**	**18.72**
Sludge Multiplier for Friction Loss 1% sludge or below = water (multiply by 1)								1	**0.00**	**0.08**	**0.29**	**0.61**	**1.04**	**1.58**	**2.21**	**2.95**	**3.77**	**4.69**	**5.70**	**6.80**	**7.99**	**9.27**	**10.63**	**12.08**	**13.61**	**15.23**	**16.93**	**18.72**

HEAD LOSS FOR PIPE FITTINGS [for Metric Units $h_L=K(v^2/2g)$], based on Table B-6 of "Pumping Station Design", Second Edition, Butterworth Heinemann.

Fittings	Nominal Pipe Size (mm)	Pipe Size-ID (m)	Increaser Smaller ID (m)	Pipe Fitting Type	Pipe Fitting No.	K-Factor	K Correction Factor	HEAD LOSS (m) THROUGH FITTINGS																			
Section 1: Pump Suction																											
1	100	0.1082		Entry, square mouth	1	0.5	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
Section 2: Pump Discharge																											
2	100	0.1082		90 Bend	2	0.25	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
3	100	0.1082		Swing Check	1	2.5	1.40	0.00	0.00	0.01	0.02	0.03	0.05	0.08	0.10	0.14	0.17	0.21	0.26	0.30	0.36	0.41	0.48	0.54	0.61	0.68	0.76
4	100	0.1082		Plug Valve	1	0.5	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
5	100	0.1082		90 Bend	1	0.25	1.40	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.08
6	100	0.1082		Tee, branch flow	1	0.75	1.40	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.12	0.14	0.16	0.18	0.21	0.23
Section 3: Forcemain																											
7	100	0.1082		Magflow	1	1	1.40	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.08	0.10	0.12	0.14	0.17	0.19	0.22	0.24	0.27	0.30
8	100	0.1082		Plug Valve	1	0.5	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
9	150	0.1287	0.1082	Increaser	1		1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04
10	150	0.1287		Tee, line flow	0	0.3	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	150	0.1287		90 Bend (FM)	5	0.25	1.30	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.14	0.16	0.18
12	150	0.1287		45 Bends (FM)	11	0.18	1.30	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.22	0.25	0.28
13	150	0.1287		Exit	1	1	1.30	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.13	0.14
Total Pipe Fitting Head Loss								**0.00**	**0.01**	**0.03**	**0.07**	**0.12**	**0.18**	**0.26**	**0.36**	**0.46**	**0.59**	**0.72**	**0.88**	**1.04**	**1.22**	**1.42**	**1.63**	**1.86**	**2.09**	**2.35**	**2.62**

Farsight-Ballantrae SPS and Forcemain

TOTAL DYNAMIC HEAD CALCULATIONS

CONDITION: OF C= 140 WATER LEVEL (m): 330.30 DISCHARGE ELEVATION (m): 330.55 FLOW : start - 0.000 m^3/s increase increment - 0.001 m^3/s

Roughness Coefficient	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140
Pumped Flow (L/s)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Pumped Flow (m^3/s)	**0.000**	**0.001**	**0.002**	**0.003**	**0.004**	**0.005**	**0.006**	**0.007**	**0.008**	**0.009**	**0.010**	**0.011**	**0.012**	**0.013**	**0.014**	**0.015**	**0.016**	**0.017**	**0.018**	**0.019**
Total Pumping Station Piping Friction Losses (m)	0.00	0.08	0.29	0.61	1.04	1.58	2.21	2.95	3.77	4.69	5.70	6.80	7.99	9.27	10.63	12.08	13.61	15.23	16.93	18.72
Total Pumping Station Fitting Losses (m)	0.00	0.01	0.03	0.07	0.12	0.18	0.26	0.36	0.46	0.59	0.72	0.88	1.04	1.22	1.42	1.63	1.86	2.09	2.35	2.62
Static Head (m)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total Dynamic Head Including PS Losses (m)	**0.25**	**0.34**	**0.57**	**0.93**	**1.41**	**2.01**	**2.72**	**3.55**	**4.49**	**5.53**	**6.68**	**7.93**	**9.28**	**10.74**	**12.30**	**13.96**	**15.72**	**17.58**	**19.53**	**21.58**
Net Positive Suction Head Available (m)	7.83	7.83	7.82	7.82	7.82	7.82	7.81	7.81	7.80	7.79	7.78	7.78	7.77	7.76	7.74	7.73	7.72	7.70	7.69	7.67

