July 6, 2022

Village of Pemberton,
P.O. Box 100,
7400 Prospect Street,
Pemberton, B.C., V0N 2L0

Attention: Scott McRae, Manager of Development Services

Dear Scott:

Reference: Application for OCP Bylaw and Zoning Bylaw Amendments
Parkside Development – 7362 Pemberton Farm Road East
Lot C, Plan EPP40824, DL 211, LLD

On behalf of Rivertown (Pemberton) Nominee Ltd., Inc. No. BC1348508, please find attached an OCP/Zoning Bylaw Amendment Application for the proposed Parkside Development at 7362 Pemberton Farm Road East (Lot C, Plan EPP40824, DL 211, LLD) in Pemberton. These OCP/Zoning Bylaw Amendments are needed to accommodate the proposed development which consists of 34 single-family residential strata parcels and a fee simple commercial-use parcel.

The following is a list of the documents that are submitted in support of this Application:

- Cover Letter
- Application Forms
- Registered Legal Plan
- Conceptual Site Plan
- Commercial Site Layout Concept
- Description / Rationale Statement
- Photographs of the Property
- Webster Preliminary Engineering Design Brief
- Cascade Environmental Assessment
- Kontur Geotechnical Review
- Delcan Traffic Impact Study
- ISL Water/Sewer Modeling Reports
- Certificate of Title and Charges on Title
- Site Profile

The application fee is estimated to be $8,200 based on the Fees and Charges Bylaw 905 ($1,200 Application Fee, plus $250 x 24 additional dwelling units in excess of the first 10 dwelling units, plus $250 for 0 additional 100-sm of commercial floor area in excess of the first 1,000-sm, plus $750 Public Notification Fee), We are not including the $6,000 Water and Sanitary Servicing Model Analysis Deposit as this site was included when ISL undertook modeling of the Hillside development in 2012 (see attached ISL Modeling Reports). The Application Fee will be paid when the amount payable is confirmed.

If you have any questions on any of the above or require further information, please do not hesitate to contact me.

Yours truly,

[redacted]
Grant Gillies
Rivertown (Pemberton) Nominee Ltd.,

attachment: Application for OCP/Zoning Bylaw Amendments as detailed above

cc: Michael Oord, Cam McIvor, Nyal Wilcox

Application Forms

Box 100 | 7400 Prospect Street
Pemberton BC V0N 2L0
P: 604.894.6135 | F: 604.894.6136
Email: admin@pemberton.ca
Website: www.pemberton.ca

DEVELOPMENT-GENERAL INFORMATION

Application:

- [X] OCP Bylaw Amendment &/or Zoning Bylaw Amendment **(Form OR13)**
- [ ] Development Permit **(Form MDP13)**
- [ ] Major or Minor Development Permit **(Form Minor DP)**
- [ ] Development Variance Permit **(Form DVP13)**
- [ ] Temporary Use Permit **(Form MDP13)**
- [ ] Subdivision, Bare Land Strata Approval & Strata Title Conversion **(Form SUB13)**
- [ ] Antenna System Siting Review **(Form ANT 13)**

All Applications **Please include Application Requirements Form (Checklist)**

SITE

Civic Address: 7362 Pemberton Farm Road East

Legal Description:
PID: 030-164-532 Lot: Lot C
District Lot(DL): 211 Plan: EPP 40824

OWNER(S)

Owner Name(s): Riverside (Pemberton) Nominee Ltd. Inc. No. BC1348508

Home: Contact: Grant Gillies
Work: 604-614-4295
Cell:
Email: ggillies@targetdevelopments.com

Mailing Address: 1780 Scott Road, North Vancouver, BC, V7J 3J5

OWNER(S) AGENT IF APPLICABLE

Agent's Name:

Work:
Fax:
Cell:
Email:

Mailing Address:

☐ *If applicable* Please include Owner's Authorization

X [redacted]
Owner Signature *Date* July 6, 2022

X
Authorized Agent Signature *Date*

COMMENTS:

Application No | Fee: $

VILLAGE OF PEMBERTON
DEVELOPMENT APPLICATION REQUIREMENTS AND FORMS

APPLICATION REQUIREMENTS FOR AN OFFICIAL COMMUNITY PLAN BYLAW AMENDMENT AND/OR ZONING BYLAW AMENDMENT

1. Pre-Application Meeting

It is strongly recommended that prior to submitting an application to amend the Official Community Plan and/or the Zoning Bylaw, an applicant should meet with the Village of Pemberton's Development Services Department to review application requirements. The intent of the pre-application will be to confirm specific submission requirements for each proposal.

It is important to have the Village identify the information required for the application since any applications deemed incomplete by the Development Services Department will not be accepted and subsequently returned to the applicant.

2. Submission Checklist

- [X] Complete Application Form *(Form OR13)*
- [ ] Application Fee *(in accordance with Development Procedures Bylaw No. 725, 2013)*
- [X] Certificate of State of Title or of Indefeasible Title *(dated no more than thirty (30) days prior to submission of the application must accompany the application as a proof of ownership)*
- [X] Copy of Charges on Title *(i.e. covenants, rights of way, statutory building schemes, etc)*
- [X] Owners Agent Authorization *(if applicable)*
- [X] Site Profile (*as per* http://www.env.gov.bc.ca/epd/remediation/site_profiles/index.htm)

3. Property Information

Legal Description: Lot C, Plan EPP40824, District Lot 211, Lillooet District

PID#: 030-164-532

Civic Address: 7362 Pemberton Farm Road East

Property Size*: 2.43-ha

Current OCP Land Use Designation *(Schedules A and B of the OCP Bylaw):*

None (Hillside Special Planning Area / Regional Context Statement Area)

Proposed OCP Land Use Designation *(Schedules A and B of the OCP Bylaw):*

Single-Family Residential, Commercial

Existing Use/Development on the Property: none

Proposed Use/Development of the Property: Single-Family Residential, Commercial

Lands within Agricultural Land Reserve: none

**All plans shall be prepared at metric scale and dimensions*

4. Project Summary Information Checklist *(provide in written format)*

- [X] Description of Proposed Development
- [X] Rationale in Support of the Proposed Development
- [ ] Overview of the Proposed OCP and/or Zoning Bylaw Amendment(s)
- [ ] Consistency with OCP Policies and Maps
- [ ] Proposed OCP Policy Amendment(s)
- [ ] Proposed OCP Map Amendment(s)
- [ ] Proposed Zoning Regulation Amendment(s)
- [ ] Proposed Zoning Bylaw Map Amendment(s)

5. Supporting Plans and Illustrations Checklist
(hard copies include full size plans and reductions as well as a digital copy)*

- [X] Location Context Plan see Description/Rationale Statement
- [X] Conceptual Site Plan *(indicating development footprints, approximate density, parks/playgrounds, preservation areas, access roads, trails. parking, transit stops, watercourses, agricultural lands, etc.)*
- [ ] Site Development Statistics *(approximate area, unit count, building coverage, area, height, parking, loading, bike racks, etc.)*
- [X] Environmental Review *(refer to Schedule B of the OCP)*
- [X] Geotechnical and Slope Stability Study *(by a qualified professional)*
- [ ] Viewscape Analysis
- [ ] Archeological Overview *(by a qualified professional)*
- [ ] Lot Grading Plan
- [ ] Stormwater Management Plan
- [X] Traffic Impact Study
- [X] Photographs of the property
- [X] Existing Subdivision (Legal) Plan
- [ ] Proposed Subdivision Plan
- [ ] Existing and Proposed Slope Analysis
- [X] Aerial Photo Map see Description/Rationale Statement
- [ ] Additional Information _____

6. Servicing Information
(written text and hard copies of plans to include full size plans and reductions as well as a digital copy)*

- [X] Engineering Design Design Brief, Webster Engineering Ltd.
- [X] ISL Water/Sewer Modeling Reports
- [ ] Description of Existing or Proposed Storm Drainage flows
- [ ] Description of Existing or Proposed Water Service Connections
- [ ] Description of Existing or Proposed Available Sewer Service Connections
- [ ] Description of Existing or Proposed Road Access
- [ ] Location Plan of Existing and Proposed Water and Sewer connections
- [ ] Information to be provided regarding development for the Village to perform an independent evaluation of the water and sanitary requirements in context of the existing systems:
    - AutoCAD based base plan illustrating the onsite collection/distribution system of each utility. Base plan must be referenced to legal cadastral.
    - Sanitary catchment plan complete with calculations and expected pipe inverts.

**All plans shall be prepared at metric scale and dimensions*

- Water system plan complete with all expected fixtures (fire hydrants, air valves etc. if applicable) and load calculations. Fire Underwriters Survey fire flow calculation sheet under a Professional Engineer's seal.
- Proposed onsite and offsite works in AutoCAD format for each utility as supported above.
- Preliminary ground elevations within the development.

**All plans shall be prepared at metric scale and dimensions*

APPLICATION FORM FOR AN AMENDMENT TO THE OFFICIAL COMMUNITY PLAN AND/OR ZONING BYLAWs (OR13)

I/We hereby make application under the provisions of Part 26 of the *Local Government Act* and the Village's Development Procedure Bylaw No. 725, 2013 for:

X An Amendment to the Official Community Plan Bylaw and/or
X An Amendment to the Zoning Bylaw

to permit development on lands legally described as:

Lot: C, Plan: EPP40824, District Lot: 211, LLD.

THIS APPLICATION IS MADE WITH MY FULL KNOWLEDGE AND CONSENT

[redacted] July 6, 2022

Registered owner's signature Date

Where the applicant is NOT the REGISTERED OWNER, the application must be signed by the REGISTERED OWNERS designated AGENT and proof thereof must be registered in the office of the Village of Pemberton.

FOR OFFICE USE ONLY:

Application/File No.: _____

Application Fee received $_____ Receipt No.: _____

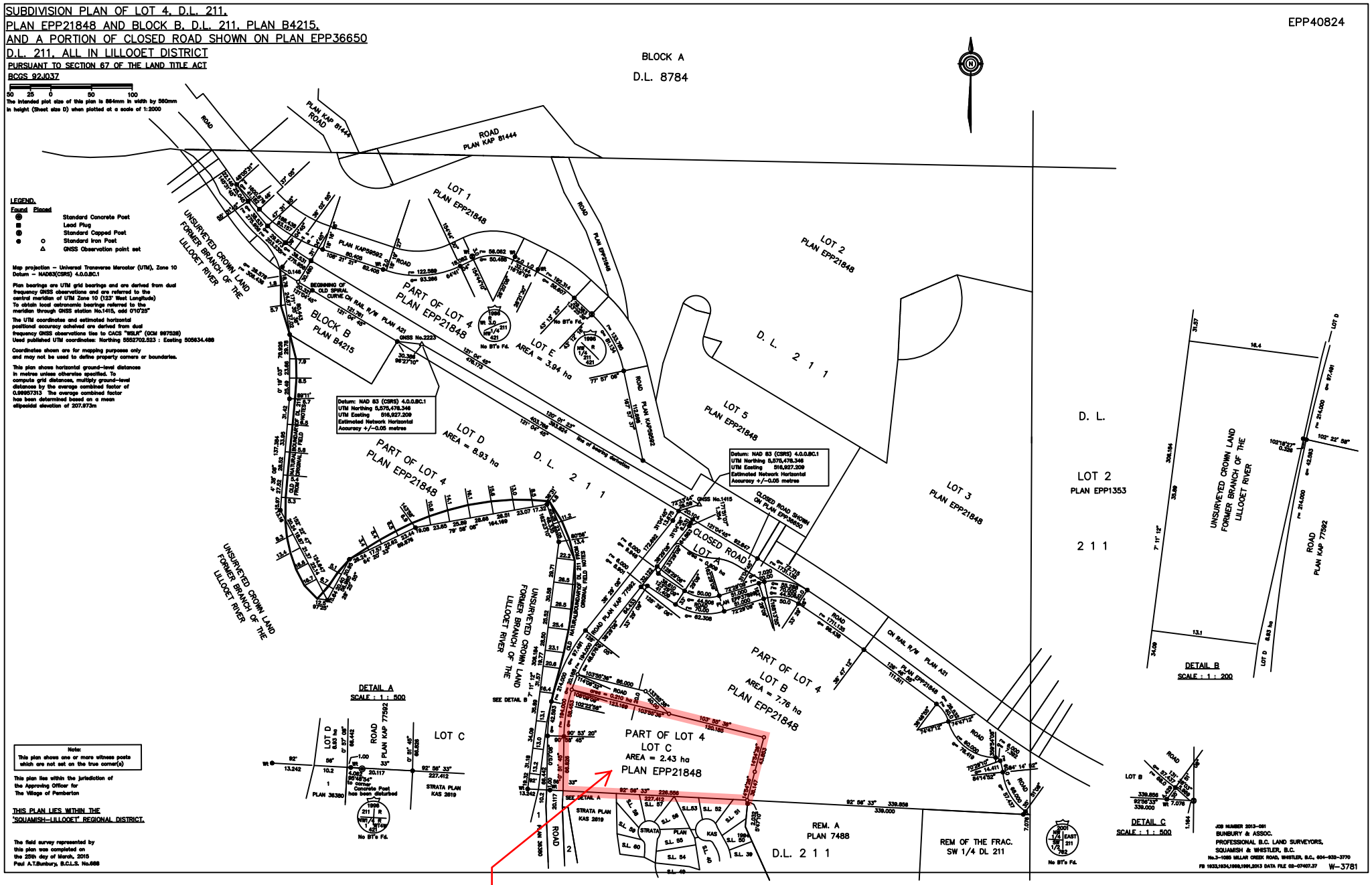
Date received: _____

_____

Signature of Official

**All plans shall be prepared at metric scale and dimensions*

Registered Legal Plan EPP 40824



General Notes

1. This drawing depicts a layout concept. It is provided for conceptual planning purposes only.
2. Typical design criteria are:
   - 15-m wide strata road ROW
   - 6-m wide paved road
   - residential lot width: 18-m for regular lots, 15-m for Lots 1-7, 12-m frontage for irregular lots
   - minimum 300-sm residential lot area
3. Lidar topographic mapping is from 2012 and may not reflect current conditions.

Conceptual Site Plan

0 10-m 20-m 30-m 40-m

N

Pemberton Farm Road East

Sabre Way

Road B

Road B

Den Duyf Park

Commercial Site

Lot 35
Lot Area 1,741-sm
Lot Width 66-m
Lot Depth 26-m

Lot 26
Lot Area 956-sm
Lot Width 18-m

Lot 25
Lot Area 727-sm
Lot Frontage 12-m

Lot 24
Lot Area 544-sm
Lot Frontage 12-m

Lot 23
Lot Area 842-sm
Lot Frontage 12-m

Lot 27
Lot Area 685-sm
Lot Frontage 12-m

Lot 28
Lot Area 710-sm
Lot Frontage 12-m

Lot 29
Lot Area 676-sm
Lot Frontage 18-m

Lot 30
Lot Area 507-sm
Lot Width 18-m

Lot 31
Lot Area 479-sm
Lot Width 18-m

Lot 32
Lot Area 450-sm
Lot Width 18-m

Lot 33
Lot Area 421-sm
Lot Width 18-m

Lot 34
Lot Area 467-sm
Lot Width 24-m

Lot 1
Lot Area 346-sm
Lot Width 15-m

Lot 2
Lot Area 347-sm
Lot Width 15-m

Lot 3
Lot Area 335-sm
Lot Width 15-m

Lot 4
Lot Area 324-sm
Lot Width 15-m

Lot 5
Lot Area 312-sm
Lot Width 15-m

Lot 6
Lot Area 301-sm
Lot Width 15-m

Lot 7
Lot Area 300-sm
Lot Width 15-m

Lot 8
Lot Area 309-sm
Lot Frontage 12-m

Lot 9
Lot Area 571-sm
Lot Frontage 12-m

Lot 10
Lot Area 749-sm
Lot Frontage 12-m

Lot 11
Lot Area 529-sm
Lot Frontage 12-m

Lot 12
Lot Area 657-sm
Lot Frontage 12-m

Lot 13
Lot Area 454-sm
Lot Frontage 12-m

Lot 14
Lot Area 405-sm
Lot Width 18-m

Lot 15
Lot Area 366-sm
Lot Width 18-m

Lot 16
Lot Area 383-sm
Lot Width 18-m

Lot 17
Lot Area 400-sm
Lot Width 18-m

Lot 18
Lot Area 417-sm
Lot Width 18-m

Lot 19
Lot Area 434-sm
Lot Width 18-m

Lot 20
Lot Area 450-sm
Lot Width 18-m

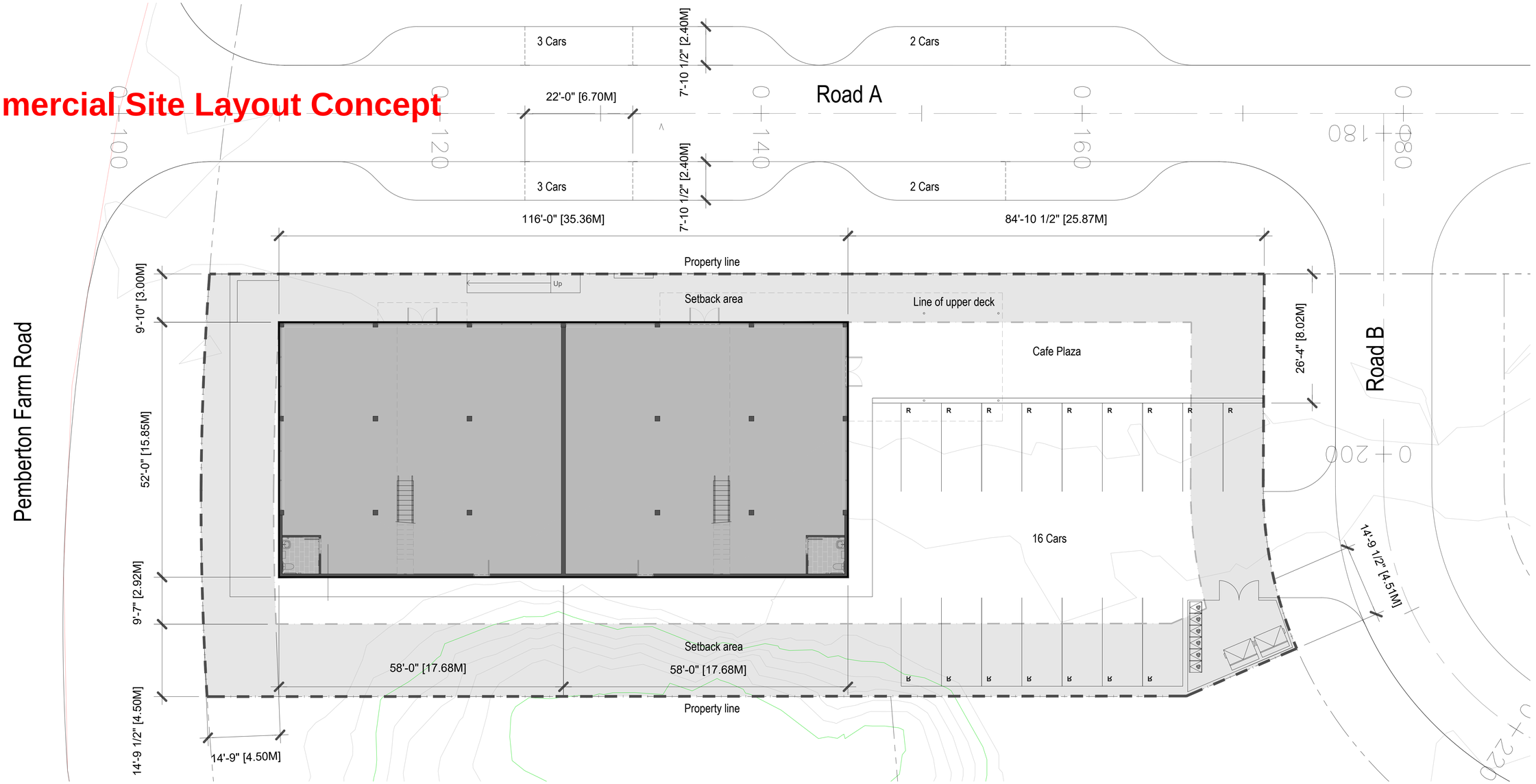
Lot 21
Lot Area 467-sm
Lot Width 18-m

Lot 22
Lot Area 489-sm
Lot Frontage 12-m

Rivertown Properties - 7362 Pemberton Farm Road East
Proposed Layout Concept with Topography (1June22)

Pemberton Plateau Development

Commercial Site Layout Concept

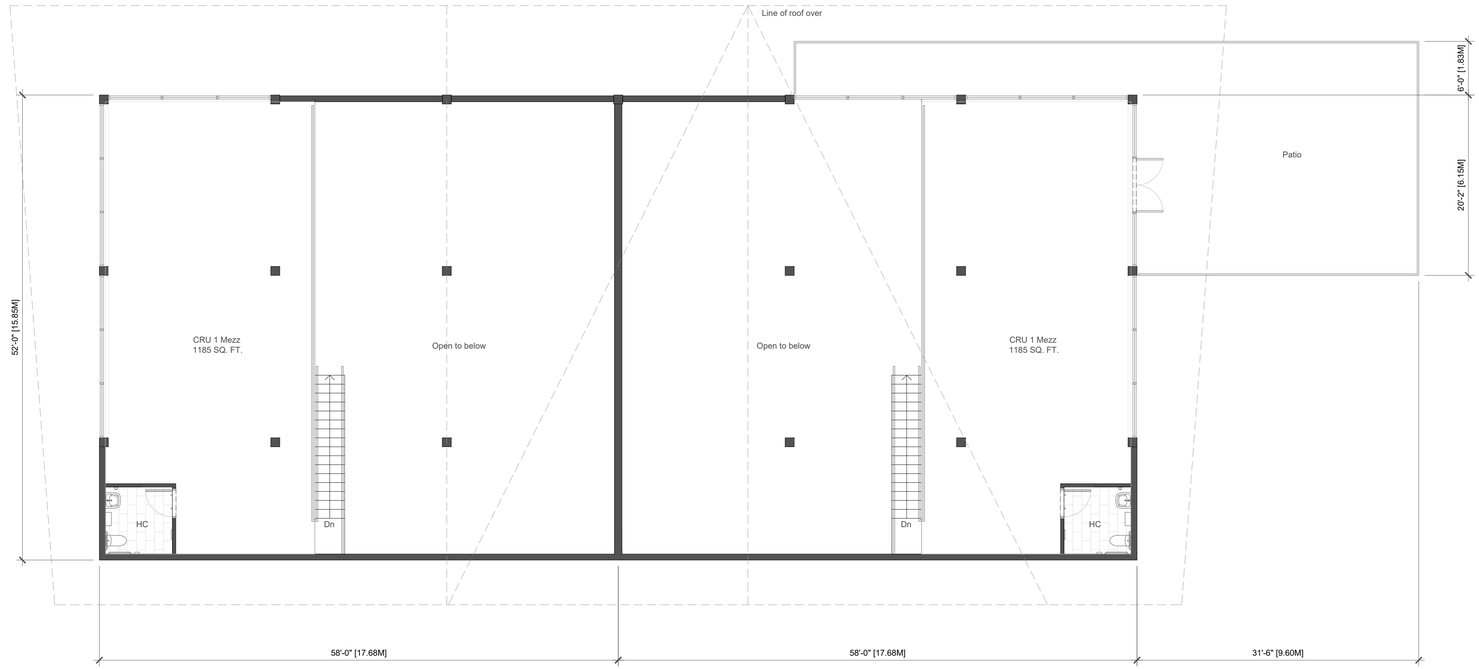


1 Site Plan
1/10"=1-0"

Lot C - Farm Road East
Lot 35

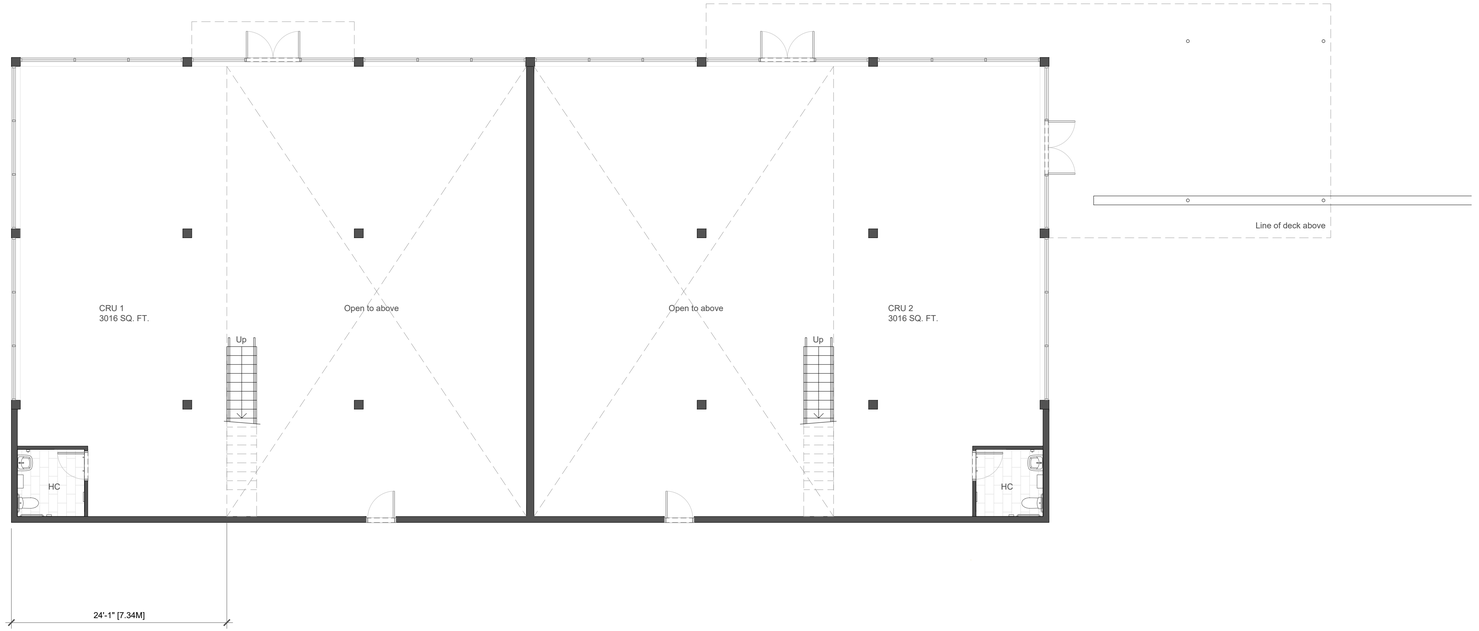
Site Area	18,647 Sq.ft.
Site Coverage	45%
Floor Area Total	8402 Sq.ft.
Floor Area Ground	3016 x 2 = 6032 Sq.ft.
Floor Area Mezz.	1185 x 2 = 2370 Sq.ft.