Design Flow: 0.0100 m^3/s

	Multiple Pumps / FM	FLOW THROUGH SECTIONS (m^3/s)																			
Sec 1: Suction	1	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019
Sec 2: Disharge Piping	1	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019
Sec 3: Forcemain	1	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019

HEAD LOSS THROUGH PIPE [Hazen-Williams formula for Metric Units $h=L*\{V/0.85*C*(D/4)^{0.63}\}^{1/0.54}$]

Pipes	Nominal Pipe Size (mm)	Pipe Size-ID (m)	Pipe Material	Pipe Sectional Area (m^2)	V=Q/A (m/s) (Max)		Pipe Length (m)		HEAD LOSS (m) THROUGH PIPE																			
Section 1: Pumping Station Suction Line																												
Section 1	100	0.1082	SS-SCH10S	0.009	1.09		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Section 2: Pumping Station Discharge Line																												
Section 2	100	0.1082	SS-SCH10S	0.009	1.09		8.00		0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.22	0.24	0.27	0.30
Section 3: Common Discharge/Forcemain																												
Section 3	150	0.1287	HDPE-IPS-DR9	0.013	0.77		1155.00		0.00	0.08	0.28	0.60	1.03	1.55	2.18	2.90	3.71	4.62	5.61	6.69	7.86	9.12	10.46	11.89	13.40	14.99	16.66	18.42
Total Piping Friction Head Loss									**0.00**	**0.08**	**0.29**	**0.61**	**1.04**	**1.58**	**2.21**	**2.95**	**3.77**	**4.69**	**5.70**	**6.80**	**7.99**	**9.27**	**10.63**	**12.08**	**13.61**	**15.23**	**16.93**	**18.72**
Sludge Multiplier for Friction Loss 1% sludge or below = water (multiply by 1)								1	**0.00**	**0.08**	**0.29**	**0.61**	**1.04**	**1.58**	**2.21**	**2.95**	**3.77**	**4.69**	**5.70**	**6.80**	**7.99**	**9.27**	**10.63**	**12.08**	**13.61**	**15.23**	**16.93**	**18.72**

HEAD LOSS FOR PIPE FITTINGS [for Metric Units $h_L=K(v^2/2g)$], based on Table B-6 of "Pumping Station Design", Second Edition, Butterworth Heinemann.

Fittings	Nominal Pipe Size (mm)	Pipe Size-ID (m)	Increaser Smaller ID (m)	Pipe Fitting Type	Pipe Fitting No.	K-Factor	K Correction Factor	HEAD LOSS (m) THROUGH FITTINGS																			
Section 1: Pump Suction																											
1	100	0.1082		Entry, square mouth	1	0.5	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
Section 2: Pump Discharge																											
2	100	0.1082		90 Bend	2	0.25	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
3	100	0.1082		Swing Check	1	2.5	1.40	0.00	0.00	0.01	0.02	0.03	0.05	0.08	0.10	0.14	0.17	0.21	0.26	0.30	0.36	0.41	0.48	0.54	0.61	0.68	0.76
4	100	0.1082		Plug Valve	1	0.5	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
5	100	0.1082		90 Bend	1	0.25	1.40	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.08
6	100	0.1082		Tee, branch flow	1	0.75	1.40	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.12	0.14	0.16	0.18	0.21	0.23
Section 3: Forcemain																											
7	100	0.1082		Magflow	1	1	1.40	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.08	0.10	0.12	0.14	0.17	0.19	0.22	0.24	0.27	0.30
8	100	0.1082		Plug Valve	1	0.5	1.40	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.15
9	150	0.1287	0.1082	Increaser	1		1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04
10	150	0.1287		Tee, line flow	0	0.3	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	150	0.1287		90 Bend (FM)	5	0.25	1.30	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.10	0.11	0.13	0.14	0.16	0.18
12	150	0.1287		45 Bends (FM)	11	0.18	1.30	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.22	0.25	0.28
13	150	0.1287		Exit	1	1	1.30	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.13	0.14
Total Pipe Fitting Head Loss									**0.00**	**0.01**	**0.03**	**0.07**	**0.12**	**0.18**	**0.26**	**0.36**	**0.46**	**0.59**	**0.72**	**0.88**	**1.04**	**1.22**	**1.42**	**1.63**	**1.86**	**2.09**	**2.35**	**2.62**

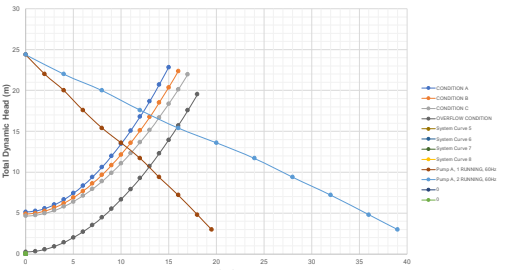
Farsight-Ballantrae SPS and Forcemain
SYSTEM CURVES AND PUMP CURVES

System Curve Data

Pump Flow (L/s)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
CONDITION A	5.15	5.28	5.56	6.03	6.66	7.43	8.36	9.42	10.63	11.98	13.46	15.08	16.83	18.76	20.71	22.85				
CONDITION B	4.90	5.00	5.26	5.67	6.21	6.89	7.70	8.63	9.69	10.87	12.16	13.58	15.11	16.75	18.52	20.39	22.37			
CONDITION C	4.65	4.74	4.97	5.33	5.81	6.41	7.12	7.95	8.89	9.93	11.08	12.33	13.68	15.14	16.70	18.36	20.12	21.98		
OVERFLOW CONDITION	0.25	0.34	0.57	0.93	1.41	2.01	2.72	3.55	4.49	5.53	6.68	7.93	9.28	10.74	12.30	13.96	15.72	17.58	19.53	
System Curve 5																				
System Curve 6																				
System Curve 7																				
System Curve 8																				

Pump Curve Data

Pump A, 1 RUNNING, 60Hz		Pump A, 2 RUNNING, 60Hz					
Flow (L/s)	Head (m)	Flow (L/s)	Head (m)	Flow (L/s)	Head (m)	Flow (L/s)	Head (m)
	24.4		24.4				
2.0	22.0	4.0	22.0				
4.0	20.0	8.0	20.0				
6.0	17.6	12.0	17.6				
8.0	15.4	16.0	15.4				
10.0	13.8	20.0	13.6				
12.0	11.7	24.0	11.7				
14.0	9.4	28.0	9.4				
16.0	7.2	32.0	7.2				
18.0	4.8	36.0	4.8				
19.5	3.0	39.0	3.0				
Hz	60	Hz	60	Hz	60	Hz	60