6/29/2022 10:57:41 AM, Design Intent Only



2 Upper Floor

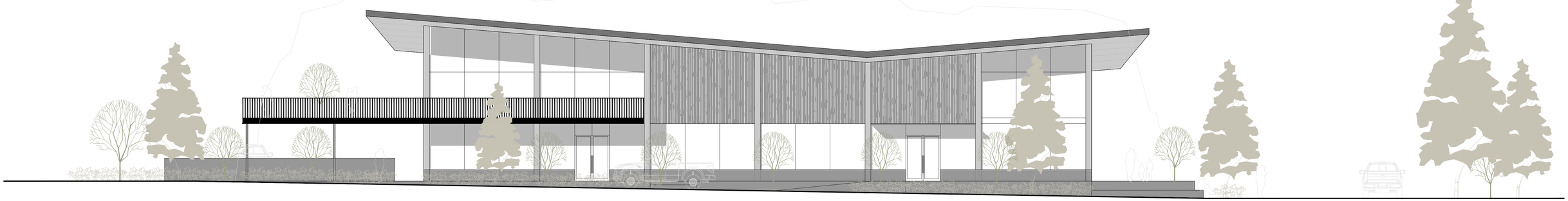
1/8"=1-0"



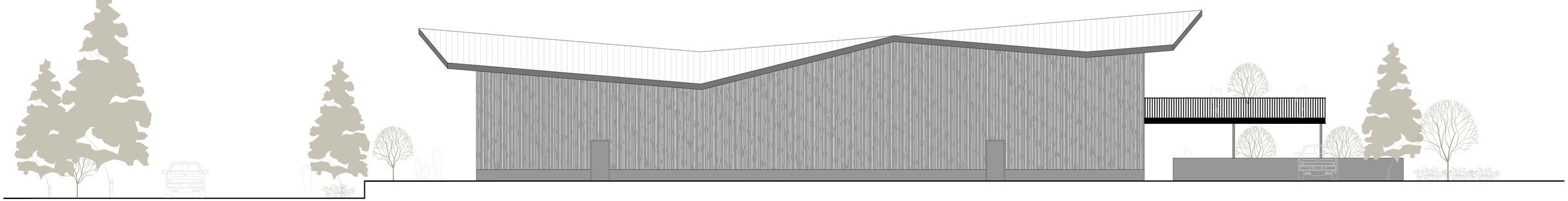
1 Lower Floor

1/8"=1-0"

6/29/2022 10:57:44 AM, Design Intent Only

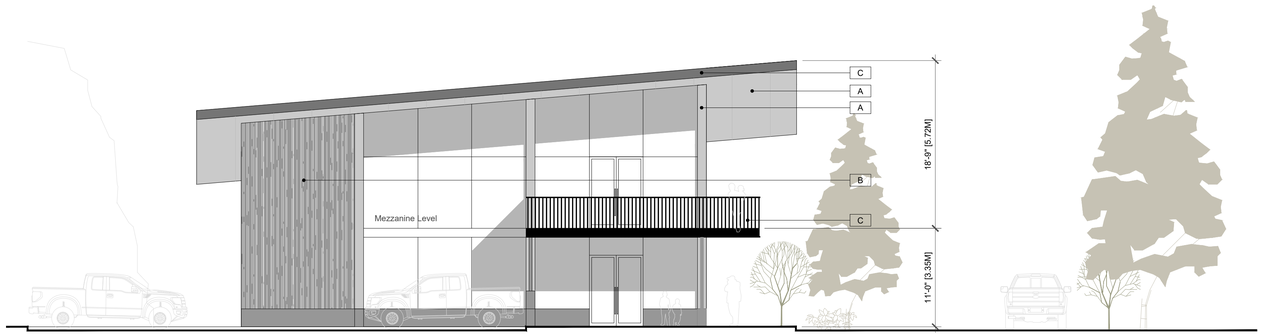


1 Elevation - Road A
1/8"=1-0"



2 Elevation
1/8"=1-0"

3 Elevation - Farm Rd
1/8"=1-0"



4 Elevation - Road B
1/8"=1-0"

A

Soffit / Beams
6" Channel Profile
Dark Fir

B

Siding
6" Channel Profile
Black Cedar / Hardi

C

Metal Trim
Charcoal Grey

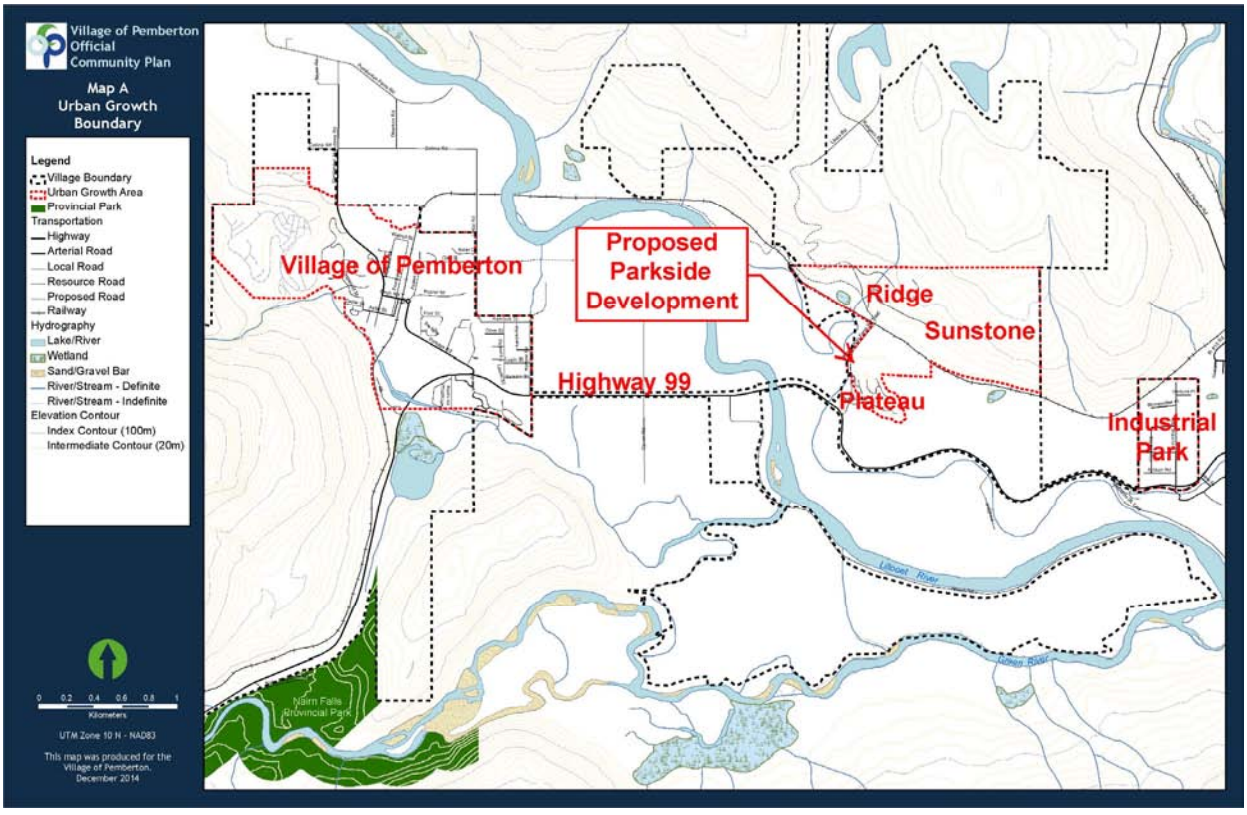
6/29/2022 10:57:50 AM, Design Intent Only

Description/Rationale Statement
for OCP/Zoning Amendment Application
Rivertown Properties – 7362 Pemberton Farm Road East

Rivertown Pemberton GP Ltd. appreciates the opportunity to present this OCP/Zoning Amendment Application to the Village of Pemberton. The purpose of this Application is to propose the rezoning of the subject lands to allow for a single-family residential subdivision and a small neighbourhood commercial property fronting Sabre Way on the corner of Pemberton Farm Road East.

Description of the Proposed Development

The proposed development is a 2.4-ha (6-acre) site located at 7362 Pemberton Farm Road East, 3.5-km east of the Village of Pemberton. The site is on the east side of Pemberton Farm Road East and south of Sabre Way (new road dedication), between the Pemberton Plateau neighborhood and Den Duyf Park. It is legally described as Lot C, Plan EPP40824, DL 211. The site location is illustrated below.



The property is immediately north of the 60-lot single-family residential subdivision known as Pemberton Plateau (accessed from the south from Pinewood Drive), and the 29-unit townhouse complex known as Pemberton Plateau Townhouses (with primary access from Pemberton Farm Road East). An aerial perspective of the site looking west is provided below.

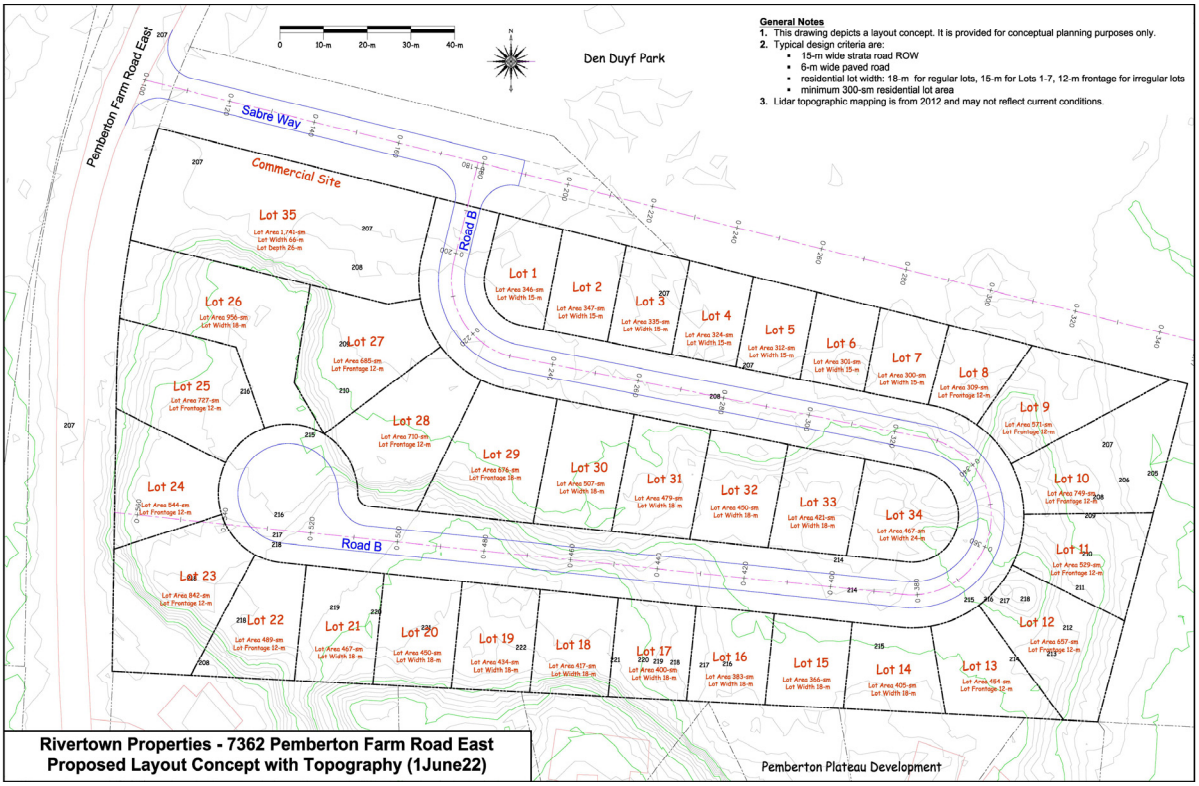
Description/Rationale Statement
for OCP/Zoning Amendment Application
Rivertown Properties – 7362 Pemberton Farm Road East

Directly north of the subject property is Den Duyf Park, (formerly know as the Pemberton and District Recreation Site) where there will be multiple, family-oriented recreation facilities including two grass playing fields (and a to-be-constructed amenity building and change room), a mountain bike skills park, amenity building and space for a future baseball diamond, as well as an indoor recreation complex. Flanking the north side of the proposed Recreation Facility are the recent neighbourhood-oriented subdivisions of The Ridge (a 44-lot single family development), Sunstone Pemberton (currently, a 114-lot single-family development with future phases coming) and Elevate (a 50-unit multi-family development). All families in these subdivisions will pass by the subject lands daily making this site an ideal location for small neighbourhood commercial service providers.

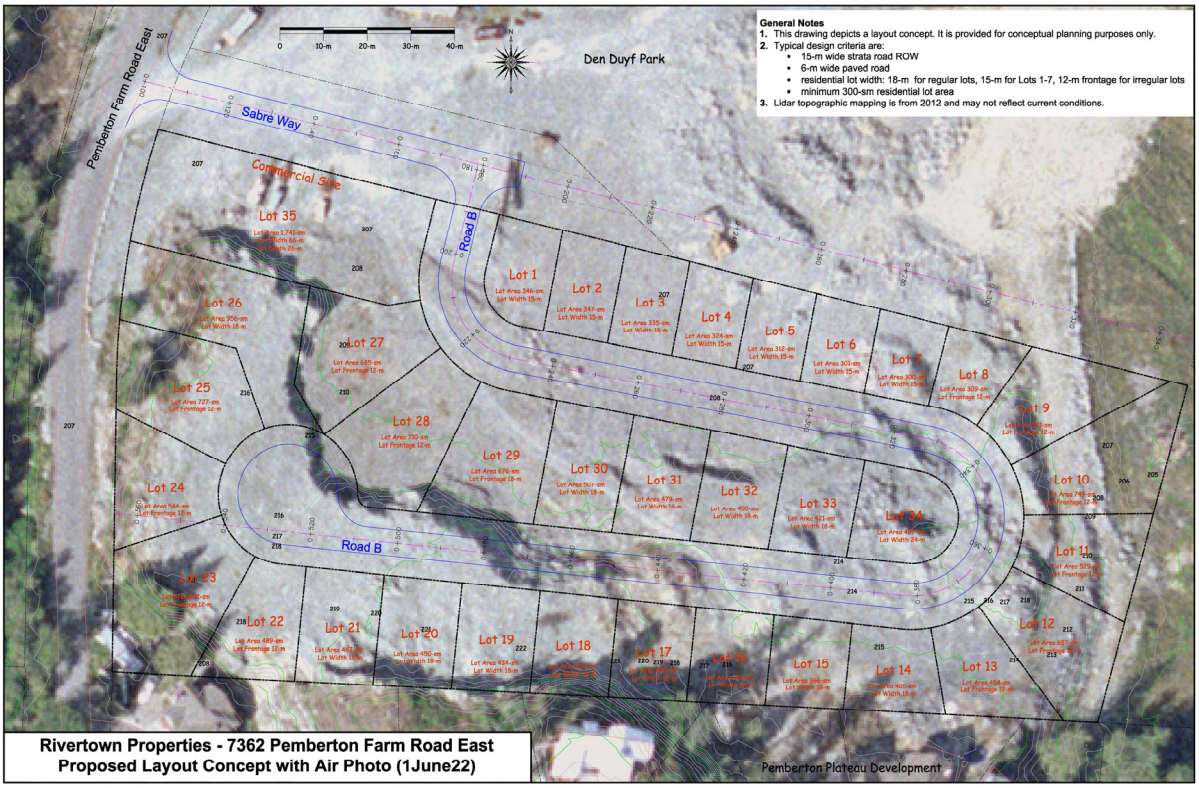
The site is currently vacant. Historically, it was used for part of a gravel processing operation. There is no significant vegetation on the site. The site consists mostly of tailings from the gravel operation (boulders and a gravel stockpile) and exposed rock outcrops. The site is not within the Agricultural Land Reserve but is subject to floodplain requirements.

The site is currently zoned RES-1 (Resource 1). It is proposed to rezone it to a Comprehensive Development (CD) zone that would permit affordable single-family residential lots (minimum 300-sm lot size), as well as a commercial building with surface parking. The proposed development concept is illustrated below.

Description/Rationale Statement
for OCP/Zoning Amendment Application
Rivertown Properties – 7362 Pemberton Farm Road East



Rivertown Properties - 7362 Pemberton Farm Road East
Proposed Layout Concept with Topography (1June22)



Rivertown Properties - 7362 Pemberton Farm Road East
Proposed Layout Concept with Air Photo (1June22)

Site servicing will conform to Village of Pemberton servicing standards. Access to the site will be from Pemberton Farm Road East along an existing road right-of-way. A 6-m wide paved road will be constructed to provide access to the site. Water services will connect to the existing watermain adjacent to the site on Pemberton Farm Road East. Sewer services will connect to the existing sewer pumpstation at the intersection of Pemberton Farm Road East and Sunstone Way.

In the Village of Pemberton Official Community Plan, the proposed development site is located within the Hillside Special Planning Area (reference Section 6.2 and Map O of the OCP). The site is further identified as Parcel #7 of the Regional Context Statement Area (reference Section 3 and Map N of the OCP).

Rationale in Support of the Proposed Development

Given the demand for housing in Pemberton and the nature of the surrounding neighbourhoods, it makes logical sense that this infill site be rezoned for small single-family lots and add to the residential stock of the Pemberton community. We propose to create single-family lots rather than townhouses as the property's topography and composition make a townhouse project more difficult to service and would require excessive blasting and disruption. In addition, small single-family homes provide a more affordable option to larger single-family homes and offer more living space for a growing family than a typical townhouse unit.

We also contemplated development models where duplex lots could run along the north perimeter of the site (east of the commercial lot). Since it is not possible to stratify a strata plan, these duplex lots could be separate strata corporations (one for each duplex) that all share Road B with the bare land strata corporation – a complicated arrangement. Alternatively, we considered whether the duplex lots could be fee-simple lots however due to the constraints of the site, it is not possible to accommodate a municipal road. Instead, fee-simple duplex lots could be oriented with driveways facing north toward the park, accessed by an extension of Road A/Sabre Way (municipal road with additional requirements for infrastructure). We understand that the Village of Pemberton prefers that all lots are accessed from the internal strata road (internal driveways).

After analyzing these different scenarios, we conclude that the most efficient use of this unique site is to provide a combination of a commercial building for neighbourhood-oriented service providers together with affordable small single-family lots. We believe that small single-family homes will be attractive to the "missing middle" demographic of young families and empty nesters. This demographic will enjoy the development's prime location right across from the recreation centre and park, trails, biking and hiking.

Once rezoned, we will propose to subdivide the property into:

a) one commercial lot (subdivided from the parent parcel) located at the corner of Pemberton Farm Road East and Road A/Sabre Way along the northwest border of the subject lands with a lot size of 1,732 square metres.

b) a bare land strata subdivision which would include 34 small single-family strata lots ranging in size from approximately 300 to 700 square metres (3,229 to 7,535 square feet).

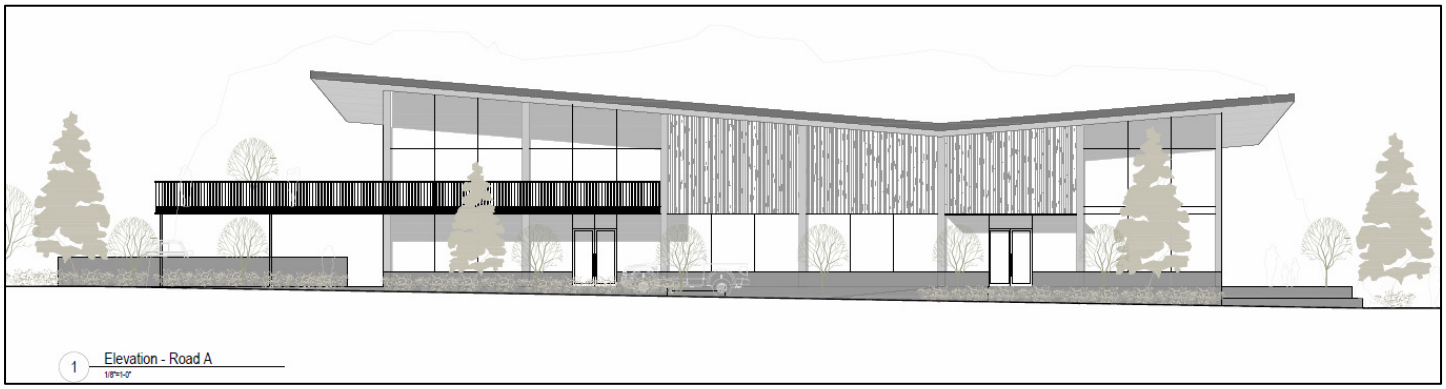
Commercial Lot

We envision the commercial lot will comprise a small neighbourhood commercial building with a single level and mezzanine (or two full levels) with adequate surface parking for patrons. An easement would allow the commercial lot to share part of Road B with the bare land strata subdivision, to provide access to the side and rear of the building for parking, loading and waste facilities.

We have provided a sample massing drawing of a commercial building with a total of 8,402 square feet broken down as 6,032 sf on the ground floor and 2,370 sf on the 2nd level mezzanine. You will note that we intend to blast/remove a minimum amount of rock from the shear wall at the back of the proposed commercial lot to maximize the usable land and provide for more design options.

Here is a list of potential commercial tenants who would be interested in this location as the hub for Dun Duyf Recreation Centre and as the centre point for services provided to the growing residential population in the surrounding neighbourhoods:

- Bike shop, sporting store
- Bakery, café, bistro, coffee bar
- Private liquor store
- Convenience store, variety store
- Pet store, Doggie daycare
- Local office services such as business/accounting, insurance, legal
- Hair salon, beauty salon, esthetic services, day spa
- Health services – physiotherapy, massage, acupuncture
- Daycare (if parkland across the street can be used for outdoor space requirements)



Elevation – looking South from Dun Duyf Park

Full-size drawings of the sample commercial building elevations are included in this package for your review. This sample layout contains a minimum of 2 commercial units (4,200 sq.ft. each) and has been designed to allow for up to 6 different commercial units of 1,400 sq.ft. each (or units can be combined).

Residential Bare Land Strata Lots

We have reviewed Pemberton's R-2 Small Lot zoning and find most of the regulations could be met by our proposed development, with two exceptions noted below.

Lot Regulations	**R-2 Zoning**	**Proposed**
a) Min lot size	***350 m²***	***300 m²***
b) Minimum lot width	12 m	12 m (min frontage)
Building Regulations		
a) Minimum Principal Building Width	6 m	6 m
b) Minimum Front Setback	6 m	6 m
c) Minimum Rear Setback	5 m	5 m
d) Minimum Interior Side Setback	1.5 m	1.5 m
e) Minimum Exterior Side Setback	2.7 m	2.7 m
f) Maximum Lot Coverage	50%	50%
g) Maximum No. of Principal Buildings	1	1
h) Maximum No. of Accessory Buildings	1	1
i) Maximum Building Height, Principal	***Two (2) storeys***	***Three (3) storeys***
j) Maximum Building Height, Accessory	4.6 m	4.6 m

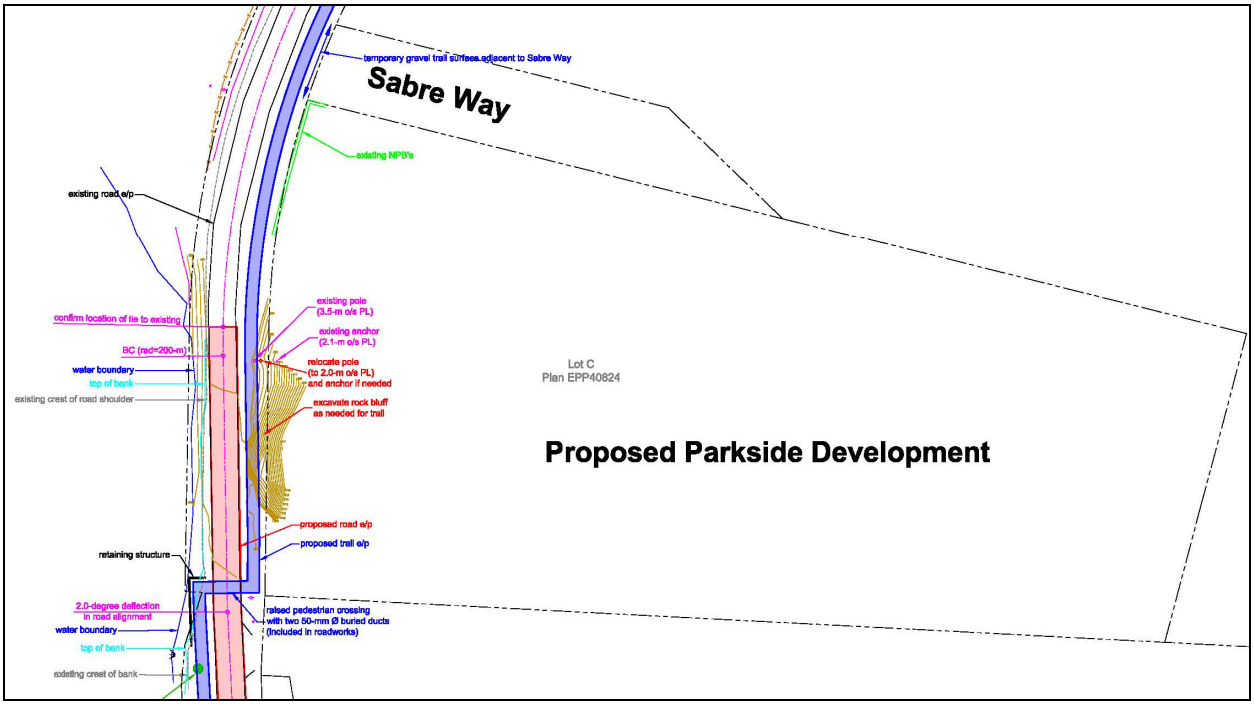
The eight proposed single-family lots along the north PL are on the flood plain, so we envision two levels of living space atop garage/storage/entry = three levels.

For the remaining lots that do not have floodplain restriction on the ground floor, we propose that secondary suites be allowed in the design of the homes. These suites can be rented out as a mortgage helper for the owner and at the same time, address the need in Pemberton for affordable rental studio/bachelor suites for local residents and employees.

Other Notable Items

- As you are aware, there are townhome neighbours near the southwest corner of the property whose backyards are encroaching over the property line. We are offering to formalize this arrangement with a surveyed easement allowing them to continue to use it.

- We are committed to assist with the extension of the Valley Trail along the West side of Pemberton Farm Road East and have provided a preliminary drawing of how we can trim back some of the rock within the SRW to accommodate the trail (below).



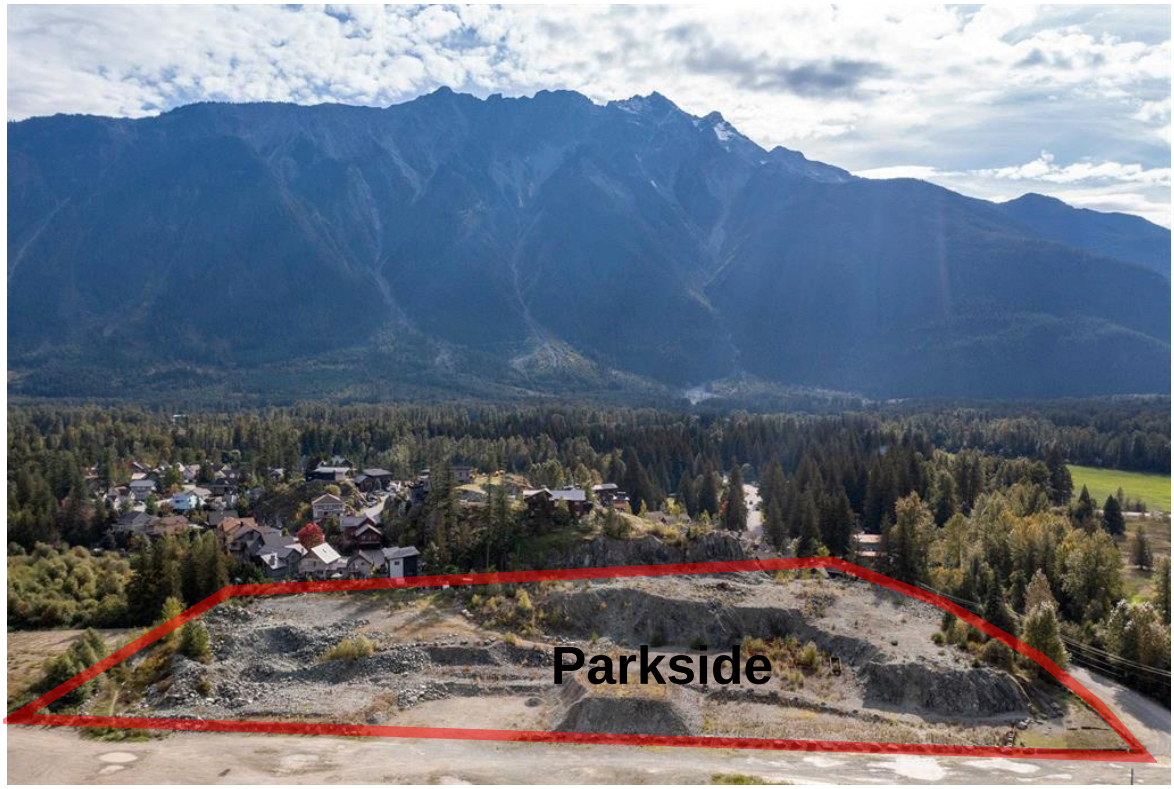
Aligned Goals and Objectives of the OCP

The proposed development is consistent with the goals and objectives of the OCP as follows:

- the site is identified in the OCP for residential and neighbourhood commercial use;
- the proposed lot size will result in more affordable housing than for the larger lots in the adjacent Hillside developments;
- the site is adjacent to the proposed Recreation Facility, as well as an extensive network of trails and bike routes;
- the site will be adjacent to regional transit services when they are established to service the Recreation Facility and Hillside developments.

Photographs of the Site

Site Photographs for OCP/Zoning Amendment Application
Rivertown Development – 7362 Pemberton Farm Road East



Looking South at Site

Looking West at Site

Looking East at Site

Looking South at Site

Webster Engineering Design Brief

VILLAGE OF PEMBERTON, B.C.

Preliminary Engineering Design Brief

Lot C

7362 Pemberton Farm Road East

Prepared for:

Rivertown Properties

Prepared by:

STEEP ROCKY TERRAIN SPECIALISTS
WEBSTER ENGINEERING LTD

EGBC PERMIT No. 1001444

July 7, 2022

Contents

LIST OF FIGURES

Page:

APPENDICES

1.0 Introduction & Site Context

Rivertown Properties (the Developer) has retained Webster Engineering Ltd. (WEL) for Civil Engineering services and preparation of site servicing drawings and an engineering design brief in support of the Subdivision Application for Lot C at 7632 Pemberton Farm Road East located within the Village of Pemberton (VoP). A Master Servicing Plan drawing is enclosed in **Appendix A** for general site layout and servicing.

The subject site is located adjacent to Pemberton Farm Road East, approximately 150m south of Sunstone Way and approximately 250m south of the existing mountainside. It borders the Pemberton Plateau neighborhood to the south, and the future Pemberton & District Recreation Site to the north. Further north of Lot C sits the existing Ridge Development and the Sunstone Development area. Currently, the Lot C is accessed via. a gravel access road that branches off Pemberton Farm Road East and extends slightly in the property.

Topographically, Lot C is characterized by a well-defined bedrock plateau that was altered as part of previous quarrying works. The crest of the plateau sits immediately east of Pemberton Farm Road East, approximately 9m above the roadway, and extends along the south and west edges of the subject property. From the plateau, the terrain slopes gradually to the east before meandering back towards the west.

Figure 1: Aerial Photo facing South-East (January 2022)

Lot C has a total area of 2.3 hectares and its subdivision will include thirty-four (34) single family lots and one (1) commercial lot. Of the thirty-four (34) single family lots, twenty-six (26) are proposed to be zoned to permit secondary suites. A new road network will be established that connects Lot C to Pemberton Farm Road East and provides access to all lots. It is anticipated that the entire subdivision site servicing and access will be built in a single construction phase.

Figure 2: Aerial Photo facing South-West (January 2022)

At the time of this report, it is understood that the neighboring Recreation Site is in the early stages of planning/design. It is also understood that the adjacent Pemberton Farm Road East corridor will be upgraded soon as part of VoP's capital works. As such, the servicing and access concepts presented in this report include provisions for future developments.

2.0 Report Resource Materials

In preparation of this report, the following design guidelines and reports have been reviewed and referenced, including:

- Village of Pemberton Subdivision and Development Control Bylaw No. 677 (2011) – Village of Pemberton
- Master Municipal Construction Document (MMCD) Design Guidelines (2014)
- Village of Pemberton Sanitary Sewer Forcemain Analysis (Nov 6, 2012) – ISL Engineering and Land Services
- Sunstone Ridge (SRD) Water and Water Design Brief and Submission Reviews (Apr 30, 2018) – Memorandum – ISL Engineering and Land Services
- The Ridge at Pemberton Sanitary Forcemain Design Brief (Jul 21, 2016) – Parsons
- Sunstone Preliminary Design Report (Dec 2017) – Parsons
- Sunstone Pump Station Calculations (Feb 2018) – Parsons
- Sunstone Ridge Developments – Subdivision Environmental Assessment (Jun 2013) – Dayesi Services Ltd.
- Electoral Area D Subdivision and Development Servicing (Planned Communities) Bylaw No. 741 (Oct 28, 2002) – Squamish-Lillooet Regional District
- Transportation Association of Canada Geometric Design Guide for Canadian Roads (1999)
- Stormwater Source Controls Design Guidelines – GVRD (2005)
- Stormwater Planning: A Guidebook for British Columbia (2002)
- Urban Stormwater Guidelines and Best Management Practices for the Protection of Fish and Fish Habitat – DFO
- Geotechnical Review – Residential Subdivision – 7362 Pemberton Meadows Road, Pemberton, BC (Jan 2022)
- Village of Pemberton Water System Performance Assessment - VoP (2020)
- Environmental Assessment – 7362 Pemberton Farm Road East, Lot C, Pemberton, BC – Cascade Environmental (Feb 2022)

3.0 Roadworks

The proposed road network layout for Lot C is based on preferred land use concepts discussed with the Developer. The road network includes two (2) new roads, which will be referred to as Sabre Way and Road B for the purposes of this report.

Sabre Way will branch perpendicularly off Pemberton Farm Road East and run parallel to the northern PL of Lot C for approximately 90m, where it will intersect with Road B at a tee intersection. It will be graded relatively flat in order to match the surrounding area while maintaining positive drainage towards Pemberton Farm Road. Sabre Way will be paved just beyond the intersection for future extension to developments north and/or east of Lot C.

Road B will branch perpendicularly off the south side of Sabre Way and generally follow the existing gravel at the start with full embankment cut and fill before terminating on the plateau located at the SW corner of the property. In general, the road will be graded to best fit the existing bedrock slope and will maintain positive drainage towards Sabre Way for its entire length. A cul-de-sac will be included at the end of Road B to facilitate turnaround of passenger and emergency vehicles.

Designated snow storage zones will be included adjacent to the intersection of Sabre Way and Road B, within the Road ROW.

3.1 Road Design Standards & Criteria

Roadworks design criteria is as per the VoP Subdivision and Development Control Bylaw No. 677 (2011) and the Transportation Association of Canada Geometric Design Guide for Canadian Roads (1999).

Lot C will seek similar variances as granted by VoP Staff and Council for the neighboring Sunstone Ridge development, which help suit the steep slope terrain. These variances are summarized in **Figure 3** on the next page and are incorporated into the proposed roadworks design.

Figure 3: Road Standard Variance Summary

Road	**Standard**	**Driving Lanes** (m)	**Drainage**	**Shoulder** (m)	**Sidewalk** (m)	**On-Street Parking**
Sabre Way	Local Hillside	6.6	Curb & Gutter	1.45 (N) / 0.5 (S)	1.0 (S)	No
Road B	Local Hillside	6.6	Curb & Gutter	1.45 / 0.5	1.0	No

We note that **Figure 3** above present minimum values. Shoulder widths are increased in locations to suit appropriate design for utility structures, hydrants, vehicle barriers, and other structures.

3.2 Geotechnical Considerations

Kontur Geotechnical Consultants have prepared a Preliminary Geotechnical Assessment (dated January 24, 2022), which includes a site investigation of the existing soil conditions as well as recommendations for subgrade preparation and pavement structure. These recommendations have been incorporated into the roadworks design by WEL.

4.0 Water Distribution System

The water distribution system supplies domestic and fire flow demands. A Master Servicing Plan is included in **Appendix A** which illustrates the proposed waterworks system.

The proposed Lot C water distribution system will connect to the existing 250mm watermain that runs along Pemberton Farm Road East. This watermain is supplied by both the existing Ridge Reservoir and the Benchlands Reservoir, with flow capable of travelling in either direction depending on system conditions.

As part of previous development works, a tee and stub for Lot C's water connection was installed at the entry point to Sabre Way off Pemberton Farm Road East. From the existing stub, the proposed 250mm watermain follow Sabre Way and subbed off beyond the tee intersection of Sabre Way and Road B for future extension. At the intersection, the main will branch off to a 250mm line that follows the Road B alignment before terminating at the proposed cul-de-sac.

Service connections complete with curb stops will be provided off the Road B watermain for each of the single-family lots and mixed-use lot per VoP standard drawing VOP-W11. Sizing of these connections will be determined at detailed design and will depend on sprinkler requirements for the proposed buildings.

Hydrants will be located at standard intervals along Road B with the preferred locations at common property boundaries.

4.1 Water System Design Parameters

Relevant design criteria for the proposed water distribution system are provided in review of Section 2.0 in the MMCD Design Guideline Manual, 2014, the VoP Subdivision and Development Control Bylaw No. 677 (2011), and the Squamish-Lillooet Regional District (SLRD) Subdivision and Development Servicing Bylaw No. 741 (Oct 2002). Criteria from the VoP generally takes precedence over criteria outlined in MMCD and SLRD Bylaw. Design criteria applied are summarized in the section below.

4.1.1 Watermain Design Criteria

Sizing the proposed watermain distribution system for Lot C is based on the following design criteria:

- Minimum 200mm pipe diameter;
- Minimum 100mm pipe diameter where no extension in future and does not service hydrant;
- Hydrants to be serviced by minimum 150mm diameter watermain.

4.1.2 Domestic Water Demand

VoP has provided the domestic demand rates, while SLRD has provided the residential population factors, and MMCD has provided the commercial population factors to be used for the mixed-use lot. **Figure 4** shows population factors based on land use type and unit flow rates per capita.

Figure 4: Population Factor and Domestic Water Demand

Land Use Type	**Population Factor**	**Max Daily Demand Unit Rate** (L/cap/day)	**Peak Hour Demand Unit Rate** (L/cap/day)
Single Family (Conventional)	4 cap/lot	910	1,820
Single Family (with Secondary Suite)	7 cap/lot	910	1,820
Commercial (Lot 35)	90 cap/ha	910	1,820

4.1.3 Fire Flow Demand Criteria

Fire flows requirements for the site are governed by the commercial building on Lot 35. Based on preliminary architectural plans, the commercial building will have a total floor area of 8,397 ft^2 (780 m^2). Building materials and fire suppression measures will be selected based on the available fire flow supply and anticipated construction timelines. A range of fire flow demands is provided in **Figure 5** below based on various build out conditions. Demands have been calculated in accordance with the Fire Underwriters Survey "Water Supply for Public Fire Protection, 1999", which is the required method under MMCD specifications. Detailed calculations are provided in **Appendix D**.

Figure 5: Fire Flow Demand Summary

Material Type	**Sprinklers?** (Y/N)	**Fire Wall?** (Y/N)	**Fire Flow** (L/s)
Wood Frame	N	N	133
Wood Frame	N	Y	100
Ordinary	N	N	83
Wood Frame	Y	N	67
Ordinary	Y	N	50

The VoP water distribution system governs the available fire flow supply. Currently, the supply capacity is limited to 115.4 L/s; however, this is anticipated to increase upon construction of the future reservoir at Sunstone Ridge - Phase 4.

A hydrant test will be conducted prior to detailed design and hydraulically modelled to confirm the available fire flow to site.

Based on the hydraulic modelling results, recommendations will be provided relating to building construction (e.g. fire suppression sprinkler requirements, construction materials, fire wall requirements). Service connection sizing for the proposed subdivision will be governed by fire suppression sprinkler requirements.

4.2 Domestic Water Demands

Maximum Daily Demands (MDD) and Peak Hour Demands (PHD) were calculated using the unit flow rate values outlined in Section *4.1.2 Domestic Water Demand* above. Using the unit flow rate values as per **Figure 4**, populations and total domestic water demands were determined and are summarized in **Figure 6**.

Detailed calculations are provided in **Appendix B**.

Figure 6: Anticipated Population and Total Domestic Water Demand

Development Area	**Single Family Lots**	**Commercial Area** (ha)	**Equivalent Population** (cap)	**Max. Daily Demand** (L/s)	**Peak Hour Demand** (L/s)
Single Family Lots (Conventional)	8	0	32	0.3	0.7
Single Family Lots (with Secondary Suite)	26	0	182	1.9	3.8
Commercial (Lot 35)	0	0.17	15	0.2	0.3
Total	34	0.17	229	2.4	4.8

4.3 Watermain Hydraulic Design

Sizing of the proposed watermains will accommodate on-site domestic water demands and fire flows. Hydrostatic conditions for the proposed on-site watermain are based on values presented in the VoP's Water System Performance Assessment (2020).

Lot C falls within the Valley Floor pressure zone, which has a Hydraulic Grade Line (HGL) set to 265m controlled by the Ridge, Fernwood Drive, and Eagle Drive PRV stations. At this HGL, the high point on Lot C (216m el.) has a static servicing pressure of approximately 70psi, while the low point (207m) has a static servicing pressure of approximately 82psi. As such, the servicing pressure for Lot C under normal operating conditions is within the acceptable range per VoP bylaw.

5.0 Sanitary Conveyance System

The Lot C sanitary sewer will be entirely gravity-fed. Each of the proposed lots will include a standard service connection that connects to a piped sanitary sewer routed below Road B. The proposed sewer will then convey sanitary flows west along Sabre Way and north along Pemberton Farm Road before tying-in to an existing stub at the Sunstone Way intersection. From there, flows will then feed into the existing wet well / lift station, which pump flows to the Pemberton Sewage Treatment Plant via. an existing force main.

Trenching and restoration works will be required along Pemberton Farm Road East to facilitate the sewer connection. A stub will also be provided at the edge of paving for Sabre Way for future extension.

5.1 Sanitary Flow Calculations

Sanitary demands are based on information provided in the VoP Subdivision and Development Control Bylaw No. 677 (2011), Squamish-Lillooet Regional District (SLRD) Subdivision and Development Servicing Bylaw No. 741 (Oct 2002) and calculated based on the MMCD methodology.

5.1.1 Sanitary Demand

Population Factor and Unit Average Dry Weather Flow (ADWF) rates are as per SLRD Bylaw No. 741 and VoP Bylaw No. 677 respectively and are summarized below in **Figure 7**.

Figure 7: Population Factor and Unit ADWF

Land Use Type	**Population Factor**	**Unit ADWF** (L/cap/day)
Single Family (Conventional)	4 cap/lot	410
Multi Family	3 cap/lot	410
Single Family (with Secondary Unit)	7 cap/lot	410
Commercial (Lot 35)	90 cap/ha	410

Using the unit flow rate values as per **Figure 7** populations and unit flow demands, the sanitary flow demands were determined and are summarized in **Figure 8**. Detailed calculations are provided in **Appendix B**.

Figure 8: Anticipated Population and Sanitary Demand

Development Area	**Single Family Units**	**Commercial Area** (ha)	**Equivalent Population** (cap)	**ADWF** (L/s)	**PDWF** (L/s)	**PWWF** (L/s)
Single Family Lots (Conventional)	8	0	32	0.15	0.49	0.64
Single Family Lots (with Secondary Suite)	26	0	182	0.86	2.76	2.92
Commercial (Lot 35)	0	0.17	15	0.07	0.23	0.24
Total	34	0.17	229	1.09	3.48	3.63

5.2 Sanitary Conveyance – Gravity Sewer Mains

Gravity sanitary sewer mains are designed as per MMCD Design Guidelines 2014 and are as follows:

- Minimum pipe diameter of 200mm will be used for gravity sewers;
- Pipe Capacity Calculations: Manning's (n=0.013);
- Infiltration allowance = 0.1 l/s/ha;

5.3 Service Connections

All proposed lots will be provided a 100mm sanitary service connection capped at property line. Service connections will be constructed as per MMCD standard drawing S7 and complete with an inspection chamber near PL. Inverts for the individual connections will be provided at detailed design.

5.4 Downstream Sanitary Pump Station

All sanitary flows from Lot C will be directed to the existing pump station located at the intersection of Pemberton Farm Road East and Sunstone Way. The pump station was constructed as part of the neighboring Ridge development and includes a pair of Flygt NP 3153 SH 3-274 pumps, providing a design pump rate of 12.1 L/s at 51.7m Total Dynamic Head (TDH).

Currently, the pump station receives flows from The Ridge (44 Lots), which has a calculated PWWF of 5.0 L/s. With the addition of Lot C, the PWWF load will increase by 3.63 L/s for a total post-development PWWF of 8.67 L/s. A summary of sanitary loads to the existing pump station is shown in **Figure 9** below.

Figure 9: Sanitary Pump Station Loads

Development	**No. of Lots**	**PWWF** (L/s)
The Ridge	44	5.04
Lot C	35	3.63
Total	79	**8.67**

It is understood that this load will increase further in the future as the neighboring lots are developed. The head in the downstream forcemain will also increase as the lands are developed and more flows are directed to the forcemain. Operation and performance of the pumps will need to be reviewed as the surrounding area is developed; however, no upgrades are necessary to facilitate Lot C's sanitary flows at this time.

The existing wet well and forcemains are adequately sized and will not require any upgrades.

6.0 Stormwater Management & Conveyance System

The objective of the proposed stormwater management plan is to mitigate changes in quantity and quality of discharging water, and safely convey the minor and major storm events to existing ditches, channels, and watercourses. The following criteria are applied to the proposed stormwater management and conveyance system:

(a) A conventional underground storm sewer system to convey the post-development flow of the minor storm (10-year return period) event to the offsite storm sewer system without surcharge;

(b) A conventional underground storm sewer and/or overland flow drainage system to convey the post-development flow up to the major 100-year return period storm event to the offsite storm system;

(c) Provide an overland flow route;

(d) Provide stormwater detention to meet pre-development peak flows for the post-development 5-year, 10-year, and 100-year return periods; and,

(e) Provide stormwater cleansing where achievable to meet 80% removal of Total Suspended Solids (TSS) removal.

6.1 Storm Design Parameters

The Rational Method is used to calculate conveyance requirements including sizing of culverts and storm sewers.

6.1.1 Rational Method Design Parameters

Storm design parameters are based on information provided in the VoP Subdivision and Development Control Bylaw No. 677 (2011), Squamish-Lillooet Regional District (SLRD) Subdivision and Development Servicing Bylaw No. 741 (Oct 2002), and the MMCD.

- Rainfall Data: IDF Curve for Village of Pemberton
- Inlet Time: Airport Method; Single-Family Lot = 15 min
- Travel Time: Modified Manning's Formula (MMCD)
- Rational Method : Q= CiA

6.1.2 Storm Sewer Design Parameters

- Minimum pipe diameter of 250 mm
- Formula: Manning's assuming n=0.013 for all pipe, n=0.035 for all open channels.

6.2 Off-Lot Conveyance

Existing drainage characteristics sees water that sheds to the north, east, and west before generally migrating towards the existing swale that runs along the Pemberton Farm Road East. From the swale, flows are directed under the roadway via. an existing 450mm concrete culvert located at the intersection of Sunstone Way and Pemberton Farm Road East. The culvert discharges to a local creek that runs parallel to Pemberton Farm Road East, which ultimately leads to the Lillooet River.

It is understood that the existing swale system along Pemberton Farm Road East has poor conveyance capacity and will be re-instated or replaced as part of future roadworks upgrades.

In lieu of discharging to the existing swale system, a new storm outfall will be constructed as part of the Lot C subdivision, which will allow flows from the site to directly discharge to the local creek west of Pemberton Farm Road East. Detailed design of the storm outfall will be provided at Building Permit.

6.3 On-Lot Conveyance

Stormwater management criteria (a), (b), and (c) are satisfied with a conventional curb and gutter, and piped storm sewer system. In general, the 100-year flow in maintained within the storm sewer system below grade and generally within the pipe.

The on-lot storm sewer will be entirely gravity-based and follow the proposed road alignments. Stubs for future connection will be provided at the edge of Road A paving, with downstream pipes sized for future flows.

6.4 Peak Flow Detention

The existing undeveloped site is generally defined by exposed and shallow bedrock. Currently, rain that falls on Lot C runs off quickly to the surrounding areas with minimal flow retention and minimal infiltration.

It is anticipated that peak flows will decrease as a result of the proposed subdivision. Specifically, introduction of landscaped areas around the houses will provide storage volume on-site thereby reducing peak runoff rates. As such, the proposed subdivision will satisfy stormwater criterion (d) without the use of engineered detention systems.