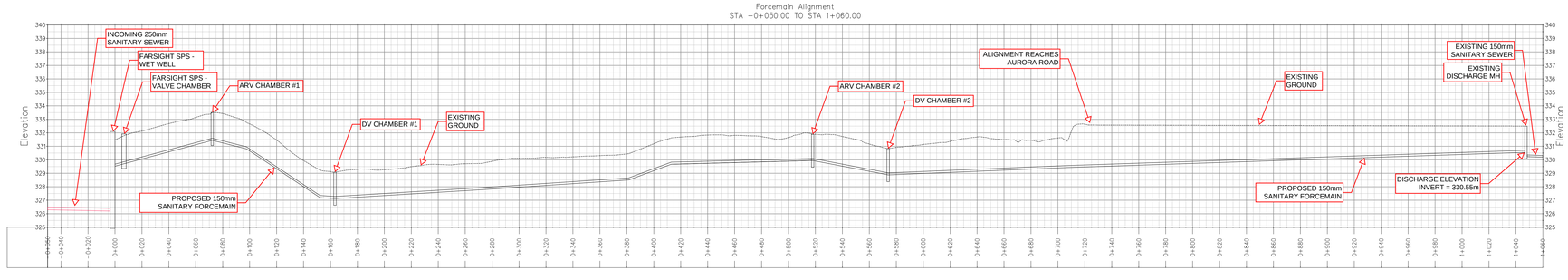


APPENDIX 4

Conceptual Design Plan Overview

LEGEND:

- PROPOSED SANITARY SEWER
- PROPOSED SANITARY MANHOLE
- PROPOSED SANITARY FORCEMAIN (SHARED ALIGNMENT)



NO.	DATE	NAME	REVISIONS

DESIGNED: EAT
DRAFTED:
CHECKED:
APPROVED:

SCALE

BAR IS 25 mm ON ORIGINAL DRAWING

0 mm — 25 mm

IF NOT 25mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

R.V. ANDERSON ASSOCIATES LIMITED

RVA Project No.
237294

FARSIGHT
SEWAGE PUMPING STATION
AND FORCEMAIN

CONTRACT NUMBER:
DRAWING NUMBER:

CONCEPTUAL DESIGN PLAN OVERVIEW

SHEET NUMBER
OF

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Plot: 2024-12-12 2:26 PM

APPENDIX 5

Conceptual Sewage Pumping Station Site Layout

FUTURE CREEK CHANNEL

COMMUNAL WATER SYSTEM BUILDING

300mm OVERFLOW PIPE

OVERFLOW MH

200mm SANITARY SEWER

200mm WATERMAIN

BLOCK 151
OPEN SPACE
CONSERVATION

COMMUNAL WATER SYSTEM DISCHARGE PIPE

COMMUNAL WATER SYSTEM WELL #1

INLET BYPASS SITE MH WITH ISOLATION GATE

WET WELL ELECTRICAL BACKBOARD

200mm SANITARY SEWER

3600mm I.D. SEWAGE PUMPING STATION WET WELL

SITE AREA (EXTENDED PROPERTY LIMITS)

FORCEMAIN BYPASS AND VALVE CHAMBER

BLOCK 148
SWM

DRY POND
MEADOW

COMMUNAL WATER SYSTEM WELL #2

ASPHALT PARKING AREA

SITE WATER SERVICE

STANDBY GENERATOR

SITE POST HYDRANT

SITE FENCING

BLOCK 156
PUMPING STATION

FENCE GATE

LAKESHORE ROAD

BLOCK 154
OPEN SPACE

STREET D

BLOCK 155
EMERGENCY ACCESS

150mm SANITARY FORCEMAIN

SITE DRIVEWAY

NO.	DATE	NAME	REVISIONS

DESIGNED EAT

DRAFTED

CHECKED

APPROVED

SCALE

BAR IS 25 mm ON ORIGINAL DRAWING

0 mm — 25 mm

IF NOT 25mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

R.V. ANDERSON ASSOCIATES LIMITED

RVA Project No.
237294

FARSIGHT
SEWAGE PUMPING STATION
AND FORCEMAIN

CONTRACT NUMBER

DRAWING NUMBER

CONCEPTUAL SEWAGE PUMPING STATION SITE LAYOUT

SHEET NUMBER
OF

File: R:\2023\237294 - Farsight Homes-Ballantrae\10 CAD\dwg\01 Linear\04 Sheets\237294 Farsight-Ballantrae Conceptual Design SPS Site.dwg
Plot: 2024-12-12 2:38 PM