6.5 Stormwater Treatment

To satisfy stormwater management criterion (f), a mechanical Oil-Grit Separator unit will be installed near the intersection of Sabre Way and Road B. All storm flows from the proposed lots and Road B will be pass through the treatment unit before discharging to the adjacent storm sewer and environment. Shop drawings and engineering design will be provided at detailed design to certify that the proposed infrastructure will satisfy the 80% TSS removal criterion.

7.0 Shallow Utilities / Street Lighting

Hydro and communication services will be provided by a traditional underground system. Hydro distribution and coordination with other shallow utilities is currently underway.

In discussion with VoP Staff, streetlighting design will be dark-sky friendly and will only be proposed at key locations.

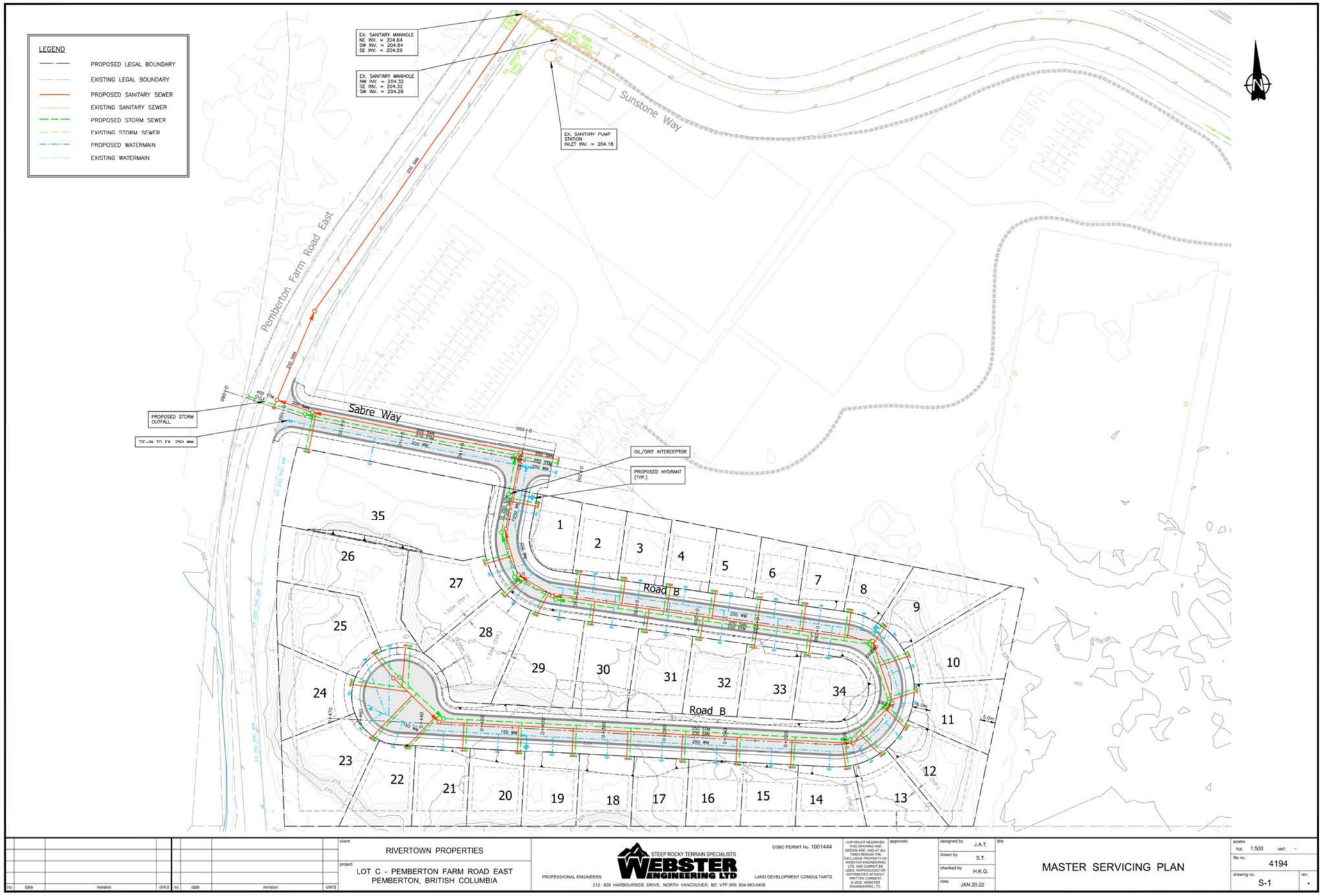
If you have any questions or comments in this regard, please call us at (604) 983-0458.

All of which is respectfully submitted by:

WEBSTER ENGINEERING LTD.

John Tynan, P.Eng.
Principal

Appendix A: Design Drawings



RIVERTOWN PROPERTIES

LOT C - PEMBERTON FARM ROAD EAST
PEMBERTON, BRITISH COLUMBIA

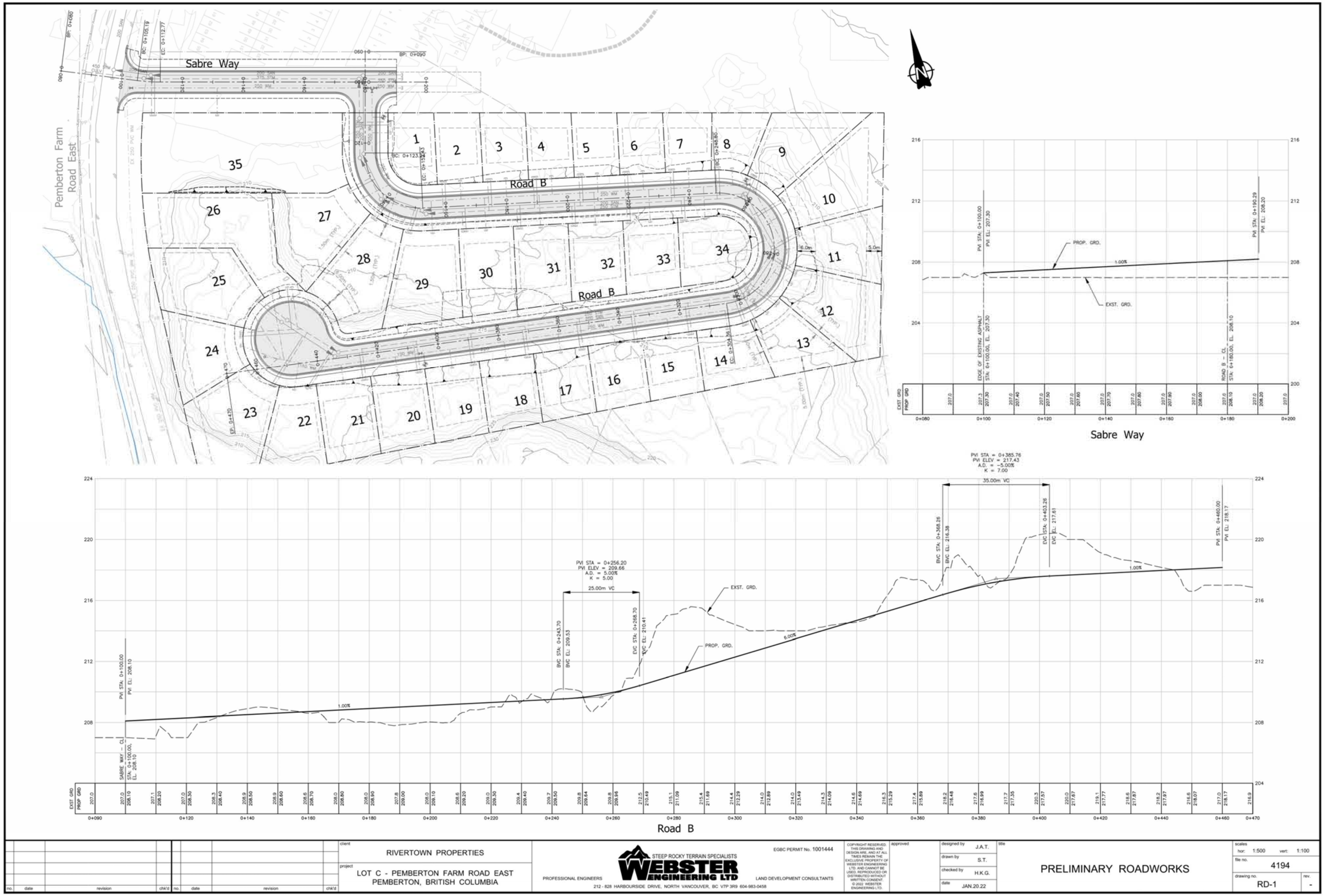
STEEP ROCKY TERRAIN SPECIALISTS
WEBSTER ENGINEERING LTD
PROFESSIONAL ENGINEERS
212 - 828 HARBOURSIDE DRIVE, NORTH VANCOUVER, BC V7P 3R9 604-983-0458
LAND DEVELOPMENT CONSULTANTS

EGBC PERMIT No. 1001444

designed by J.A.T.
drawn by S.T.
checked by H.K.G.
date JAN.20.22

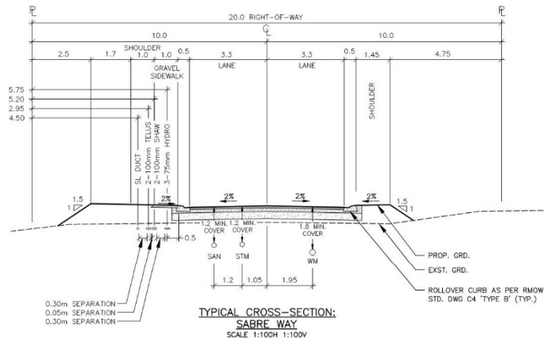
MASTER SERVICING PLAN

scales hor. 1:500 vert. -
file no. 4194
drawing no. S-1
rev -

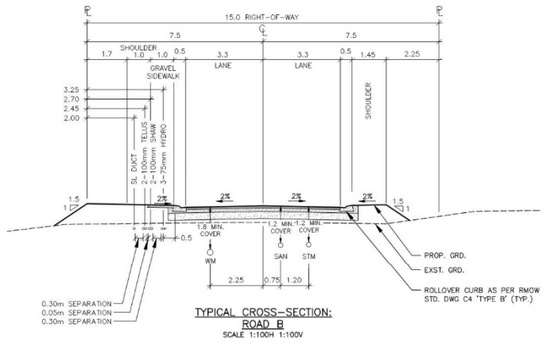

Sabre Way
Pemberton Farm Road East
Road B
Road B
PROP. GRD.
EXST. GRD.
Sabre Way
PVI STA = 0+256.20
PVI ELEV = 209.66
A.D. = 5.00%
K = 5.00
25.00m VC
PVI STA = 0+385.76
PVI ELEV = 217.43
A.D. = -5.00%
K = 7.00
35.00m VC
EXST. GRD.
PROP. GRD.
Road B
RIVERTOWN PROPERTIES
LOT C - PEMBERTON FARM ROAD EAST
PEMBERTON, BRITISH COLUMBIA
STEEP ROCKY TERRAIN SPECIALISTS
WEBSTER ENGINEERING LTD
PROFESSIONAL ENGINEERS
LAND DEVELOPMENT CONSULTANTS
EGBC PERMIT No. 1001444
212 - 828 HARBOURSIDE DRIVE, NORTH VANCOUVER, BC V7P 3R9 604-983-0458
designed by J.A.T.
drawn by S.T.
checked by H.K.G.
date JAN.20.22
PRELIMINARY ROADWORKS
scales hor: 1:500 vert: 1:100
file no. 4194
drawing no. RD-1
rev. -

ROAD STRUCTURE
40mm SURFACE LIFT ASPHALT PER MMCD (UPPER COURSE #2)
45mm BASE LIFT ASPHALT PER MMCD (LOWER COURSE #2)
100mm – 19mm MINUS CRUSHED GRANULAR BASE (CGB) COMPACTED TO 95% MMPDD
300mm – 75mm MINUS CRUSHED GRANULAR SUB-BASE (CGSB) COMPACTED TO 95% MMPDD
ROAD STRUCTURE PLACEMENT TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER

ALL DIMENSIONS ARE IN METRES



TYPICAL CROSS-SECTION:
SABRE WAY
SCALE 1:100H 1:100V



TYPICAL CROSS-SECTION:
ROAD B
SCALE 1:100H 1:100V

F:\4194\Civil\4194 Sunstone Pemberton\PRELIM\4194 PRELIM TYP-SECTION.dwg, 2022-07-04 3:59:40 PM, EBW

no.	date	revision	chk'd	no.	date	revision	chk'd

client: RIVERTOWN PROPERTIES

project: LOT C - PEMBERTON FARM ROAD EAST
PEMBERTON, BRITISH COLUMBIA

STEEP ROCKY TERRAIN SPECIALISTS
WEBSTER ENGINEERING LTD
PROFESSIONAL ENGINEERS
LAND DEVELOPMENT CONSULTANTS
212 - 828 HARBOURSIDE DRIVE, NORTH VANCOUVER, BC V7P 3R9 604-983-0458
EGBC PERMIT No. 1001444

approved

designed by J.A.T.
drawn by S.T.
checked by H.K.G.
date JAN.20.22

title: PRELIMINARY
TYPICAL CROSS - SECTIONS

scales hor: 1:100 vert: -
file no. 4194
drawing no. TYP-1
rev. -

Appendix B: Water Demand Calculations

Type: Domestic Water Demand - Lot C

Project:	Lot C - Pemberton Farm Road East	File:	4194
Location:	Pemberton, BC	Date	July 4, 2022 - V.1
Client:	Rivertown Properties	Prep'd By:	BJW / JAT

1) Bylaw Parameters

As per *Squamish Lillooet Regional District (SLRD) Subdivision and Development Servicing Bylaw No. 741, 2002*

Population Equivalents:		
Single Family (Conventional)	=	4 cap/lot
Multi Family	=	3 cap/unit
Single Family (with Secondary Suite)	=	7 cap/lot
Commercial	=	90 cap/ha

As per *Village of Pemberton Subdivision and Development Control Bylaw No. 677, 2011*

Per Capita Demands:		
Maximum Daily Demand (MDD) Unit Rate	=	910 L/cap/day
Peak Hour Demand (PHD) Unit Rate	=	1820 L/cap/day

2) Population

Single Family Lots (Conventional)		8 lots	
Population Equivalent	x	4 cap/lot	*(as above)*
Population	=	32 cap	
Single Family Lots (with Secondary Suite)		26 units	
Population Equivalent	x	7 cap/unit	*(as above)*
	=	182 cap	
Commercial Lot Area		0.17 ha	
Population Equivalent	x	90 cap/ha	*(as above)*
Population	=	15 cap	
Total Population	=	**229 cap**	

3) Maximum Daily Demand (MDD)

MDD Unit Rate		910 L/cap/day	*(as above)*
Population	x	229 cap	*(as above)*
MDD	=	208390 L/day	
MDD	=	**2.41 L/s**	

4) Peak Hour Demand (PHD)

PHD Unit Rate		1820 L/cap/day	*(as above)*
Population	x	229 cap	*(as above)*
PHD	=	416780 L/day	
PHD	=	**4.82 L/s**	

Appendix C: Sanitary Demand Calculations

SANITARY DESIGN FLOW

Lot C - Pemberton Farm Road East

Use MMCD Parameters

As per Village of Pemberton Subdivision and Development Bylaw No. 677, 2011 use MMCD methodology for design flow calculations. Use MMCD Design Guidelines 2014.

1) Population

Land Use:	Units	Pop. Equiv. (cap/unit)	
Single Family (Conventional)	8	4	(from SLRD Bylaw No. 741)
Multi Family	0	3	(from SLRD Bylaw No. 741)
Single Family (with Secondary Suite)	26	7	

	Area (ha)	Pop. Equiv. (cap/ha)	
Commercial	0.17	90	(per MMCD)

Population = **229 cap**

2) Average Dry Weather Flow (ADWF)

Average Daily Demand		410 L/cap/day	(VOP Bylaw No. 677)
Total Population	x	229 cap	(as above)
Average Dry Weather Flow		93890 L/day	
	=	**1.09 L/s**	

3) Peak Dry Weather Flow (PDWF)

PDWF = ADWF x Peaking Factor

Peaking Factor	=	3.2 / population in thousands$^{0.105}$	(MMCD)
	=	3.2 / $1^{0.105}$	
	=	3.20	
Average Dry Weather Flow		1.09 L/s	(as above)
Peaking Factor	x	3.20	(as above)
Peak Dry Weather Flow	=	**3.48 L/s**	

4) Design Flow = Peak Wet Weather Flow (PWWF)

PWWF = PDWF + Infiltration Allowance

Catchment Area		0.9 ha	
Unit Infiltration Rate	x	0.17 L/s/ha	
Infiltration Allowance	=	0.16 L/s	(VOP Bylaw No. 677, 2011)
Peak Dry Weather Flow		3.48 L/s	(as above)
Infiltration Allowance	+	0.16 L/s	(as above)
Peak Wet Weather Flow	=	**3.63 L/s**	

Appendix D: Fire Flow Calculations

1.) Parameters and Assumptions

- Material Type: Ordinary Construction
- Building considered to be Low Hazard Occupancy.
- Building is retrofitted with Fire Suppression Sprinklers.

2.) Calculation

- The following calculation is based on "Water Supply for Fire Protection" (1999) published by the Fire Underwriters Survey.

(a) Building Type and Size

C = 1.0 (Ordinary Construction)
A = 780 m²

(b) Initial Fire Flow

Finitial = 220CA^.5
= 6,144 L/min
= 6,000 L/min (Rounded to nearest 1000)

(c) Low content hazard, 25% credit

F(c) = 1,500 L/min $F_{revised}$ = 4,500 L/min

(d) Fire Suppression Sprinklers @ 50% credit

F(d) = 2,250 L/min

(e) Exposures

North	0.0%	
East	5.0%	
South	10.0%	
West	0.0%	
Total	15.0%	(Max 75%)

Maximum Charge:	
0 to 3m	*25%*
3 to 10m	*20%*
10 to 20m	*15%*
20 to 30m	*10%*
30 to 45m	*5%*

F(e) = 675 L/min

(f) Fire Demand

F = Frevised - F(d) + F(e) = 2,925 L/min for 1.25 hours
= 3,000 L/min (Rounded to nearest 1000)
= 50 L/s

FIRE FLOW = 50 L/s

1.) Parameters and Assumptions

- Material Type: Wood Frame Construction
- Building considered to be Low Hazard Occupancy.
- Building is retrofitted with Fire Suppression Sprinklers.

2.) Calculation

- The following calculation is based on "Water Supply for Fire Protection" (1999) published by the Fire Underwriters Survey.

(a) Building Type and Size

C = 1.5 (Wood Frame Construction)
A = 780 m²

(b) Initial Fire Flow

Finitial = 220CA^.5
= 9,216 L/min
= 9,000 L/min (Rounded to nearest 1000)

(c) Low content hazard, 25% credit

F(c) = 2,250 L/min $F_{revised}$ = 6,750 L/min

(d) Fire Suppression Sprinklers @ 50% credit

F(d) = 3,375 L/min

(e) Exposures

North	0.0%	
East	5.0%	
South	10.0%	
West	0.0%	
Total	15.0%	(Max 75%)

Maximum Charge:	
0 to 3m	*25%*
3 to 10m	*20%*
10 to 20m	*15%*
20 to 30m	*10%*
30 to 45m	*5%*

F(e) = 1,013 L/min

(f) Fire Demand

F = Frevised - F(d) + F(e) = 4,388 L/min for 1.5 hours
= 4,000 L/min (Rounded to nearest 1000)
= 67 L/s

FIRE FLOW = 67 L/s

1.) Parameters and Assumptions

- Material Type: Ordinary Construction
- Building considered to be Low Hazard Occupancy
- No Fire Suppression Sprinklers

2.) Calculation

- The following calculation is based on "Water Supply for Fire Protection" (1999) published by the Fire Underwriters Survey.

(a) Building Type and Size

C = 1.0 (Ordinary Construction)
A = 780 m²

(b) Initial Fire Flow

Finitial = 220CA^.5
= 6,144 L/min
= 6,000 L/min (Rounded to nearest 1000)

(c) Low content hazard, 25% credit

F(c) = 1,500 L/min $F_{revised}$ = 4,500 L/min

(d) Fire Suppression Sprinklers @ 0% credit

F(d) = 0 L/min

(e) Exposures

North	0.0%	
East	5.0%	
South	10.0%	
West	0.0%	
Total	15.0%	(Max 75%)

Maximum Charge:	
0 to 3m	*25%*
3 to 10m	*20%*
10 to 20m	*15%*
20 to 30m	*10%*
30 to 45m	*5%*

F(e) = 675 L/min

(f) Fire Demand

F = Frevised - F(d) + F(e) = 5,175 L/min for 1.75 hours
= 5,000 L/min (Rounded to nearest 1000)
= 83 L/s

FIRE FLOW = 83 L/s

1.) Parameters and Assumptions

- Material Type: Wood Frame Construction
- Building considered to be Low Hazard Occupancy.
- No Fire Suppression Sprinklers
- Building is divided into two sections with Fire Wall.

2.) Calculation

- The following calculation is based on "Water Supply for Fire Protection" (1999) published by the Fire Underwriters Survey.

(a) Building Type and Size

C = 1.5 (Wood Frame Construction)
A = 390 m² (Divided Floor Area)

(b) Initial Fire Flow

$F_{initial}$ = 220CA^.5
= 6,517 L/min
= 7,000 L/min (Rounded to nearest 1000)

(c) Low content hazard, 25% credit

F(c) = 1,750 L/min $F_{revised}$ = 5,250 L/min

(d) Fire Suppression Sprinklers @ 0% credit

F(d) = 0 L/min

(e) Exposures

North	0.0%	
East	5.0%	
South	10.0%	
West	0.0%	
Total	15.0%	(Max 75%)

Maximum Charge:	
0 to 3m	*25%*
3 to 10m	*20%*
10 to 20m	*15%*
20 to 30m	*10%*
30 to 45m	*5%*

F(e) = 788 L/min

(f) Fire Demand

F = $F_{revised}$ - F(d) + F(e) = 6,038 L/min for 2.0 hours
= 6,000 L/min (Rounded to nearest 1000)
= 100 L/s

FIRE FLOW = 100 L/s

1.) Parameters and Assumptions

- Material Type: Wood Frame Construction
- Building considered to be Low Hazard Occupancy
- No Fire Suppression Sprinklers

2.) Calculation

- The following calculation is based on "Water Supply for Fire Protection" (1999) published by the Fire Underwriters Survey.

(a) Building Type and Size

C = 1.5 (Wood Frame Construction)
A = 780 m²

(b) Initial Fire Flow

Finitial = 220CA^.5
= 9,216 L/min
= 9,000 L/min (Rounded to nearest 1000)

(c) Low content hazard, 25% credit

F(c) = 2,250 L/min $F_{revised}$ = 6,750 L/min

(d) Fire Suppression Sprinklers @ 0% credit

F(d) = 0 L/min

(e) Exposures

North	0.0%	
East	5.0%	
South	10.0%	
West	0.0%	
Total	15.0%	(Max 75%)

Maximum Charge:	
0 to 3m	*25%*
3 to 10m	*20%*
10 to 20m	*15%*
20 to 30m	*10%*
30 to 45m	*5%*

F(e) = 1,013 L/min

(f) Fire Demand

F = Frevised - F(d) + F(e) = 7,763 L/min for 2.0 hours
= 8,000 L/min (Rounded to nearest 1000)
= 133 L/s

FIRE FLOW	**=**	**133 L/s**

CASCADE ENVIRONMENTAL
RESOURCE GROUP LTD

Environmental Assessment

7362 Pemberton Farm Road East, Lot C, Pemberton, BC

Cascade Environmental Review

Prepared by:
Cascade Environmental Resource Group Ltd.
Unit 3 – 1005 Alpha Lake Road
Whistler, BC
V8E 0H5

Prepared for:
Michael Oord
Rivertown Properties Ltd.
c/o Cata Management

Project Number: 584-05-01
Date: February 2, 2022

Statement of Limitations

This Document was prepared by **Cascade Environmental Resource Group Ltd.** for **1309325 BC Ltd.** Should this report contain an error or omission then the liability, if any, of Cascade Environmental Resource Group Ltd. should be limited to the fee received by Cascade Environmental Resource Group Ltd. for the preparation of this Document. Recommendations contained in this report reflect Cascade Environmental Resource Group Ltd.'s judgment in light of information available at the time of study. The accuracy of information provided to Cascade Environmental Resource Group Ltd. is not guaranteed. Neither all nor part of the contents of this report should be used by any party, other than the client, without the express written consent of Cascade Environmental Resource Group Ltd. This report was prepared for the client for the client's own information and may not be used or relied upon by any other person unless that person is specifically named by Cascade Environmental Resource Group Ltd. as a beneficiary of the report, in which case the report may be used by the additional beneficiary Cascade Environmental Resource Group Ltd. has named. If such consent is granted, a surcharge may be rendered. The client agrees to maintain the confidentiality of the report and reasonably protect the report from distribution to any other person. If the client directly or indirectly causes the report to be distributed to any other person, the client shall indemnify, defend and hold Cascade Environmental Resource Group Ltd. harmless if any third party brings a claim against Cascade Environmental Resource Group Ltd. relating to the report.

This Document should not be construed to be:

- A Phase 1 - Environmental Site Assessment
- A Stage 1 – Preliminary Site Investigation (as per the Contaminated Sites Regulations of the Waste Mgt. Act)
- An Environmental Impact Assessment

Table of Contents

Maps

Tables

Photos

1. Introduction

Cascade Environmental Resource Group Ltd. (Cascade) was retained by Rivertown Properties Ltd. to conduct an Environmental Assessment (EA) of 7362 Pemberton Road E in Pemberton, BC. The subject site is cleared and does not contain any structures.

The purpose of an EA is to assist VOP staff in the evaluation of rezoning and/or development permit applications, providing information to be included on the Environmental Impact Assessment Process (VOP, 2019). This report reviews and assesses the biophysical conditions, ecosystem integrity, habitat potential, species present (plant and animal), and aquatic features on and adjacent to the subject site. It includes a discussion of the environmental regulatory framework that may affect development activities and provides alternatives for mitigation or resolution. Potential constraints are identified, and recommendations are provided to inform and facilitate the environmental review and approval process.

The assessment was conducted by Adrien Baudouin, M.Sc., R.P. Bio. and Margot Webster, B.Sc., R.P.Bio. Mapping support was provided by Nicola Church, B.A., M.Sc. (G.I.S.). All project team members have extensive experience in conducting environmental inventories, reviews and assessments.

1.1. Location

The subject property is located at 7362 Pemberton Farm Road E of Pemberton, BC (Map 1), and is legally described as LOT C DISTRICT LOT 211 LILLOOET DISTRICT PLAN EPP40824 (PID 030-164-532). The subject property covers an area of 2.43 ha.

1.2. VOP Bylaw Zoning

The site is currently zoned RES-1 (Resource Management) under the VOP zoning bylaw amendment No. 862, 2019 (VOP, 2019). The intent of this zone is to accommodates resource management uses on Crown Land.

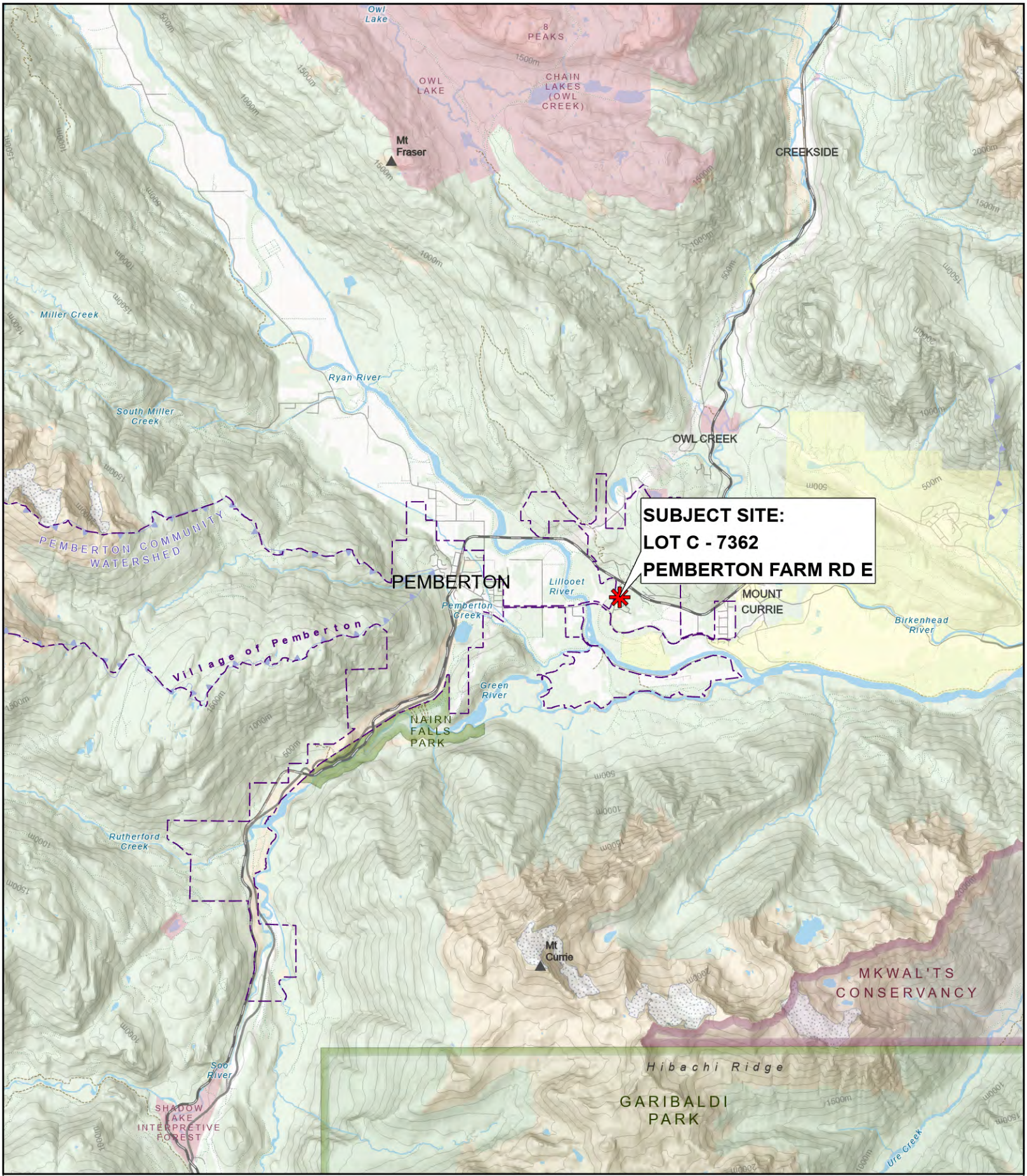
Principal Uses:

- Forestry
- Resource extraction

1.3. Methodology

The ecosystem units present on the subject site were determined using the map imagery analysis and study of photos obtained from October 2021. Relevant sections of the Terrestrial Ecosystem Mapping standards (RISC, 1998) were employed to identify and delineate the ecosystem units and define their distribution within the study area. Terrestrial Ecosystem (TE) codes for the subject polygon are displayed in Map 2. The ecosystem units were not investigated in the field due to the disturbed nature of the site and the snow cover due to the time of year.

Wildlife that potentially occur in the area's habitats are described using the BC Conservation Data Centre (CDC), a centralized BC government database of information on species and ecological communities (BC MOE, 2021). Presence or absence of valued ecosystem components were inferred based the terrestrial ecosystem unit and study of provided photographs.



GIS Cartographer: Nicola Church
Date: *1/17/2022*
CERG File #: 584-05-01
Projection: NAD 1983 UTM Zone 10N

CASCADE ENVIRONMENTAL
RESOURCE GROUP LTD

N

0 1 2 4 6 8
Kilometers

Map 1 - Location

Environmental Assessment
7362 Pemberton Farm Rd E
Pemberton
British Columbia

2. Existing Environmental Conditions

2.1. Physical Environment

2.1.1. Climate

The study area lies within the Eastern Pacific Ranges Ecosection, within the Coast Mountains Ecoprovince in southern British Columbia (Demarchi, 1996). This Ecosection is comprised of a rugged inland area that has a transitional climate, falling between the rain shadowed Southern Interior Ecoprovince to the east, and the high rainfall associated with the Southern Pacific Ranges Ecosection to the west (Demarchi, 1996). The climate is principally influenced by frontal systems moving in from the Pacific Ocean and over the Coast Mountains to the Interior (Green and Klinka 1994). The annual precipitation in Pemberton in the year 2021 was 1051.5 mm and average temperature is 9.2°C (Environment Canada, 2021). Climate normals are not available for the Pemberton station.

Pemberton weather is typically in between that of nearby weather stations for Whistler and Lillooet. The Lillooet Seton BCHPA weather station records an annual total precipitation of 349.0 mm, which mainly falls as rain. The total precipitation peaks in the month of November (44.4 mm average), and is least in the month of March (16.8 mm average). The mean annual temperature is recorded as 9.5°C. July is the warmest month, with a mean daily maximum temperature of 28.3°C, and a mean daily average temperature of 21.6°C. Conversely, January is the coolest month with a mean daily minimum temperature of -5.2°C, and a mean daily average temperature of -2.4°C (Environment Canada, 2021).

The meteorological records from the Whistler weather station record an average annual total precipitation of 1227.7 mm. The heaviest precipitation occurs in the month of November (192.1 mm average), while July is the driest month (44.7 mm average). Precipitation as snow can occur from October until May. The mean annual temperature is 6.7°C, with the highest mean monthly temperature occurring in August (16.5°C mean daily average; 24.0 mean daily maximum) and the lowest mean monthly temperature occurring in December (-2.8°C mean daily average; -5.4 mean daily minimum) (Environment Canada, 2021).

2.1.2. Geology

The subject lands are located within the Southern Coast Mountains. This complex was formed during the Mesozoic – Lower Cretaceous era, composed of marine sedimentary and volcanic rocks. This complex consists of peninsula and brokenback hill formations and is made up of conglomerate, sandstone, shale, crystal and lapilli tuff, tuffaceous sandstone, volcanic conglomerate, volcanic breccia, and andesitic to dacitic flows (Shiarizza and Church, 1997).

2.1.3.Geomorphology

The subject property exists within the major terrain area of the Lillooet River flood plain deposits which grade from gravels and sands near Meager Creek through sands and sandy loams to silt loams between Pemberton and Lillooet Lake. Soils originate from Pleistocene or Recent age unconsolidated fluvial and glacial deposits influenced by the local bedrock. The study area consists of bedrock from metavolcanic

and metasedimentary rocks with influences from unconsolidated materials and intrusive rocks (R.B. Kuurne, 1980).

2.1.4.Hydrology

There are no watercourses within the property boundary. The North Arm Channel is present west of the property, across Pemberton Farm Road East. This section of the North Arm Channel was historically fed by Lillooet River. This channel is also fed by Ivey Creek from the south slopes of Mount McKenzie (iBC Gov, 2022a).

The property lies within the Pemberton aquifer (No. 326) located throughout Pemberton valley bottom. This aquifer is composed of fluvial sand and gravel with moderate vulnerability, medium stream system, no quality concerns and has high productivity (BC Gov, 2022a). Well density throughout this aquifer is moderate. There are no wells on or adjacent to the property. There are two groundwater wells nearby, registered at Pinewood Drive, within the residential subdivision south of the property. Well tag No. 78225 is listed as unlicensed and abandoned. Well tag No. 78255 is owned by Windridge Properties.

2.2. Terrestrial Environment

2.2.1. Soils

The subject property is within the Lillooet River flood plain. Soils of the flood plains are mainly imperfectly drained Gleyed Reosols, or poorly to very poorly drained Rego or Rego Humic Gleysols with lesser amounts of poorly to very poorly drained Organic soils (R.B. Kuurne, 1980). The BC Soil Information Finder Tool displays three soil polygons occurring on the subject property and are described below.

The majority of the property is within Soil Polygon 1, which contains 70% undifferentiated bedrock and 30% Collister soil. The Collister soil is sandy loam, rapidly drained, Orthic Eutric Brunisol, and colluvial deposits. Collister soils are formed in shallow (less than 1 m) colluvial deposits derived from intrusive bedrock (BC MOE, 1980).

A small portion of the parcel at the northeast corner is part of Soil Polygon 2, which is compose of 70% Scobie soil and 30% Ranson soil. The Scobie soil is silt loam, poorly drained, with no coarse fragments, by fluvial deposition. Scobie soils are formed in sandy floodplain deposits of the Lillooet River. Scobie is acidic and poorly drained due to seasonally high ground water levels and occur on level sites. Ranson soil is Rego Gleysol, loamy sand, very poorly drained, no coarse fragments and fluvial deposition. Ranson soils developed on sandy floodplain deposits of the Lillooet River that have shallow organic material (less than 20 cm) and are periodically inundated by standing water (BC MOE, 1980).

A small area on the northwest corner of the parcel is part of Soil Polygon 3, composed of 100% Wolverine soil. The Wolverine soil is loam, imperfectly drained, has no coarse fragments, and is fluvial deposit. Wolverine soils have formed in sandy fluvial deposits on the Lillooet River floodplain. They are classified as Gleyed Regosol, are imperfectly drained due to fluctuating ground water levels and occur on level to very gentle slopes (BC MOE, 1980).

2.3. Vegetation

2.3.1. Vegetation Associations

A site investigation was not conducted for this environmental assessment due to snow cover for the time of year. Vegetation and terrestrial ecosystem analysis was conducted based on base map imagery and photos taken from October 2021. The property is entirely disturbed from site preparation activities. Vegetation has been cleared, bedrock has been blasted, and aggregate is stockpiled on the property. The existing vegetation on site is sparse (Structural Stage 1a) and is described below in Table 1. The successional status is Non-Vegetated (NV) as vegetation is less than 5% cover due to anthropogenic causes. Vegetation present on site includes plants listed in Table 2 and other unidentified invasive plant species.

Table 1: Vegetation Age Class Descriptions

Structural Stage Code	- Interpretation
1 a) Sparse b) Bryoid c) Lichen	- Community is in initial stages of primary and secondary development - Bryophytes and lichens often dominant - Times since disturbance typically <20 years but may be 50-100 + years in areas with little or no soil - Shrub and herb cover <20 % of total area - Tree cover < 10 % of total area
2a/b/c/d Herb	- Early successional stage or edaphic herb community - 2a forb dominated - 2b graminoid dominated, including grasses, sedges, reeds and rushes - 2c aquatic plant dominated, but not 2b plants - 2d dwarf shrub dominated, low growing woody shrubs
3a/b Shrub	- Shrub dominated communities maintained by environmental conditions or disturbance - 3a low shrub < 2 metres tall - 3b tall shrub < 10 metres tall - Tree cover <10 %
4 Pole/Sapling	- Densely stocked trees - Self-thinning not yet evident - Time since disturbance usually < 40 years
5 Young Forest	- Stocking density persists - Self-thinning not yet evident - Time since disturbance usually 40-80 years
6 Mature Forest	- Trees established after the last disturbance have matured - The second cycle of shade-tolerant trees may have become established - Time since disturbance generally 80–250 years
7 Old Forest	- Structurally complex stands composed mainly of shade-tolerant and regenerating tree species - Snags and coarse woody debris in all stages of decomposition typical - Time since disturbance >250 years
Modifiers: B – Broadleaf C – Coniferous M – Mixed	- Broadleaf stands composed of > 75 % broadleaf tree cover - Coniferous stands composed of > 75 % coniferous tree cover - Mixed stands neither coniferous nor broadleaf compose > 75 % of the total tree cover

Table 2: Vegetation present on the subject property

Common Name	Scientific Name	Native
Trees		
Douglas-fir	*Pseudotsuga menziesii*	Native
Paper birch	*Betula papyrifera*	Native
Black cottonwood	*Populus trichocarpa*	Native
Western redcedar	*Thuja plicata*	Native
Shrubs		
Red-osier dogwood	*Cornus sericea*.	Native
Thimbleberry	*Rubus parviflorus*	Native
Baldhip rose	*Rosa gymnocarpa*	Native
Forbs		
Grass	*Poaceae* sp.	Native
Common tansy	*Tanacetum vulgare*	Non-native
Common mullein	*Verbascum thapsus*	Non-native
Yarrow	*Achillea filipendulina*	Native

Biogeoclimatic Zone

The subject site is at the boundary of two separate Biogeoclimate zones. The south half of the property is within the Coastal Western Hemlock (CWH) Southern Dry Maritime (ds1) variant. CWHds1 occurs at lower elevations in drainages throughout the eastern Coast Mountains from upper Harrison Lake to the Homathko River. The climate is transitional between the coast and interior, characterized by warm, dry summers and moist, cool winters with moderate snowfall. Vegetation is typically dominated by Douglas-fir, western hemlock (*Tsuga heterophylla*), and to a lesser extent, western redcedar. The understorey contains poorly developed shrub and herb layers with falsebox, prince's pine, full Oregon-grape, and queen's cup. The moss layer is well developed (Green and Klinka, 1994).

The north half of the property is within the Interior Douglas-fir (IDF) Wet Warm (ww) – IDFww – Variant (Green & Klinka 1994). The IDFww zone has limited distribution in the Vancouver Forest Region. It is more commonly distributed along southwest-facing slopes. The elevational limits range from approximately 100 to 1200m. Typical vegetation is dominated by Douglas-fir with a smaller amount of western hemlock and western redcedar. The understorey is characterized by a well-developed shrub layer featuring a diverse mixture of species, including falsebox, saskatoon, tall and dull Oregon-grape, prince's pine, birch leaved spirea, baldhip rose, beaked hazelnut and western trumpet honeysuckle. The moss layer is dominated by step moss and red-stemmed feathermoss (Green & Klinka 1994).

Biogeoclimatic subzones and variants can be further classified into site series. The site series represent subtle changes in microclimate, soil conditions and associated vegetation. The different site series are further classified into Terrestrial Ecosystem Units based on the structural stage of the vegetation and the terrain of the site.

Terrestrial Ecosystem

TE codes for the polygon areas were identified based on the vegetation and soil attributes available from online resources and photographs from October 2021. The subject property was classified into one non-vegetated TE polygon, representing the development on the property (Map 2). The polygon TE codes are described in the following sections.

Polygon 1: 10ES1M

Polygon 1 - TEM Code ES (Exposed Soil)

POLYGON 1 TEM CODE DERIVATION			
Decile			
10	**ES** Exposed Soil	**1** Sparse	**M** Mixed

Polygon 1 consists of the site series **10ES1M** and comprises the entire subject property (Map 2). The topography features a level slope and soils consisting of bedrock and fluvial river deposits with a seasonally high water table. The site no longer experiences flooding due to local flood mitigations (iMapBC, 2022a).

Exposed Soil is a classification given to non-vegetated or sparsely vegetated units. These are areas not included in other definitions which include areas of recent disturbance from natural or anthropogenic causes where vegetation cover is less than 5%. The structural stage is 1 – Sparse and stand composition is mixed (M) (Province of BC, 1998).

Photo 1: Looking south at the subject property. Minimal 6vegetation on disturbed site. October 26, 2021.

Photo 2: Looking north at the subject property. Aggregate stockpile is on site with minimal shrub and herb vegetation. October 26, 2021.

2.3.2. Rare and Endangered Plant Species and Ecological Communities

In BC, there are two governing bodies involved with the ranking of species and/or ecological communities at risk. At the national level, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) provides advice in regards to the *Species at Risk Act* (SARA), and at the provincial level, the Conservation Data Centre (CDC) manages the BC Status List.

The Canadian government created SARA in 2002 to complement the Accord for the Protection of Species at Risk (a national effort to identify and protect threatened and endangered wildlife and their associated habitats across the country). COSEWIC is the scientific body responsible for assigning the status of species at risk under SARA.

A species that is listed as Endangered, Extirpated or Threatened is included on the legal list under Schedule 1 of SARA and is legally protected under SARA with federal measures to protect and recover these species in effect.

The BC CDC designates provincial red or blue list status to animal and plant species, and ecological communities of concerns (BC MOE, 2021). The red list includes indigenous species or subspecies considered to be endangered or threatened. Endangered species are facing imminent extirpation / extinction, whereas threatened groups or species are likely to become endangered if limiting factors are not reversed. The blue list includes taxa considered to be vulnerable because of characteristics that make them particularly sensitive to human activities or natural events. Although blue listed species are at risk, they are not considered endangered or threatened. Yellow listed species are all others not included on the red or blue lists and may include species which are declining, increasing, common, or uncommon. Table 3 to Table 6 below include the CDC listed (i.e. rare and threatened) species that have the potential to occur on the subject site; species designated as SARA Schedule 1 are also noted. Potentially occurring species are based on broad habitat preferences delineated by forest district and biogeoclimatic zone, and refined by habitat type available in the subject site. Forest and anthropogenic terrain were selected as habitat type to identify potential listed species for the purposes of this report.

Potential occurrences are then designated as unlikely or possible based upon species specific habitat requirements and an on-site assessment of those habitats. Note that a comprehensive evaluation of the study area for each species was not possible due to time constraints, seasonal migration patterns, and the transient nature of some species.

The CDC iMap (BC Gov, 2021b) does not list any rare and endangered plant species on the subject lot. A list of potentially occurring plant species at risk in the area of the subject site is provided below in Table 3. However, none of these species has the potential to occur on site due to specific habitat requirements.

Table 3: Plant species at risk potentially occurring on the site

Common Name *Scientific name*	**Status**		**Habitat Requirements**	**Potential Occurrence**
	BC List	**SARA Status**		
Tall bugbane *Actaea elata var. elata*	Red	1-Endangered	Commonly found in coniferous forest, deciduous forests, broadleaf forest, mixed forest. Favours seepage slopes and benches in mature forest situations.	**Unlikely** - Not known in area.
Alpine anemone *Anemone drummondii var. drummondii*	Blue	-	Habitat ranges from alpine/ tundra, grasslands, shrubs, meadows, and rock areas.	**Unlikely -** Not known in area.
Vancouver Island beggarticks *Bidens amplissima*	Blue	1-Special concern	Habitat preferences include beaches, estuaries, mudflats, intertidals, wetlands, marshes, and ditches. This wetland and shoreline species is tied to varying water levels.	**Unlikely -** No suitable habitat**.**
Mountain moonwort *Botrychium montanum*	Blue	-	Habitat requirements include coniferous forests. Commonly found in meadows and moist coniferous forests at upper montane to subalpine elevations.	**Unlikely – S**ite at lower elevation.
Roell's brotherella *Brotherella roelli*	Red	1-Endangered	Occurs in second-growth forests and forms on mats or rotting forest remains (stumps, logs, tree bases). Incident light is deemed important for this moss.	**Unlikely -** Not known in area.
Columbian carpet moss *Bryoerythrophyllum columbianum*	Blue	1-Special concern	On soil over rock; rock is usually acidic and soil is often sandy. Habitats include grassland steppe as well as ledges and bluffs near rivers.	**Unlikely** - No suitable habitat.
Two-edged water starwort *Callitriche heterophylla var. heterophylla*	Unknown	-	Habitat requirements include lakes, ponds, open waters.	**Unlikely -** No suitable habitat.
Jones' sedge *Carex jonesii*	Blue	-	Found roadside in ditches and in herbaceous riparian areas.	**Unlikely -** Not known in area.

Common Name *Scientific name*	**Status**		**Habitat Requirements**	**Potential Occurrence**
	BC List	**SARA Status**		
Cliff paintbrush *Castilleja rupicola*	Blue	1-Threatened	Habitat requirements include rock ledges and crevices in cliffs or on rocky slopes. Commonly found in 1030-2190 elevation. Found in alpine/ tundra zones.	**Unlikely -** Not known in area.
Miner's lettuce *Claytonia perfoliate ssp. intermontana*	Blue	-	Found in coniferous forest, grasslands, shrubs, sparsely vegetated shrubs, talus.	**Unlikely -** Not known in area.
British Columbia bugseed *Corispermum hookeri var. pseudodeclinatum*	Unknown	-	Unknown	**Unknown.**
Slender hawksbeard *Crepis atribarba ssp. atribarba*	Blue	-	Found in coniferous open forests, shrublands and grasslands. Tend to favour dry area.	**Unlikely -** Not known in area.
Slender spike-rush *Eleocharis nitida*	Blue	-	In peaty or sandy areas, wet soils and shallow waters. Found in wetlands and fens.	**Unlikely -** No suitable habitat.
Elmera *Elmera racemose*	Red	-	Habitat requirements include alpine/ tundra, and alpine grasslands.	**Unlikely -** No suitable habitat.
Banded cord-moss *Entosthodon fascicularis*	Blue	1-Special concern	Found in grasslands, shrublands, and Garry Oak maritime meadow. Tend to favour humid or damp areas.	**Unlikely -** No suitable habitat.
Silver hair moss *Fabronia pusilla*	Red	1-Endangered	Found on rock and can occasionally be found on the bases of trees. Little information is available.	**Unlikely -** Not known in area.
Poor pocket moss *Fissidens pauperculus*	Red	1-Endangered	Habitat requirements include bare, moist soil banks, often growing with Fissidens bryoides. Few details exist on the habitat of *Fissidens pauperculus.*	**Unlikely -** No suitable habitat.

Common Name *Scientific name*	**Status**		**Habitat Requirements**	**Potential Occurrence**
	BC List	**SARA Status**		
Leafy mitrewort *Mitellastra caulescens*	Blue	-	Commonly found in wet to moist meadows and woodlands in the lowland and montane zones. Habitat ranges: coniferous forests, moist/ wet forest, riparian area, rock,sparsely vegetated rock, cliffs, talus.	**Unlikely -** Not known in area.
Slender muhly *Muhlenbergia filiformis*	Blue	-	Occurs in dry coniferous forests and near springs (cold and hot).	**Unlikely -** Not known in area.
whitebark pine *Pinus albicaulis*	Blue	1-Endangered	Within montane forests and on thin, rocky, cold soils at or near timberline. 1300 - 3700 m	**Unlikely** - Subject site elevation is below 600 m
elegant Jacob's-ladder *Polemonium elegans*	Red	-	Rock, cliff and talus	**Unlikely** - Nearest record in Skagit Valley Provincial Park
Alaska holly fern *Polystichum setigerum*	Blue	-	Occurring in Coastal BC in moist to mesic shady forests, rock outcrops, and lava flows in the lowland and montane zones. Can also be found in riparian areas, rock, sparsely vegetated rocks, near streams and rivers.	**Unlikely -** No suitable habitat.
Stiff-leaved pondweed *Potamogeton strictifolius*	Blue	-	Found in lakes, ponds, and open waters.	**Unlikely -** No suitable habitat.
Leafless wintergreen *Pyrola aphylla*	Blue	-	Occurs coastal BC and lower mainland.	**Unlikely** - Nearest record on Texada Island
American bulrush *Schoenoplectus americanus*	Unknown	-	Found in unique habitats such as Alkali ponds, salt flats, and estruaries. Can also be ffound in wetlands, fens, marshes and swamps.	**Unlikely -** No suitable habitat.
Lance-leaved figwort *Scrophularia lanceolata*	Blue	-	Habitat requirements include coniferous forest, grasslands, shrublands, and meadows.	**Unlikely -** Not known in area.
Purple-marked yellow violet *Viola purpurea var. venosa*	Blue	-	Found in alpine, rock, sparsely vegetated rock, talus and tundra habitats.	**Unlikely -** No suitable habitat.