APPENDIX 6

Draft Plan of Subdivision

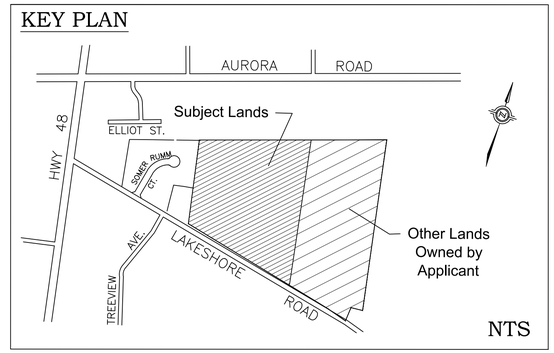
ADDITIONAL INFORMATION

Required Under Section 51 of the Planning Act R.S.O. 1990

a) shown on draft plan
b) shown on draft plan
c) shown on key map
d) shown on schedule of land use
e) shown on draft plan
f) shown on draft plan
g) shown on draft plan
h) on-site communal water system
i) sand, silty sand
j) shown on draft plan
k) connection to existing WWTP
l) none

Note: Contours relate to Canadian Geodetic Datum

KEY PLAN



SCHEDULE OF LAND USE

Lots 1-145 - Condominium Single Detached Residential	7.68 ha	46 %
Blocks 146-148 - Storm Water Management (SWM)	0.49 ha	3 %
Blocks 149-151 - Open Space Conservation	5.31 ha	32 %
Blocks 152-154 - Open Space	0.09 ha	1 %
Block 155 - Emergency Access	0.01 ha	1 %
Block 156 - Utilities	0.11 ha	1 %
Block 157 - Private Roads (21.4m-11.0m)	2.29 ha	12 %
Block 158 - Road Widening	0.23 ha	1 %
Block 159 - Future Development	0.07 ha	1 %
Block 160 - Temporary Turning Circle	0.03 ha	1 %
Block 161 - 0.3m Reserve	0.01 ha	1 %
TOTAL	16.32 ha	100.0%

OWNER'S AUTHORIZATION

We, hereby, authorize Alcorn & Associates Limited to prepare and submit this Revised Draft Plan of Subdivision 19T(W)14.003 to the Town of Whitchurch-Stouffville.

Original Signed — Dec 20, 2018
2506339 Ontario Inc. — Date

Original Signed — Dec 20, 2018
Richard Schickedanz — Date

SURVEYOR'S CERTIFICATE

We, hereby, certify that the boundaries of the lands to be subdivided and their relationship to adjacent lands are accurately drawn and correctly shown.

Original Signed — Nov 13, 2018
Greg Robinson, O.L.S. — Date
JD Barnes Limited

Draft Plan of Subdivision
19T(W)-19.001

PART OF LOTS 19 & 20, CONCESSION 8
TOWN OF WHITCHURCH - STOUFFVILLE
REGIONAL MUNICIPALITY OF YORK
Farsight Developments Ballantrae Inc.
5426, 5452 and 5584 Lakeshore Road, Ballantrae

SCALE 1:1500

ALCORN & ASSOCIATES LIMITED
Land Planning and Development Consultants

12 Greenvalley Circle,
Stouffville, Ontario L4A 2L4

Tel: (905) 940-0931

November 14, 2024

APPENDIX 7

Ballantrae WWTP Existing Sanitary Sewer (West Leg) Plan

250mm PVC @ 0.6%
Full Cap = 46.1 L/s

200mm HDPE @ 0.5%
Full Cap = 23.2 L/s

250mm Conc @ 0.23%
Full Cap = 28.5 L/s

375mm Conc @ 1.5%
Full Cap = 215 L/s

Ballantrae WWTP

Ballantrae WWTP
Site SPS

200mm HDPE @ 0.5%
Full Cap = 23.2 L/s

150mm PVC @ 1.0%
Full Cap = 15.2 L/s

Ballantrae SPS Forcemains to Connect here to Existing Maintenance Hole