Source: BC Ecosystems Explorer, Ministry of Environment.

2.3.3. Rare and Endangered Ecological Communities

The term "ecological" is a direct reference to the integration of biological components with non-biological features such as soil, landforms, climate and disturbance factors. The term "community" reflects the interactions of living organisms (plants, animals, fungi, bacteria, etc.), and the relationships that exists between the living and non-living components of the community. Currently, the most common ecological communities that are known in BC are based on the Vegetation Classification component of the Ministry of Forests and Range Biogeoclimatic Ecosystem Classification, which focuses on the terrestrial plant associations of BC's native plants.

Large tracts of undisturbed plant communities are considered ecologically more important than disturbed/fragmented or second growth communities. Vegetation on the subject site consists mostly of barren disturbed ground, as the subject lands have been disturbed by anthropogenic activities. Existing vegetation on site consists of low shrubs, herbs and invasive species in low densities, particularly at the east and west property boundaries. Ecological communities of concern are described in a climax state. Due to the lack of vegetation and disturbed state of the property, it is not possible for any of these communities to occur on the subject property.

2.4. Wildlife and Wildlife Habitats

The subject site is unlikely to provide high or moderate quality wildlife habitat due to the absence of forest, aquatic habitat, native vegetation, available forage, coarse woody debris and wildlife trees. Wildlife may be present on the site when moving between habitats due to the site's proximity to the North Arm Channel (west), south facing lower McKenzie Ridge slopes (north), rocky slope (south), and open grass areas (east, northeast).

2.4.1.Mammals

Various mammals are common in the area and are likely to be present on the property when moving between habitats: black bears may move between high elevation habitat (north) and low elevation or aquatic feeding areas; black-tailed deer utilize lower slopes of McKenzie ridge in the winter; other potentially occurring mammals include the northern flying squirrel (*Glaucomys sabrinus*), bushy-tailed woodrat (*Neotoma cinereal*), ermine (*Mustela erminea*), deer mouse (*Peromyscus maniculatus*), coyote (*Canis latrans*), wolf (*Canis lupus*), cougar (*Puma concolor*), bobcat (*Lynx rufus*), raccoon (*Procyon lotor*), western long-eared bat (*Myotis evotis*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), snowshoe hare (*Lepus americanus*), pine marten (*Martes americana*), pika (*Ochotona princeps*), common shrew (*Sorex cinereus*), dusky shrew (*Sorex monticolus*) and yellow-pine chipmunk (*Tamias amoenus*).

2.4.2. Birds

The site is mostly barren of vegetation and is unlikely to provide suitable nesting habitat. Limited grass, shrubs and adjacent properties may provide foraging for birds that inhabit the Pemberton area. Birds that may occur on the site are listed in Table 5.

Table 4: Bird species potential occurring on the subject site.

Common Name	Scientific Name
Northern goshawk	*Accipiter gentillis atricapillus*
Western grebe	*Aechmophorus occidentalis*
White-throated swift	*Aeronautes sexatalis*
Grasshopper sparrow	Ammodramus savannarum
Short-eared owl	*Asio flammeus*
Burrowing owl	*Athene cunicularia*
Upland sandpiper	*Bartramia longicauda*
American bittern	*Botaurus lentiginosus*
Marbled murrelet	*Brachyramphus marmoratus*
Brant	*Branta bernicla*
Rough-legged hawk	*Buteo lagopus*
Green heron	*Butorides virescens*
Smith's longspur	*Calcarius pictus*
Red knot	*Calidris canutus*
Canada warbler	*Cardellina canadensis*
Lark sparrow	*Chondestes grammacus*
Common nighthawk	*Chordeiles minor*
Evening grosbeak	*Coccothraustes*
Yellow-billed cuckoo	*Coccyzus americanus*
Olive-sided flycatcher	*Contopus cooperi*
Black swift	*Cypseloides niger*
Bobolink	*Dolichonyx oryzivorus*
Horned lark, strigata subspecies	*Eremophila alpestris strigata*
Rusty blackbird	*Euphagus carolinus*
Prairie falcon	*Falco mexicanus*
Peregrine falcon	*Falco peregrinus*
Peregrine falcon *anatum subspecies*	*Falco peregrinus anatum*
Gyrfalcon	*Falco rusticolus*
Tufted puffin	*Fratercula cirrhata*
Northern fulmar	*Fulmarus glacialis*
Barn swallow	*Hirundo rustica*

Common Name	Scientific Name
Caspian tern	*Hydroprogne caspia*
Yellow-breasted chat	*Icteria virens*
California gull	*Larus californicus*
Short billed dowitcher	*Limnodromus griseus*
Hudsonian godwit	*Limosa haemastica*
Western screech owl	*Megascops kennicottii*
Lewis's woodpecker	*Melanerpes lewis*
Black scoter	*Melanitta americana*
Surf scoter	*Melanitta perspicillata*
Long-billed curlew	*Numenius americanus*
Black-crowned night-heron	*Nycticorax nycticorax*
Sage thrasher	*Oreoscoptes montanus*
Band-tailed pigeon	*Patagioenas fasciata*
American white pelican	*Pelecanus erythrorhynchos*
Double crested cormorant	*Phalacrocorax auratus*
Red necked phalarope	*Phalaropus lobatus*
American golden plover	*Pluviallis dominca*
Eared grebe	*Podiceps nigricollis*
Purple martin	*Progne subis*
Cassin's auklet	*Ptychoramphus aleuticus*
American avocet	*Recurvirostra americana*
Black-throated green warbler	*Setophaga virens*
Williamson's sapsucker	*Sphyrapicus thyroideus*
Williamson's sapsucker, thyroideus subspecies	*Sphyrapicus thyroideus thyroideus*
Forster's tern	*Sterna forsteri*
Spotted owl	*Strix occidentalis*
Ancient murrelet	*Synthliboramphus antiquus*
Wandering tattler	*Tringa incana*
Barn owl	*Tyto alba*
Common murre	*Uria aalge*

2.4.3. Amphibians and Reptiles

Two species of snake may potentially occur on site: the valley gartersnake (*Thamnophis sirtalis fitchi)* and the wandering gartersnake (*Thamnophis elegans vagrans*). The northern alligator lizard (*Elgaria coerulea*) also has the potential to occur on the subject site near the south rock slope.

Photo 3: Looking south at the rocky slope adjacent the residential subdivision at the southeast corner of the property. October 26, 2021.

Photo 4: Looking southwest on the property at the rocky slope along its southern border. October 26, 2021.

2.4.4. Wildlife Species at Risk

A search was conducted for potentially occurring wildlife species at-risk through the BC Conservation Data Centre on January 18, 2022 based on the site's biogeoclimatic zone and geographic location. Potentially occurring wildlife species are provided in Table 6. Potential occurrence at the subject site is determined based on specific habitat requirements and population distribution.

From the search results, one wildlife species at-risk has the potential to occur on site: common nighthawk (*Chordeiles minor*).

Table 5: Wildlife Species at Risk Potentially Occurring on the Subject Site

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Northern goshawk *Accipiter gentilis atricapillus*	Blue	-	Breeds throughout most of mainland BC east of the Coast Ranges.	**Unlikely** – Site within coast mountains.
Northern goshawk *Accipiter gentilis laingi*	Red	Threatened	Coastal forests of BC, especially central and northern coastal islands. Closest known occurrence is the Gulf Islands	**Unlikely** – No suitable forest habitat on site.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Green sturgeon *Acipenser medirostris*	Blue	Special Concern	Found in estuaries, lower reaches of large rivers, and in salt or brackish water off river mouths.	**None** – No fish habitat on site.
White sturgeon *Acipenser transmontanus*	-	Endangered	In British Columbia they are restricted to the Fraser, Columbia and Kootenay River systems and in Harrison and Pitt Lakes.	**None** – No fish habitat on site.
Western grebe *Aechmophorus occidentalis*	Red	Special Concern	Marshes, lakes, and bays; in migration and winter also sheltered seacoasts, less frequently along rivers (Subtropical and Temperate zones).	**Unlikely** – No suitable aquatic habitat on site.
White-throated swift *Aeronautes saxatalis*	Blue	-	Primarily mountainous country, especially near cliffs and canyons where breeding occurs; forages over forest and open situations in a variety of habitats (Subtropical and Temperate zones).	**Unlikely** – No cliffs or canyons on subject site.
Grasshopper sparrow *Ammodramus savannarum*	Red	-	Prefer grasslands of intermediate height and are often associated with clumped vegetation interspersed with patches of bare ground. No known occurrences near site.	**Unlikely** – No grasslands on site.
Nelson's sparrow *Ammospiza nelsoni*	Red	-	Range in BC is from Dawson Creek and northwards.	**Unlikely** – Outside of range.
Western toad *Anaxyrus boreas*	Yellow	Special Concern	Various upland habitats around ponds, lakes, reservoirs, and slow-moving rivers and streams.	**Unlikely** - No aquatic habitat on site.
Mountain beaver *Aplodontia rufa*	Yellow	Special Concern	Mountain Beaver is found in extreme southwestern British Columbia in the Cascade Mountains, and south of the Fraser River.	**Unlikely** – Not present in BC Coast Mountains.
Mormon Metalmark *Apodemia mormo*	Red	Endangered	In BC occurs only in south Okanagan valley.	**Unlikely** – Outside of range.
Great blue heron *Aredea herodias fannini*	Blue	Special Concern	Aquatic areas <0.5 m deep, fish bearing streams and rivers, undisturbed nesting in tall trees. Closest known occurrence is Lost Lake.	**Unlikely** - No aquatic areas on site.
Emma's dancer *Argia emma*	Blue	-	Aquatic and riparian habitat.	**Unlikely** – No suitable habitat on site.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Vivid dancer *Argia vivida*	Blue	Special Concern	Cold springs and warm springs.	**Unlikely** – No suitable habitat on site.
Coastal tailed frog *Ascaphus truei*	Yellow	Special Concern	Although they may be found in fish-bearing streams, tailed frogs typically occur in non-fish bearing, permanent, cold, fast flowing mountain streams that flow over rocky substrates.	**Unlikely** – No suitable aquatic habitat.
Short-eared owl *Asio flammeus*	Blue	Special Concern	In general, any area that is large enough, has low vegetation with some dry upland for nesting, and that supports suitable prey may be considered potential breeding habitat, although many will not have breeding short-eared owls. Nearby water is a requirement for nesting habitat.	**Unlikely –** No suitable grasslands or fields on site.
Burrowing owl *Athene cunicularia*	Red	Endangered	Habitat includes open grasslands, especially prairie, plains, and savanna, sometimes other open areas such as vacant lots near human habitation or airports. This owl spends much time on the ground or on low perches such as fence posts or dirt mounds.	**Unlikely** – Site is not open grassland.
Upland sandpiper *Bartramia longicauda*	Red	-	Likely restricted to a few suitable areas within the Peace River lowlands near Ft. St. John and the Cariboo-Chilcotin grasslands near Riske Creek and at least one area in the East Kootenays north of Cranbrook.	**Unlikely** – Not within range.
American bittern *Botaurus lentiginosus*	Blue	-	Breeding occurs in lowland marshes in lakes, ponds, and rivers in south and central interior British Columbia and in the lower Fraser Valley.	**Unlikely** – No suitable aquatic habitat on site.
Marbled murrelet *Brachyramphus marmoratus*	Blue	Threatened	Coastal areas within 2 km of shore, occasionally on rivers and lakes within 20 km of the ocean in old growth forest. Closest known occurrence is Toba River.	**Unlikely -** No old growth forest or shore.
Brant *Branta bernicla*	Blue	-	Restricted to coastal B.C., mainly Vancouver Island, Queen Charlotte Islands, and the Fraser River delta.	**Unlikely** – Pemberton is not coastal.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Rough-legged hawk *Buteo lagopus*	Blue	-	Grasslands, field, marshes, sagebrush flats, and open cultivated areas; sometimes rat-infested garbage dumps. Nests on cliffs (typically) or in trees in arctic and subarctic, in tundra, mountain sides, forests with plenty of open ground. Winters in low valleys of southern BC.	**Unlikely** – Site does not contain fields or grasslands.
Green heron *Butorides virescens*	Blue	-	Aquatic areas, especially slow moving, shallow waters with good riparian cover.	**None** – No fish habitat on site.
Smith's longspur *Calcarius pictus*	Blue	-	BREEDING: Dry, grassy, and hummocky tundra (AOU 1983). NON-BREEDING: in migration and winter in grassy and weedy areas, fields, prairies and airports.	**Unlikely** – No suitable grass habitat on site.
Red knot *Calidris canutus*	Red	Threatened/ Endangered	Primarily seacoasts on tidal flats and beaches, less frequently in marshes and flooded fields. On sandy or pebbly beaches, especially at river mouths; feeds on mudflats, loafs and sleeps on Salinas and salt-pond dikes. Nests on ground in barren or stony tundra and in well-vegetated moist tundra.	**Unlikely** – No suitable aquatic habitat on site.
Immaculate green hairstreak *Callophrys affinis*	Blue	-	Grassland, meadows, shrub, sparsely vegetated rock. Host plant to larvae is sulphurflower buckwheat.	**Unlikely** – No suitable host plant.
Western pine elfin *Callophrys eryphon sheltonensis*	Blue	-	Grassland, wetland, bog at alpine or tree line.	**Unlikely** – No suitable habitat.
Johnson's hairstreak *Callophrys johnsoni*	Red	-	Older coniferous forests, particularly with western hemlock that are infected by dwarf mistletoe.	**Unlikely** – No forest habitat.
Canada warbler *Cardellina canadensis*	Blue	Threatened	Known to reside in Dawson Creek and northwards.	**Unlikely** – Site is not within range.
Western thorn *Carychium occidentale*	Blue	-	Low elevation forests in rich, relatively undisturbed leaf litter, usually dominated by Bigleaf maple.	**Unlikely** – No forest or leaf litter on site.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Salish sucker *Catostomus* sp. 4	Red	Threatened	Salish Sucker has a small, restricted range in the lower Fraser River Valley in southwest BC. This fish faces significant threats including severe hypoxia and habitat degradation.	**None** – No fish habitat on site.
Common wood-nymph *Cercyonis pegala incana*	Red	-	Pasture, fields, forests, grassland, sparsely vegetated rock.	**Unlikely** – Site is not vegetated.
Roosevelt elk *Cervus elaphus roosevelti*	Blue	-	Roosevelt Elk are restricted in British Columbia (and Canada) to Vancouver Island and portions of the southwestern mainland. A small remnant population of Roosevelt elk occur in the Phillips/Apple River area on the mainland coast.	**Unlikely** – Range restricted to mainland coast and Vancouver Island.
Northern rubber boa *Charina bottae*	Yellow	Special Concern	Rubber Boas are most often associated with low elevation mountainsides. Here they can take advantage of warm aspect slopes	**Unlikely** – Site is disturbed and barren.
Hoffman's checkerspot *Chlosyne hoffmanni*	Red	-	Range is from Manning provincial park and southwards through the Cascades.	**Unlikely** – Not within range.
Lark sparrow *Chondestes grammacus*	Blue	-	Breeding range extends from extreme southern British Columbia and eastern Washington. Thrives in grazed habitats, disturbed areas, and ecotones. Agriculture may increase edge habitat.	**Unlikely** – Only occurs in the interior of BC.
Common nighthawk *Chordeiles minor*	Yellow	Threatened	Mountains and plains in open coniferous forest, savanna, grassland, and towns. Nesting occurs on the ground on a bare site in an open area.	**Possible** – May occur at the east side of the site where there is less traffic.
Painted turtle *Chrysemys picta*	-	Endangered/ Special Concern	Ponds, marshes, small lakes, ditches, and sluggish streams, usually with muddy bottoms and considerable growth of aquatic plants.	**Unlikely –** No suitable aquatic habitat on site.
Painted turtle (Rocky Mountain Population) *Chrysemys picta* pop. 2	Blue	Special Concern	The Rocky Mountain Population is confined to lower elevations and valley bottoms in the southeastern portion of the province, east of the Cascade Mountains and north to Williams Lake.	**Unlikely –** Outside of range.
Hairy-necked tiger beetle *Cicindela hirticollis*	Blue	-	Dunes, beach.	**Unlikely** – No suitable habitat.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Evening grosbeak *Coccothraustes vespertinus*	Yellow	Special Concern	Coniferous (primarily spruce and fir) and mixed coniferous- decidouous woodland, second growth, and occasionally parks; in migration and winter in a variety of forest and woodland habitats, and around human habitation.	**Unlikely** – No forest on site.
Yellow-billed cuckoo *Coccyzus americanus*	Red	-	Associated with open, brushy deciduous woodlands, riparian groves, overgrown orchards, woodlots, parks, and abandoned farmland, coastal alder groves, forest edges, wooded suburbs, and orchards.	**Unlikely** – Not observed in Pemberton area and little deciduous forest on site.
North American racer *Coluber constrictor*	Blue	Special Concern	In the NW, North American Racers generally absent from dense forest/high mountains. Racers are restricted to the dry southern interior grasslands of the southern Columbia, Okanagan/Similkameen, Kettle, Thompson, Nicola and the middle Fraser drainages.	**Unlikely** – Not known in the area.
Sharp-tailed snake *Contia tenuis*	Red	Endangered	In British Columbia, the Sharp-tailed Snake occurs in low-elevation woodland habitats dominated by Douglas-fir, arbutus and/or Garry oak. The snakes are often found in small openings on talus rocky outcrops and on warm hillsides	**Unlikely** – Site is highly disturbed with no habitat complexity.
Olive-sided flycatcher *Contopus cooperi*	Blue	Threatened	Mixed coniferous-deciduous forest with old growth snags along forest edges. Known to occur in the Pemberton area.	**Unlikely** – No forest habitat on site.
Townsend's big-eared bat *Corynorhinus townsendiii*	Blue	-	On the West Coast, Townsend's big-eared bats are found regularly in forested regions and buildings, and in areas with a mosaic of woodland, grassland, and/or shrubland. In BC, it inhabits Vancouver Island, the Gulf Islands and the Vancouver area; and in the interior, it has been found as far north as Williams Lake and east to Creston.	**Unlikely** – No suitable habitat although may forage in general open area.
Coastrange sculpin Cultus population *Cottus aleuticus* pop. 1	Red	Threatened	Cultus Pygmy Sculpin is restricted to a single lake in southwestern B.C., which makes it highly vulnerable to any ecological change.	**None** – No fish habitat on site.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Tundra swan *Cygnus columbianus*	Blue	-	Winter range is restricted to a few localities in southernmost British Columbia; migrants are widespread. Migrations along coast and Peace River country. Winter habitat along South Thompson River and Shuswap Lake.	**Unlikely** – Outside of range.
Black swift *Cypseloides niger*	Blue	Endangered	Nests behind or next to waterfalls and wet cliffs, on sea cliffs and in sea caves. Along BC coast, Vancouver Island, southern BC and interior.	**Unlikely** – No suitable nest habitat.
Monarch *Danaus plexippus*	Red	Endangered	Occur throughout the dry BC interior and along the pacific coast.	**Unlikely** – Do not occur through coast mountains.
Coastal giant salamander *Dicamptodon tenebrosus*	Blue	Threatened	In BC, this species is found in southwestern B.C., extending from the west side of Vedder Mountain to the slopes east of Chilliwack Lake.	**Unlikely** – Site is outside of species' range.
Bobolink *Dolichonyx oryzivorus*	Blue	Threatened	Breeding is locally distributed in the main valley bottoms in the southern and central interior, east to Creston. This species generally selects habitat with moderate to tall vegetation, moderate to dense vegetation, and moderately deep litter, lacking woody vegetation.	**Unlikely** – No suitable grass or agriculture habitat.
Alkali bluet *Enallagma clausum*	Blue	-	Lake, pond, open water.	**Unlikely** – No aquatic habitat.
Silver-spotted skipper *Epargyrreus clarus californicus*	Blue	-	Occurs along southern BC coast.	**Unlikely** – Not within range.
Horned lark *Eremophila alpestris strigata*	Red	Endangered	Occurs in lower mainland along coast and in southern Kootenays.	**Unlikely** – Not within range.
Propertius duskywing *Erynnis propertius*	Red	-	Open oak or mixed woodlands with the foodplant oaks.	**Unlikely** – No oaks or forest.
Western pondhawk *Erythemis collocata*	Blue	-	Lakes, pond, open water, wetland, marsh.	**Unlikely** – No aquatic habitat on site.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Rusty blackbird *Euphagus carolinus*	Blue	Special Concern	Breeds in habitats that are dominated by coniferous forest with wetlands nearby including bogs, marshes and beaver ponds. During the winter, it is found in wet woodlands, swamps, and pond edges and often forages in agricultural lands.	**Unlikely** – No suitable aquatic habitat on site.
Dun skipper *Euphyes vestris*	Blue	Threatened	Grassland, shrub, meadow.	**Unlikely** – No suitable forage vegetation.
Prairie falcon *Falco mexicanus*	Red	-	The provincial population was down to one known active nesting site south of Williams Lake. The species has been extirpated from its historic core area of the province, the Okanagan Valley, for almost a decade. Bred in cliff habitats.	**Unlikely**- Not known to occur in Pemberton area.
Peregrine falcon subsp. *Falco peregrinus anatum*	-	Special Concern	The Anatum (*F.p. anatum*) Peregrine Falcon occurs in the southern interior, and although taxonomy still is uncertain, it is thought to be the subspecies that inhabits the Fraser River valley and Gulf Islands. Anatum Peregrine Falcons typically nest on rock cliffs above lakes or river valleys where abundant prey is nearby.	**Unlikely** – No suitable cliff habitat on site.
Peregrine falcon *Falco peregrinus*	Red	Special Concern	Cliff edges near water, interior rivers and wetlands.	**Unlikely** – No suitable cliff habitat on site.
Gyrfalcon *Falco rusticolus*	Blue	-	Usually nests on cliff ledges, ideally beneath sheltering overhang; sometimes nests in trees or on man-made structures.	**Unlikely** – No cliff habitat on site.
Tufted puffin *Fratercula cirrhata*	Blue	-	Coastal sea bird.	**Unlikely** – Site not close to ocean.
Northern fulmar *Fulmarus glacialis*	Red	-	Coastal sea bird.	**Unlikely** – Site not close to ocean.
Prairie fossaria *Galba bulimoides*	Blue	-	Known populations in southern BC include Vancouver Island and Kamloops. Lives in perennial-water habitats and vernal habitats.	**Unlikely** – No suitable aquatic habitat.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Dusky fossaria *Galba dalli*	Blue	-	Lakes, ponds, rivers and marshes across southern BC.	**Unlikely** – No suitable aquatic habitat.
Golden fossaria *Galba obrussa*	Blue	-	Known occurrences from north of Prince George in a straight line south to the Okanagan.	**Unlikely** – Not within range.
Pygmy fossaria *Galba parva*	Blue	-	In BC recorded only northeast of Prince George.	**Unlikely** – Not within range.
Wolverine *Gulo gulo*	Blue	Special Concern	A range of habitat types from valley bottoms to alpine meadows, strongly associated with the presence of large ungulate prey.	**Unlikely** - Site close to human activity and development.
Wolverine subsp. *Gulo gulo luscus*	Blue	Special Concern	A range of habitat types from valley bottoms to alpine meadows, strongly associated with the presence of large ungulate prey.	**Unlikely** - Site close to human activity and development.
Star gyro *Gyraulus crista*	Blue	-	Selective habitats of eutrophic ponds, lakes, slow moving streams and seasonal ponds in central and eastern BC.	**Unlikely** – No suitable aquatic habitat.
Northern abalone *Haliotis kamtschatkana*	Red	Endangered	Kelp beds along outer well-exposed coasts.	**Unlikely** – Site is not coastal.
Pale jumping slug *Hemphillia camelus*	Blue	-	Dry to moist coniferous forests, on and around mossy stumps, rocks and logs, also in leaf litter.	**Unlikely** – No suitable forest habitat.
Western branded skipper *Hesperia Colorado oregonia*	Red	-	Few occurrences on Vancouver Island and Gulf Islands. Gary oak ad coastal sand ecosystems.	**Unlikely** – No suitable habitat and not within range.
Nevada skipper *Hesperia nevada*	Blue	-	Observed as a single flying specimen through open grassland areas. Larval foodplant is bunchgrass.	**Unlikely** – No suitable vegetation on site.
Barn swallow *Hirundo rustica*	Blue	Threatened	Open areas, fields, ponds with vertical nesting habitat, especially buildings. Known to occur throughout the Pemberton area.	**Unlikely** – No suitable nest habitat on site.
Caspian tern *Hydroprogne caspia*	Blue	-	Seacoasts, bays, estuaries, lakes, marshes, and rivers.	**Unlikely** – No suitable aquatic habitat.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Yellow-breasted chat *Icteria virens*	Red	Endangered	The Yellow-breasted Chat breeds in the extreme southern portions of the province in the Okanagan and Similkameen valleys.	**Unlikely** – Not within species' range.
California gull *Larus californicus*	Blue	-	Seacoasts, bays, estuaries, mudflats, marshes, irrigated fields, lakes, ponds, dumps, cities, and agricultural lands.	**Unlikely** - No suitable habitat on site.
Snowshoe hare subsp. *Lepus americanus washintonii*	Red	-	The *washingtonii* subspecies hare population occurs at Burnaby Lake Regional Park.	**Unlikely** – Site is not within range.
White-tailed jackrabbit *Lepus townsendii*	Red	-	Primarily Great Basin and northern Great Plains, from Sierra Nevada east to Mississippi River, and from south-central Canada (south-central British Columbia).	**Unlikely** – Site not within range.
Viceroy *Limenitis archippus*	Red	-	Any habitat with willows or small aspens as the main larval foodplant. Prairies, wetlands, riparian, watercourses.	**Unlikely** – No suitable vegetation or aquatic habitat.
Short-billed dowitcher *Limnodromus griseus*	Blue	-	Mudflats, estuaries, shallow marshes, pools, ponds, flooded fields and sandy beaches. Prefers shallow salt water with soft muddy bottom, but visits various wetlands during migration.	**Unlikely** - No suitable aquatic habitat.
Hudsonian godwit *Limosa haemastica*	Red	Threatened	Nests on grassy tundra, near water. Bogs and marshes. Near coast or river. Nests on the ground in a sparsely lined depression, in or under edge of prostrate dwarf birch or on dry top of hummock in sedge marsh	**Unlikely** - No suitable aquatic habitat.
Western river cruiser *Macromia magnifica*	Blue	-	Lakes, ponds, open water, streams.	**Unlikely** – No suitable aquatic habitat.
Western screech-owl *Megascops kennicottii*	-	Threatened	Widespread distribution along most of the coast, much rarer in the southern interior. Population threatened in the long-term by large-scale forest harvesting at low elevations.	**Unlikely** – No forest habitat on site.
Western screech-owl (subsp.) *Megascops kennicottii kennicotti*	Blue	Threatened	Likely restricted to mature lowland coniferous and mixed forests below 600 m elevation.	**Unlikely** – No forest habitat on site.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Lewis's woodpecker *Melanerpes lewis*	Blue	Threatened	Breeds primarily in open forested areas at low elevations where an abundance of large snags provides suitable nesting sites and an open, grassy understory supports high populations of flying insects. Found east of coast mountains.	**Unlikely** – No snags or forest on site.
Black scoter *Melanitta americana*	Blue	-	Along coast from southern Vancouver Island and sw mainland coast, north to Queen Charlotte Islands, Prince Rupert, and Chatham sound region. Few records in interior: southern interior ecoprovince, 108 Mile House, Moose Lake (Mt. Robson), Spatsizi River, Fern Lake (Kwadacha Wilderness Park), Beatton Park.	**Unlikely** – Not known to occur in Pemberton area.
Surf scoter *Melanitta perspicillata*	Blue	-	Primarily marine littoral areas, less frequently in bays or on freshwater lakes and rivers	**Unlikely** - No suitable aquatic habitat.
Long-tailed weasel subsp. *Mustela frenata altifrontalis*	Red	-	Found in a wide variety of habitats, usually near water. Favored habitats include brushland and open woodlands, field edges, riparian grasslands, swamps, and marshes.	**Unlikely** – Unknown range throughout BC, limited water on site.
Southern red-backed vole subsp. *Myodes gapperi occidentalis*	Red	-	Prefers cool, mesic deciduous, coniferous, or mixed forests, especially areas with large amount of ground cover. Most of forested Canada (northern British Columbia to Labrador) south through the Rocky Mountains to central New Mexico.	**Unlikely** – Not known within coastal mountains.
Little brown myotis *Myotis lucifugus*	Yellow	Endangered	Hibernates in caves and abandoned mines. Does not appear to hibernate in buildings. Summer roosts are buildings, tree cavities, rock crevices, caves and under tree bark. Hunts insects in open areas.	**Unlikely** – No roosting habitat and limited food availability.
Double-crested cormorant *Nannopterum auritum*	Blue	-	Lakes, ponds, rivers, lagoons, swamps, coastal bays, marine islands, and seacoasts; usually within sight of land. Nests on the ground or in trees in freshwater situations, and on coastal cliffs.	**Unlikely** – No suitable habitat.
Long-billed curlew *Numenius americanus*	Blue	Special Concern	Prairies and grassy meadows, generally near water	**Unlikely** – No suitable grass habitat on site.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Black-crowned Night-heron *Nycticorax nycticorax*	Red	-	Marshes, swamps, wooded streams, mangroves, shores of lakes, ponds, lagoons; salt water, brackish, and freshwater situations. Roosts by day in mangroves or swampy woodland.	**Unlikely** – No suitable habitat on site.
Grappletail *Octogomphus specularis*	Red	Special Concern	Riparian forest, riparian shrub. Along woodland streams draining lakes.	**Unlikely** – No suitable aquatic or riparian habitat.
Jutta arctic *Oeneis jutta chermocki*	Blue	-	Conifer, deciduous or mixed forest, riparian shrub or forest, grassland, wetland.	**Unlikely** – No suitable habitat on site.
Audouin's night-stalking tiger beetle *Omus audouini*	Red	Threatened	Common pest of Douglas-fir cones. Occurs at lower mainland and Vancouver Island in BC.	**Unlikely** – Outside of range.
Cutthroat trout subsp. *Oncorhynchus clarkii clarkii*	Blue	-	Sea-run populations, freshwater-resident populations (lacustrine and fluvial) and headwater stream populations.	**None –** No fish habitat on site.
Sinuous snaketail *Ophiogomphus occidentis*	Blue	-	Lake, stream, river.	**Unlikely** – No suitable aquatic habitat on site.
Mountain goat *Oreamnos americanus*	Blue	-	Alpine and subalpine habitat; steep grassy talus slopes, grassy ledges of cliffs, or alpine meadows. Usually at timberline or above. In winter can move to lower elevations where snow is not as deep and more food is available.	**Unlikely** – Site is low elevation.
Sage thrasher *Oreoscoptes montanus*	Red	Endangered	Sagebrush plains, primarily in arid or semi-arid situations, rarely around towns. In BC only found in southern Okanagan.	**Unlikely** – No suitable habitat.
Bighorn sheep *Ovis canadensis*	Blue	-	There is a natural absence of Bighorn Sheep from heavily forested and high snowfall ranges such as the Coast, Purcell and Selkirk mountains. Habitats include open grasslands, alpine, subalpine, shrub-steppe, rock outcrops, cliffs, meadows, moist draws, stream sides, talus slopes, plateaus, deciduous forest, clear-cut or burned forest, and conifer forest, all on moderately steep to steep slopes.	**Unlikely** – Not found in area due to snow.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Blue dasher *Pachydiplax longipennis*	Blue	-	Found in lower mainland in BC. Lakes, ponds, open water, wetland, riparian forest. Occasional use in sparsely vegetated rock, cliff, stream, river.	**Unlikely** – No suitable aquatic habitat.
Indra swallowtail *Papilio indra*	Red	-	Arid rocky mountainous lands: canyons, cliffs, foothills, barrens. Known in BC only from Gibson Pass and Allison Pass in Manning Park.	**Unlikely** – Not within range.
Clodius Parnassian *Parnassius clodius claudianus*	Blue	-	Host plant is *Dicentra Formosa* that occurs in moist, cool mesothermal areas. Coastal, or wet moist areas.	**Unlikely** – No suitable habitat on site.
Clodius Parnassian *Parnassius clodius pseudogallatinus*	Blue	-	Moist riparian habitats by low elevation streams.	**Unlikely** – No suitable habitat on site.
Band-tailed pigeon *Patagioenas fasciata*	Blue	Special Concern	Habitat is forest, fields, riparian, springs. Generally found in temperate and mountain coniferous and mixed forests and woodlands, especially pine-oak woodlands, and locally in southern lowlands; also forage in cultivated areas, suburban gardens and parks. Will often forage in diverse habitats not used for nesting.	**Unlikely** – No suitable vegetated areas on site.
American white pelican *Pelecanus erythrorhynchos*	Red	-	In BC, breeding is restricted to Stum Lake, 70 km northwest of Williams Lake. Foraging occurs up to 165 km from the breeding colony.	**Unlikely** – Not within range.
Red-necked phalarope *Phalaropus lobatus*	Blue	Special Concern	Primarily pelagic, sometimes occurring in migration on ponds, lakes, open marshes, estuaries, and bays.	**Unlikely** – no suitable habitat.
Common sootywing *Pholisora catullus*	Blue	-	Very seldom in any kind of natural setting in most of its range, most typically weedy backyards, vacant lots, landfills, edges of croplands; any place where its weedy annual foodplants grow in the open. Can occur in the earliest stages of old field succession and in unnatural persistent grasslands such as edges of pastures. Associated with its host plants *Chenopodium* and *Amaranthus*.	**Unlikely** – Host plants do not occur in the Pemberton area.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Rocky mountain physa *Physella propinqua*	Blue	-	Permanent, cool water habitats, most often in lakes.	**Unlikely** – No suitable aquatic habitat.
Sunset physa *Physella virginea*	Blue	-	The type locality of this species is Mountain Lake, but otherwise the habitat needs of this species are unknown.	**Unlikely** – No suitable aquatic habitat.
River peaclam *Pisidium fallax*	Blue	-	In rivers, streams and exposed habitats in lakes; sand or gravel substrates.	**Unlikely** – No suitable aquatic habitat.
Gopher snake subsp. *Pituophis catenifer deserticola*	Blue	Threatened	Occurs within the arid interior of the province including the Okanagan, Similkameen, Kettle, Granby, Nicola, Thompson, and Fraser watersheds.	**Unlikely** – Site not within species' range.
Meadow rams-horn *Planorbula campestris*	Blue	-	This species is found in vegetated vernal ponds, swamps, and springtime flooded portions of permanent water bodies.	**Unlikely** – No suitable aquatic habitat.
American golden-plover *Pluvialis dominica*	Blue	-	Short grasslands, pastures, golf courses, mudflats, sandy beaches, and flooded fields	**Unlikely** – No suitable habitat.
Eared grebe *Podiceps nigricollis*	Blue	-	Marshes, ponds and lakes; in migration and winter also salt lakes, bays, estuaries and seacoasts	**Unlikely** – No suitable habitat.
Sonora skipper *Polites Sonora*	Blue	Special Concern	Mostly Canadian Zone moist meadows. Moist forest, riparian habitat.	**Unlikely** – No suitable habitat.
Purple martin *Progne subis*	Blue	-	Found from Port Neville and Shoal Bay, south to the tip of Vancouver Island (Pedder Bay area), on the west coast of the island in Barkley Sound and east to Squamish, Brae Island and Colony Farm, Pitt River.	**Unlikely** – Site not within species' range.
Cassin's auklet *Ptychoramphus aleuticus*	Red	Special Concern	Found along coast and islands.	**Unlikely** – Site not within species' range.
Northern red-legged frog *Rana aurora*	Blue	Special Concern	The range of the Northern Red-legged Frog extends from southwestern British Columbia, south along the Pacific coast, west of the Cascade Mountains, to northwestern California..	**Unlikely** – Site is not coastal.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Oregon spotted frog *Rana pretiosa*	Red	Endangered	Oregon Spotted Frog is found in extreme southwestern British Columbia, within the Fraser River Basin.	**Unlikely** – Site not within species' range.
American avocet *Recurvirostra americana*	Blue	-	Lowland marshes, mudflats, ponds, alkaline lakes, and estuaries.	**Unlikely** – No suitable habitat.
Nooksack dace *Rhinichthys cataractae – Chehalis lineage*	Red	Endangered	Limited to three adjacent streams (Bertrand, Pepin and Fishtrap creeks) all tributaries of the Nooksack River in Washington State.	**None** – No fish habitat on site.
Bull trout *Salvelinus confluentus*	Blue	-	The bottom of deep pools in cold rivers and large tributary streams, often in moderate to fast currents with temperatures of 45-50 F; also large coldwater lakes and reservoirs.	**None** – No fish habitat on site.
Bull trout *Salvelinus confluentus pop. 28*	Blue	Special Concern	The Southcoast British Columbia populations inhabit the Skagit, Squamish, Ryan, Lillooet, Pitt and Lower Fraser Rivers, the Pitt, Birkenhead, Chilliwack, and Chehalis Lakes, and Phelix and Ure Creeks (COSEWIC 2012).	**None** – No fish habitat on site.
California hairstreak *Satyrium californica*	Blue	-	Open woodland and edges, brushland, chaparral. Hosts are genera Ceanothus, Cercocarpus, Quercus and a few others.	**Unlikely** – No suitable vegetation on site.
Half-moon hairstreak *Satyrium semiluna*	Red	Endangered	This species ranges from extreme southern interior British Columbia, Canada, south to northeastern California, northern Nevada, and east across central Idaho, southwestern Montana, western Wyoming to northern Utah and Colorado, US.	**Unlikely** – Site not within species' range.
Townsend's mole *Scapanus townsendii*	Red	Endangered	Restricted to a very small area of land in the central Fraser Valley (Abottsford and Juntingdon).	**Unlikely** – Site not within species' range.
Black-throated green warbler *Setophaga virens*	Blue	-	The northeastern corner of British Columbia is the western extent of this species' breeding range. The majority of records are from the Peace Lowland of the Boreal Plains.	**Unlikely** – Site not within species' range.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Pacific water shrew *Sorex bendirii*	Red	Endangered	Inhabits the coastal lowlands of northern California, Oregon, Washington and British Columbia, where it is restricted to the lower Fraser River valley.	**Unlikely** – Site not within Fraser River valley.
Olympic shrew *Sorex rohweri*	Red	-	Restricted to southwestern British Columbia in the Fraser Lowland and Northwestern Cascade Ranges Ecosections.	**Unlikely** – Site not within species' range.
Trowbridge's shrew *Sorex trowbridgii*	Blue	-	Restricted to the Lower Mainland and Fraser River corridor north to about Boston Bar.	**Unlikely** – Site not within species' range.
Zerene fritillary subsp. *Speyeria zerene bremnerii*	Red	-	The species is known from the leeward side of Vancouver Island, with the majority of element occurrences in the south.	**Unlikely** – Site not within species' range.
Herrington fingernailclam *Sphaerium occidentale*	Blue	-	Recorded only from a few records in south eastern BC. Restricted to waterbodies that dry up for a part of each year.	**Unlikely** – Not within range and no suitable habitat.
Rocky mountain fingernailclam *Sphaerium patella*	Red	-	Reported from Burnaby Lake, Abbotsford lake and Kyuquot. In lakes, sloughs, rivers and streams.	**Unlikely** – Outside of range and no suitable aquatic habitat.
Striated fingernailclam *Sphaerium striatinum*	Blue	-	This species is found in broad habitat types over southern BC; however, there are only 3 known records. It lives in rivers, streams and lakes but not temporary water bodies.	**Unlikely** – No suitable aquatic habitat.
Williamson's sapsucker *Sphyrapicus thyroideus*	Blue	Endangered	In BC, *thyroideus* breeds from Manning Provincial Park near the U.S.A. border, north to the Lytton, Cache Creek and Kamloops areas, through the Okanagan Highlands and east as far as Greenwood.	**Unlikely** – Does not occur in coast mountains.
Williamson's sapsucker (subsp.) *Sphyrapicus thyroideus thyroideus*	-	Endangered	Occurs north of the U.S. border with the western limit of its range in Manning Park, and Botanie Creek (about 15 km north of Lytton); the northern limits of its range 35 km north of Cache Creek, and 50 km north of Kamloops; and the western limits of its range 10 km west of Grand Forks.	**Unlikely** – Does not occur in coast mountains.
Pygmy longfin smelt *Spiirinchus* sp. 1	Red	-	Restricted to two lakes in the lower mainland, Pitt Lake and Harrison Lake.	**Unlikely** – No suitable aquatic habitat and not within range.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Widelip pondsnail *Stagnicola traski*	Blue	-	Freshwater snails have adapted to most North American habitats including permanent standing, intermittent, and flowing waters.	**Unlikely-** No suitable aquatic habitat.
Forster's tern *Sterna forsteri*	Red	-	Freshwater and salt marshes, in migration and winter also seacoasts, bays, estuaries, rivers and lakes.	**Unlikely-** No suitable aquatic habitat.
Spotted owl *Strix occidentalis*	Red	Endangered	Dense forest and deep wooded canyons; generally in mature stands or old growth; requires cool summer roosts. Nests on broken tree top, cliff ledge, in natural tree cavity, or in tree on stick platform, often the abandoned nest of hawk or mammal; sometimes in cave.	**Unlikely** – No suitable forest habitat.
Autumn meadowhawk *Sympetrum vicinum*	Blue	-	In ponds, slow streams and lakes with dense, emergent vegetation.	**Unlikely** – No suitable vegetation on site.
Northern bog lemming subsp. *Synaptomys borealis artemisiae*	Blue	-	Habitat consists primarily of fens and bogs, may also occur in wet meadows, moist mixed and coniferous forests; alpine sedge meadows, krummholz spruce-fir forest with dense herbaceous and mossy understory, mossy streamsides.	**Unlikely** – No suitable aquatic habitat on site.
Ancient murrelet *Synthliboramphus antiquus*	Blue	Special Concern	Nineteen colonies are legally protected: 16 colonies are within Gwaii Haanas National Park Reserve, two (Reef and Limestone islands) are Provincial Wildlife Management Areas and one (Hippa Island) is an Ecological Reserve.	**Unlikely** – Site not within sea shore range.
Black petaltail *Tanypteryx hageni*	Blue	-	Found in seepage areas and bogs, flat or on hillsides, often associated with streams and usually not under forest canopy in wet mountain ranges. The eggs are laid in the soil of bog, larvae in burrows opening above water, adults forage along sunny forest edges.	**Unlikely** – No suitable aquatic habitat.
American badger *Taxidea taxus*	Red	Endangered	Badgers are most commonly found in the Cariboo, Thompson, Okanagan, and East Kootenay regions of BC.	**Unlikely** – Not known in Coast Mountains.
Eulachon *Thaleichthys pacificus*	Blue	Endangered/ Threatened	Pacific Coast (E), Fraser River (E) and Nass/Skeena River (T) populations.	**None** – No fish habitat on site.

Common Name Scientific name	Status		Habitat Requirements	Potential Occurrence
	BC List	SARA		
Wandering tattler *Tringa incana*	Blue	-	Breeding range is small, limited to the St. Elias Mountains in extreme northwestern British Columbia, but likely extends south to at least Gnat Pass near Dease Lake.	**Unlikely –** Not within range.
Barn Owl *Tyto alba*	Red	Threatened	Fields of dense grass. Open and partly open country (grassland, marsh, lightly grazed pasture, hayfields) in a wide variety of situations, often around human habitation.	**Unlikely -** No dense grass on site.
Common murre *Uria aalge*	Red	-	Pelagic and along rocky seacoasts.	**Unlikely** – Site is not coastal.
Grizzly bear *Ursus arctos*	Blue	Special Concern	Non-forested or partially forested sites with a wide range of foraging opportunities and choice of habitats.	**Unlikely** – Known to occur in area, but no habitat features or forage on site.

All references from CDC explorer (BC CDC, 2021) and E-Fauna BC (UBC, 2020)

2.5. Valued Ecosystem Components

2.5.1. Wildlife Trees

There are no wildlife trees on the property.

2.5.2. Coarse Woody Debris

There is no coarse woody debris on the property.

2.5.3.Wildlife Movement Corridors

Wildlife tend to use routes with particular features when moving across the landscape to forage for food, disperse, find mates, or locate breeding sites. These features can include such things as cover, shade, vegetation, water or surface characteristics. Scale is also a significant factor in determining the suitability of a landscape; larger animals with home ranges covering hundreds of kilometres (e.g. grizzly bear) have far different movement corridor requirements than some reptiles, whose corridor requirements are measured in metres.

There are no habitat features on site that would support the movement of wildlife through cover or shade. Daytime human presence and traffic in this area is also a deterrent to wildlife presence or movement through the subject property.

2.5.4. Rock slopes

Rock slopes provide specialized habitat for many species, particularly reptiles or small mammals. One alligator lizard was observed just southeast of the property along the rock slope by Cascade on June 2, 2021 (Photo 5).

Photo 5: Rock slope at the northeast corner of the property with a path connecting to the adjacent subdivision. October 26, 2021.

2.6. Aquatic Environment

There is no aquatic habitat on site.

2.7. Socio-Economic Conditions

2.7.1. Cultural and Heritage Resources

The subject site is within the traditional territories of the St'át'imc Nation, as mapped within the St'át'imc Land Use Plan. The St'át'imc Nation territory extends north to Churn Creek and south to French Bar, north and east toward Hat Creek Valley; west to the headwaters of Lillooet River, Ryan River and Black Tusk. They have historical ties to the land that includes utilization of the natural resources of the Pemberton area (St'át'imc First Nation, 2004).

An archeological investigation was not conducted as part of this study. However, an archaeological data request was received from the Archaeology Branch of the Ministry of Forests, Lands and Natural Resource Operations on January 20, 2022. According to provincial records, there are no known archaeological sites recorded on the subject site, and the area of the subject site is not considered to have a high potential for previously unidentified archaeology sites to be found on the subject property.

Archaeological sites are protected under the *Heritage Conservation Act*, and should such a site be discovered during development, all works must be halted and the archaeology branch must be contacted immediately (archaeology@gov.bc.ca).

2.7.2. Other Undertakings in the Area

Mining

No current coal, mineral and placer claims exist on the subject property (BC Gov, 2022a).

Recreation and Tourism

No recreation or tourism activities were observed or found on the subject site. No recreation or tourism features are identified on site from mapping data (BC Gov, 2022a).

Forestry Management

The site is at the southern boundary of the following current Forest Development Units (FDU): Birkenhead and Railroad 752. No FDUs are registered on the subject site (BC Gov, 2022a).

Ground Water

There are no groundwater wells on the subject property. Two wells exist south of the property identified on mapping within the subdivision to the south, along Pinewood Drive (BC Gov, 2022a).

Anthropogenic Features

The subject site is cleared of vegetation and is mostly graded. There is a large stockpile of aggregate in the center of the property. There are no structures on the property.

Adjacent Land Use

The property is located within the Village of Pemberton along Pemberton Farm Road East. The property is bounded by:

- Residential development to the south;
- Pemberton Farm Road East and North Arm Channel to the west;
- Private cleared lots to the north currently used for recreational parking;
- Grass sports fields to the east within the SunStone subdivision.

GIS Cartographer: Nicola Church
Date: *1/17/2022*
CERG File #: 584-05-01
Projection: NAD 1983 UTM Zone 10N

CASCADE ENVIRONMENTAL
RESOURCE GROUP LTD

N

0 12.5 25 50 75 100
Meters

Map 2 - Site Map

Environmental Assessment
7362 Pemberton Farm Rd E
Pemberton
British Columbia

3. Environmental Constraints

3.1. Physical Environment

3.1.1. Climate

The climate in the study area has high levels of precipitation. The Stormwater Management Plan should include snow removal, snow storage and storm event recommendations. Climate change should not affect this property or its development.

3.1.2. Geology

A geotechnical report should be conducted by a qualified professional if required.

3.1.3. Geomorphology

The geomorphology of the subject site and poses no obvious constraints to rezoning or development.

3.1.4. Hydrology

Hydrology of the site is very limited to temporary pooling from precipitation and groundwater. A Stormwater Management Plan is recommended for site design to direct surface flows and encourage the retention of stormwater within permeable surfaces. The plan should also make recommendations for potential flood control within the property (BC MOE, 2014).

3.2. Terrestrial Environment

3.2.1.Soils

An assessment of the soils of the site is outside the scope of this Environmental Assessment; soils on the subject site should be addressed under a separate geotechnical report, if required.

3.2.2. Vegetation

The vegetation on the subject property does not present any constraints or concerns for rezoning or development. The entire property has been disturbed due to anthropogenic activities and is mostly non-vegetated. Existing vegetation covers 5% or less of the property and contains invasive plant species. The state of vegetation on the subject site has low ecological value. It is recommended to remove invasive plant species during development in accordance to the Sea to Sky Invasive Species Council's recommendations (https://ssisc.ca/invasives/how-to) to prevent the spreading of weeds.

Rare and Endangered Plant Species

A list of plant, macrofungi and lichen species at risk that are known to occur within the geographical region of the property's forest district and biogeoclimatic zone is provided in Table 3. However, none of these species has the potential to occur on site due to specific habitat requirements.

Rare and Endangered Ecological Communities

No rare or endangered ecological communities exist on the subject property due to its disturbed state and lack of vegetation. Ecological communities on the subject site does not pose a constraint to rezoning or development.

3.3. Wildlife and Wildlife Habitat

3.3.1. Birds and Nests

Shrubs on the subject property provide potential nesting sites for a range of bird species. The BC *Wildlife Act* states:

A person commits an offence if the person, except as provided by regulation, possesses, takes, injures, molests or destroys

(a) A bird or its egg,

(b) The nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl or,

(c) The nest of a bird not referred to in paragraph (b) when the nest is occupied by a bird or its egg.

Development on the subject property may be constrained by the *Wildlife Act* if vegetation removal or ground disturbance impacts ground nesting birds or birds nesting in vegetation from April 1 to September 1. It is recommended a QEP conduct a song bird nesting survey prior to ground disturbance or vegetation clearing to avoid impact

3.3.2. Rare and Endangered Wildlife Species

Wildlife species with the potential to occur within the geographic region and biogeoclimatic zone of the subject site are listed in Table 6. One of these species is determined to have the potential to occur on the property:

- Common nighthawk (yellow, 1-T)

A species that is listed as Endangered, Extirpated or Threatened within Schedule 1 of *Species At Risk Act* (SARA) is legally protected under the Act by certain prohibitions. A species that is listed within Schedule 1 of SARA with the classification of Special Concern will not receive protection under the SARA general prohibitions.

SARA contains prohibitions that make it an offence to:

- kill, harm, harass, capture, or take an individual of a species listed in Schedule 1 of SARA as endangered, threatened or extirpated;
- possess, collect, buy, sell or trade an individual of a species listed in Schedule 1 of SARA as endangered, threatened or extirpated;
- damage or destroy the residence (e.g. nest or den) of one or more individuals of a species listed in Schedule 1 of SARA as endangered, threatened or extirpated, if a recovery strategy has recommended the reintroduction of that extirpated species.

Common Nighthawk

Common Nighthawks require open ground or clearings for nesting. The species breeds in a wide range of open habitats including sandy areas (e.g., dunes, eskers, and beaches), open forests (e.g., mixedwood and coniferous stands, burns, and clearcuts), grasslands (e.g., short-grass prairies, pastures, and grassy plains), sagebrush, wetlands (e.g., bogs, marshes, lakeshores, and riverbanks), gravelly or rocky areas (e.g., outcrops, barrens, gravel roads, gravel rooftops, railway beds, mines, quarries, and bare mountain tops and ridges), and some cultivated or landscaped areas (e.g., parks, military bases, airports, blueberry fields, orchards, cultivated fields). The female lays the eggs directly on the soil or bare rock in sites with more open ground cover with low or no vegetation, adequate camouflage from predators, and nearby shade (Environment Canada, 2016a).

The subject site contains moderate to low potential ground nesting habitat as the entire site is barren and gravelly. The site does not offer potential foraging habitat. Any ground disturbance for development within the breeding and nesting season (April to September) should ensure no bird nest is disturbed. It is recommended to retain a QEP to conduct a bird nest survey prior to ground disturbance.

3.4. Valued Ecosystem Components

3.4.1. Wildlife Trees

No wildlife trees are observed on the subject property.

3.4.2. Coarse Woody Debris

No CWD is observed on the subject property.

3.4.3. Wildlife Movement Corridor

The subject site provides limited potential for wildlife movement corridor due to a lack of habitat features. There are no habitat features that should be protected.

3.5. Aquatic Environment

The subject site does not contain any watercourses; however, North Arm Channel flows west of the subject site. A Riparian Areas Protection Regulation (RAPR) assessment has not been conducted to determine the Streamside Protection and Enhancement Area (SPEA). As the property is within the Riparian Assessment Area (RAA), within 30 m of the watercourse (Map 2), there is potential for the SPEA to fall within the property boundary. A RAPR assessment may be required. This should be taken into design consideration for development.

3.6. Socio-Economic Conditions

3.6.1. Cultural and Heritage Resources

The archaeological data request has determined there are no known archaeological sites recorded on the subject site, and the area of the subject site is not considered to have a high potential for previously unidentified archaeology sites to be found on the subject property.

If an archaeological site is encountered during future development of the subject site, activities must be halted and the appropriate authorities consulted as archaeological sites are protected under the *Heritage Conservation Act.*

3.6.2. Other Undertakings in the Area

Timber Harvesting

Timber harvesting presents no obvious constraints or concerns for the rezoning or development of the subject property.

Mining

Mining presents no obvious constraints or concerns for rezoning or development of the subject property.

Recreation and Tourism

Recreation and tourism present no obvious constraints or concerns for rezoning or development of the subject property.

Anthropogenic Features

No anthropogenic features pose constraints to rezoning or development of the subject property.

Adjacent Land Users

Adjacent land use does not restrict development or rezoning within the subject property.

4. Conclusions and Recommendations

This report details the baseline conditions and identifies potential environmental constraints for the development within 7362 Pemberton Road E (Lot C) in Pemberton, BC. Based on the conditions observed on the site and the information reviewed, the site appears to be suitable for the proposed development subject to the following recommendations:

1. Land clearing activities conducted during the nesting bird season of April 1 to September 1 must comply with Section 35 of the *Wildlife Act*, which forbids the destruction of nests occupied by a bird, its eggs, or its young. If vegetation clearing is to occur between April 1 and September 1, a song bird nesting survey of the vegetated areas should be conducted by a QEP in order to ensure compliance with the *Wildlife Act*.

   The survey will identify the location of any active bird nests including that of the common nighthawk. This bird is a species at risk identified as having the possibility of nesting on site. Any active birds' nests found during clearing must be adequately protected by a forested buffer as per Section 34 of the *Wildlife Act*.

2. Vegetation should be retained wherever possible. Retention of vegetated areas will facilitate wildlife movement through the site and retain breeding and foraging areas. Prior to vegetation clearing, it is recommended that a QEP conduct a song bird nesting survey and species at risk survey.
3. Design and construction practices should minimize erosion and sedimentation in storm water runoff.
4. Landscape plans for the subject site should include native tree and shrub species that are not bear attractants.
5. Future development and construction on the property should follow guidelines and recommendations outlined in: *Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia* (MOE, 2014) and *Land Development Guidelines for the Protection of Aquatic Habitat* (DFO, 1993). This includes best management recommendations for stormwater, pollution prevention and wildlife and ecosystem management.
6. Avoid impacts to local bear populations by following recommended management plans and adhering to the Village of Pemberton Wildlife Attractants Bylaw (684, 2011).
7. Should any future development be proposed within the 30m Riparian Assessment Area of North Arm Channel, a Riparian Areas Protection Regulation assessment should be conducted, west of the subject site.
8. Removal of the invasive plant species on site should be done in accordance to the recommendations by the Sea to Sky Invasive Species Council.

5. References

BC Government. 2022a. iMap BC. https://www2.gov.bc.ca/gov/content/data/geographic-data-services/web-based-mapping/imapbc. Accessed January 17, 2022.

BC Government 2022b. CDC iMap. http://maps.gov.bc.ca/ess/hm/cdc/?bcgovtm=eeb3c3b874-EMAIL_CAMPAIGN_2019_02_05_05_29. Accessed January 17, 2022.

BC Ministry of Environment. 2021a. Conservation Data Centre. BC Species and Ecosystems Explorer. B.C. Ministry of Environment, Victoria B.C. http://a100.gov.bc.ca/pub/eswp/. Accessed January 25, 2022.

BC Ministry of Environment. 2021b. Habitat Atlas for Wildlife at Risk. Lark Sparrow *Chondestes grammacus*. https://www.env.gov.bc.ca/okanagan/esd/atlas/species/lark.html. Accessed January 26, 2022.

BC Ministry of Environment. 2014. Develop with Care 2014 Environmental Guidelines for Urban and Rural Development in British Columbia.

BC Ministry of Environment. 2017. Wildlife/Danger Tree Assessor's Course Workbook Parks and Recreation Sites Course Module.

BC Ministry of Environment. 1980. Soil Survey of the Pemberton Valley British Columbia. RAB Bulletin 16. https://www.for.gov.bc.ca/hfd/library/documents/Bib15191.pdf. Accessed January 17, 2022.

BC, Province of. 1998. Field Manual for Describing Terrestrial Ecosystems. BC Min. Env. Land Prot., and BC Min. For. Land Manage. Handb. No. 25.

Departement of Fisheries and Ocean Canada (DFO). 1993. Land Development Guidelines for the Protection of Aquatic Habitat.

Demarchi, D.A. 1996. Ecoregions of British Columbia. Fourth Edition. British Columbia Wildlife Branch, Ministry of Environment, Lands and Parks, Victoria BC. Map (1:2,000,000).

Environment Canada. (2016a). Recovery Strategy for the Common Nighthawk (Chordeiles minor) in Canada (p. vii + 49) [Species at Risk Act Recovery Strategy Series]. Environment Canada.

Environment Canada, 2021. Climate Normals 1981 – 2010. Website: http://climate.weather.gc.ca/climate_normals/index_e.html. Accessed January 17, 2022.

Green, R.N. and K. Klinka, 1994. Field guide to site identification and interpretation for the Vancouver Forest Region. Land management handbook number 28. BC Ministry of Forests, Victoria, BC.

Kuurne, R.L.B., 1980. Soil Survey of the Pemberton Valley, British Columbia. Province of British Columbia. Ministry of Environment. http://www.env.gov.bc.ca/esd/distdata/ecosystems/Soils_Reports/bc62_report.pdf. Accessed January 26, 2021.

MacKenzie and Moran. 2004. Wetlands of British Columbia: A guide to identification.

NatureServe Explorer. 2022. *Pholisora Catullus,* Common Sootywing. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.120035/Pholisora_catullus. Accessed January 26, 2022.

Shiarizza, P. and N. Church, 1997. The geology of the Thompson - Okanagan Mineral Assessment Region. BC Geological Survey Open File 1996-20. https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/british-columbia-geological-survey/publications/openfiles-1999-1990. Accessed January 17, 2022.

St'át'imc Preliminary Draft Land Use Plan 2004, Lillooet, BC. http://www.firstnations.de/media/06-4-0-statimc.pdf. Accessed January 26, 2022.

University of British Columbia, 2020. E-Fauna BC: Electronic Atlas of the Fauna of British Columbia. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver. www.efauna.bc.ca. Accessed January 26, 2022.

Village of Pemberton, 2019. Pemberton Zoning Bylaw Amendment No. 862, 2019. https://www.pemberton.ca/public/download/files/86630. Accessed January 26, 2022.

Village of Pemberton, 2011. WILDLIFE ATTRACTANTS BYLAW No. 684, 2011. https://www.pemberton.ca/public/download/documents/37266. Accessed September 17, 2021.

KONTUR
GEOTECHNICAL CONSULTANTS

Kontur Geotechnical Assessment

February 7, 2022
Project No.: **KP-221185-00**

Michael Oord
Rivertown Properties Ltd
1527 Edgewater Lane
North Vancouver, BC
V7H 1T3

EGBC Permit to Practice #100925
[redacted]

Attention: **Michael Oord**
[redacted]

RE: **Geotechnical Review**
Residential Subdivision
7362 Pemberton Farm Road, Pemberton, BC R2

Dear Michael Oord,

1.0 INTRODUCTION

In accordance with your recent authorization, Kontur Geotechnical Consultants Inc. (Kontur) has completed this Geotechnical Review for the above-referenced project. The purposes of this study were to characterize the site from a geotechnical point-of-view and to provide comments and recommendations with respect to proposed residential subdivision.

This letter, which summarizes the findings of the Geotechnical Review, has been prepared in accordance with standard and widely accepted geotechnical engineering principles and practices for similar projects in this region. This letter does not address any environmental issues or considerations related to the proposed project.

Review and use of this letter should be completed in accordance with the attached *Interpretation and Use of Study and Report* document. It is included as an integral part of this letter and should be read in conjunction with all parts of this letter.

2.0 UNDERSTANDING OF PROJECT

Based on discussions with the contractor the project generally consists of subdividing the subject property into single family residential lots, possibly with some associated commercial/ retail lots. No proposed layout drawings were provided for this report.

3.0 SOURCES OF INFORMATION

The following sources of information were also reviewed as part of this study:

- Published surficial geology maps of the area;
- A review of Kontur's in-house geotechnical database and experience of the area;
- Relevant information obtained from the Village of Pemberton (VoP) online web-mapping application; and,

- A site reconnaissance completed by senior Kontur personnel.

A site reconnaissance was completed on November 17th, 2021 and was completed by a Principal Geotechnical Engineer. The site reconnaissance included a foot traverse across the property to visually assess the area for features of geotechnical engineering significance.

4.0 SITE DESCRIPTION

4.1 General

The subject property is located at 7362 Old Pemberton Farm Road, Pemberton with a legal description of Lot C District Lot 211 Lillooet District Plan EPP40824. The property is located on the east side of Old Pemberton Farm Road about 375m north of the intersection of Highway 99 (Sea to Sky Highway) and Old Pemberton Farm Road. The property is bounded by single and multi-family residential lots to the south, undeveloped land proposed for future community recreational services to the north and east and Old Pemberton Farm Road to the west.

The property is generally rectangular in shape with the west boundary being longer than the east boundary. The property had dimensions ranging from about 80m along the eastern boundary to about 125m along the western boundary and from about 228m along the southern boundary to about 244m along the northern boundary. The property had an area of about 24.0ha.

Topography with the subject property is mostly the result of bedrock excavations, likely for quarry purposes. The northern about 20m to 25m of the property was generally flat lying. Bedrock cut slopes were located from:

1. near the northwest corner of the property to the centre portion of the southern boundary with heights of about 8m ; and,
2. along the southern boundary in the western portion of the property with heights of about 6m to 8m.

The bedrock cuts were generally near vertical with localized accumulations of sand, gravel, cobbles and boulders at the base of the slopes, likely the result of grading of the benches during quarry operations. Between the bedrock cut slopes the ground surface was relatively flat lying forming a bench ranging from about 30m to 85m wide.

Stockpiled material (sand, gravel, cobbles and boulders) formed an access ramp from the northwest corner of the property to the southern property boundary up to the bench between the bedrock cut slopes and a stockpile area about 3m in height in the northeast corner of the property.

The site has been cleared of some forest and vegetation, though some brush has grown up since quarry operations halted.

Some ponding water has been noted within the subject property but no significant seepage has been noted.

No evidence of any recent deep-seated or wide-spread sloughing, slumping, or erosion, was observed at the time of the site visit. Some evidence of localized rock falls, topples, and/or slides, was observed at

the time of the site visit at the base the bedrock cut slope described above and located within the subject property.

4.2 Subsurface Conditions

Interpretation of subsurface conditions at the site is based on the published surficial geology map of the area, observations of soil or bedrock outcrops within the property, and Kontur's nearby and relevant experience. A geotechnical exploration (test pits or testholes) has not been completed as part of this stage of the project.

According to *"Surficial Geology and Landslide Inventory of the Upper Seat to Sky Corridor" (Open File 5324)* obtained from the Geologic Survey of Canada the site is underlain by Bedrock including in places till veneer, drift and colluvium. The bedrock in the area is typically dioritic. Based on review of geotechnical explorations completed for a proposed recreational complex on the property north of the subject site the lower portions of the property generally consist of granular fill material up to about 1m thick overlying bedrock. The remaining portions of the property generally consisted of exposed bedrock.

Static groundwater levels are anticipated to be encountered near the surface of the lower areas of the property.

It is important to note that the subsurface conditions described above generalized. Extrapolation and interpretation of the subsurface conditions is formulated based on an assumed horizontal continuity of subsurface conditions across the site. Therefore, the subsurface conditions described above are generalized and variation in the stratigraphic conditions should always be expected. Site-specific geotechnical explorations should be completed during later stages of the project to where more certainty in subsurface conditions is deemed to be necessary.

5.0 COMMENTS AND RECOMMENDATIONS

5.1 General

It is Kontur's opinion that the significant geotechnical considerations associated with subdivision of this site may be related to:

- Establishing appropriate geotechnical setbacks from steep and high bedrock slopes/steps and/or implementing local stabilization measures to mitigate potential rock falls, topples, or slides;
- Establishing appropriate geotechnical setbacks and Flood Construction Levels;
- Excavation/blasting in bedrock to achieve the desired design grades for the proposed roadways and associated infrastructure; and, or,
- Placement of *Engineered Fill* beneath the footprint of the access roads and common areas.

Based on the observations, information, and findings presented above, the following sections outline the geotechnical comments and recommendations provided by Kontur with respect to subdivision and site development.

5.2 Seismicity

The British Columbia Building Code (BCBC 2018) provides guidelines and parameters for seismic design. The design earthquake corresponds to a 2% probability of exceedance min 50 years which is equivalent to a 1 in 2475-year return period. The Natural Resources Canada website provides interpolated site-specific seismic hazard values and indicates a peak horizontal firm ground acceleration of 0.17g for the subject property.

Based on the characterization of anticipated subsurface conditions within the subject property provided in this report, bedrock overlain with structural fill, liquefaction of subsurface soil layers during the design earthquake is considered unlikely. Site Classification for Seismic Response Table 4.1.8.4.A from the BCBC 2018 for possible subsurface conditions are considered to be Site Class B.

5.3 Flood Construction Level

Based on a review of "Lillooet River Floodplain Mapping – Final Report" prepared by Northwest Hydraulic Consultants and dated November 22, 2018, Sheet 9 of the 200-year Designated Floodplain Maps Including Freeboard, a Flood Construction Level (FCL) ranging from 207.5m to 208.5m geodetic, increasing from east to west, applies along the north property boundary.

Areas below the FCL, must be sealed from water ingress. No area used for habitation below FCL can be used for installation of heating, ventilating, electrical switches, major electrical switchgear or other equipment susceptible to damage by floodwaters unless the space is protected by engineered flood control doors or tanked up to the required elevation with continuous floodproofed concrete walls. There must be no openings or vents allowing floodwaters to enter electrical/ mechanical rooms, habitable spaces or storage areas. The crawl space is not considered to be a habitable space; however, the space should not be used for storage of goods damageable by water. All cracks, ducts and pipes must be adequately sealed with non-shrink grout and all walls and ceilings below the FCL are protected by the installation of an impermeable waterproof barrier. All windows below the FCL must be waterproofed. All drains within the building must have backwater preventers or valves installed to prevent backflow into area below FCL as noted above. Entrance doors below FCL must consist of specialized watertight doors that can be used flood protection when closed.

5.4 Permanent Slopes & Rockfall Mitigation

Permanent cut and fill slopes in soil should typically be sloped no steeper than about 2H:1V with appropriate erosion protection measures implemented. Permanent rock fill slopes should typically be sloped no steeper than about 1.75H:1V. Fill slopes should consist of an approved granular material and be properly compacted in accordance with the Geotechnical Engineer.

Permanent bedrock cut slopes, provided there are no adversely oriented discontinuities in the cut face, should typically be inclined no steeper than 1H:4V. For bedrock cut slopes greater than 4.5m in height, the catchment area should be increased to 3m in width. The table below provides recommendations for catchment ditch widths for roadways adjacent to bedrock bluffs:

Bluff Height	Recommended Catchment Width
0 to 4m	2m
4 to 12m	3m
12 to 18m	5m

The catchment ditch should be sloped back away for the roadway with an inclination no shallower than 4H: 1V.

Where retaining walls are required, retaining walls may consist of Gravity or Mechanically Stabilized Earth (MSE) walls. MSE wall systems may include Stacked Rock and Concrete Lock-block, Sierra-scape Walls or Allan-Bock Walls. Reinforced concrete walls could also be considered. Retaining walls exceeding a height of 1.2m should be engineered and designed in accordance with the latest version of the EGBC Guidelines for Retaining Walls.

Where required, Kontur can provide specific retaining all designs upon request.

5.5 Building Setbacks and/or Special Measures

Appropriate geotechnical setbacks from the crest or toe of any steep slope should be implemented to protect proposed buildings and infrastructure against potential rock falls, topples, or localized bedrock instabilities. Where these setbacks are not achieved, special measures to stabilize or protect the slope from erosion or rockfall may be required as directed by the Geotechnical Engineer.

No part of the foundation for any building or critical infrastructure should be placed within 5m of the crest of bedrock bluffs or cut slopes unless additional measures have been implemented under the direction of a qualified Geotechnical Engineer. Setbacks from the toe of bedrock bluffs are dependant on the height of the bluff/ cut slope and apply to both roadways and habitable structures and should be determined by the geotechnic engineer on a site-specific basis.

The geotechnical setback may be reduced at the sole discretion of the Geotechnical Engineer on a lot-by-lot basis, provided additional measures to stabilize the slope and protect the building are considered and/or implemented.

5.6 Foundation Design Considerations

All building foundations should be designed and constructed in accordance with the 2018 British Columbia Building Code (2018BCBC). The undisturbed natural subgrade or intact bedrock encountered at the site are considered to be competent to support the loads associated with typical lightly-loaded buildings on conventional shallow foundations. Upon request, Kontur can provide detailed geotechnical comments and recommendations for new buildings on a building-by-building basis. Foundation drainage should also be provided.

5.6 Road and Pavement Structure

The minimum recommended pavement structure for new roadways is provided in the table below:

Table – Minimum Recommended Pavement Structure

Road Structure Type	Material Description
Hot-mix Asphalt Pavement	85 mm placed in two lifts (35mm top/50mm bottom)
Road Base	100 mm of 19mm minus well-graded Crushed Gravel (MMCD Granular Base)
Road Subbase	300 mm of 75mm minus Pit Run Gravel (MMCD Pit Run Gravel Sub base)
Approved Subgrade Surface	Per Geotechnical Engineer

Subgrade preparation for new road structures should be in accordance with the recommendations provided in this report. All pavement materials should meet the latest requirements of the MMCD Specifications.

5.8 Site Development

5.8.1 Temporary Excavation and Groundwater Control

Most of the project site is underlain by bedrock, or bedrock covered with a thin mantle/veneer of overburden soil. Therefore, provision for specialized excavation methods such as blasting of bedrock and large cobbles/boulders, should be planned for. Specialized methods may include the use of hydraulic rock hammering/fracturing, rock splitting, and blasting techniques, to achieve design grades and/or to excavate utility service trenches.

Where blasting techniques are implemented, it is recommended that vibration monitoring during the work be completed in addition to a pre- and post-construction survey of nearby sensitive or important buildings and/or structures.

All WorkSafeBC Regulations, Guidelines, and Best Practices, for safe and stable excavations should be implemented by the Contractor. An initial review by the Geotechnical Engineer should be completed for any excavation deeper than 1.2m below the surrounding ground surface.

5.8.2 Surface and Groundwater Control

The excavated surface must be protected and kept dry during construction. Depending on the time of year construction takes place, it should be expected that some groundwater (perched) may be encountered in the building excavation. Water accumulations in the excavation are anticipated to be able to be controlled with conventional swales, shallow sumps, and pumps.

It is the responsibility of the contractor to protect and provide a dry environment for the placement and compaction fills and/or concrete. Contractors should make their own assessment and are responsible for selecting the appropriate methods to control groundwater during construction at this site.

5.8.3 Site Preparation

Areas of foundations, roadways, or other hard-scape surfaces should be stripped and cleared of all unsuitable material including loose, saturated, organic, or other deleterious material to expose a suitable subgrade surface, such as suitably compacted structrual fill, or intact bedrock. The excavated subgrade surface should be reviewed and approved by the Geotechnical Engineer prior to placement of any *Engineered Fill* or concrete.

5.8.4 Engineered Fills

Where *Engineered Fill* is required to achieve design grades, the material should consist of an approved granular soil such as a 75mm minus well graded pit run sand and gravel or 150mm minus shot rock with no more than 5% fines passing the No.200 (0.075mm) sieve or approved equivalent. *Engineered Fill* should extend at least 450mm beyond the edges of the proposed foundation or at least a horizontal distance equal to the thickness of the fill, whichever is greater.

All *Engineered Fill* materials must be placed and compacted in lifts no thicker than 300mm. The material should be near its optimum moisture content and be compacted to at least 95% of the material's *Modified Proctor Maximum Dry Density* (MPMDD) value. Field Density Test reports should be forwarded to the Geotechnical Engineer for review and approval of compacted fill zones, or the Geotechnical Engineer should observe and witness placement and compaction of the material.

For non-structural areas, backfills may be placed and compacted as described above except to no less than 85% of the material's MPMDD value. Excavated material and/or existing fill materials may be reused in non-structural areas for general site grading purposes. These materials are not suitable for use as *Engineered Fill* in structural areas.

5.8.5 Utility/Service Trenches

Trench backfills should meet MMCD requirements for Pipe Bedding and Surround Materials and be properly compacted to at least 95% of the material's Modified Proctor Maximum Dry Density value as discussed above.

6 CLOSURE

The comments and recommendations presented in this letter are based on the referenced information and Kontur's understanding of the project as described herein. If site conditions or project parameters differ from those described in this letter, Kontur should be notified promptly to review geotechnical aspects of the project and provide additional or modified comments and recommendations, as deemed appropriate. Contractors should make their own assessments of subsurface conditions at this site and select the construction means and methods that are most appropriate for encountered site conditions.

This letter has been prepared for the exclusive use of Rivertown Properties Ltd. and/or their designated agents or consultants. Any use of the information contained in this letter for other than its intended purpose or by any other party must first be verified in writing by Kontur. Kontur does not accept any responsibility or damages because of any other party relying on or using the information, interpretations, opinions, comments, and/or recommendations that are contained in this letter.

Kontur trusts that the information described above meets your current requirements. If you should have any concerns or questions, please do not hesitate to contact the undersigned.

Sincerely,

Kontur Geotechnical Consultants Inc.

Per: [redacted]

Evan Sykes, P.Eng.
Principal | Geotechnical Engineer

Reviewed by: [redacted]

Matthew Yip, M.Eng., P.Eng.
Principal | Geotechnical Engineer

Attachments: Interpretation and Use of Study and Report Document
2015 National Building Code Seismic Hazard Calculation

INTERPRETATION AND USE OF STUDY AND REPORT DOCUMENT

1.0 STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering consulting practices in this area. No other warranty, expressed or implied, is made. Engineering studies and reports do not include environmental engineering or consulting.

2.0 COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3.0 BASIS OF THE REPORT

The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4.0 USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorise only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorised use of the Report.

5.0 INTERPRETATION OF THE REPORT

Nature and Exactness of Descriptions: Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations, or building envelope descriptions, utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarising such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

Reliance on Provided information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons providing information.

To avoid misunderstandings, KONTUR should be retained to work with the other design professionals to explain relevant engineering findings and to review their plans, drawings, and specifications relative to engineering issues pertaining to consulting services provided by KONTUR. Further, KONTUR should be retained to provide field reviews during the construction, consistent with building codes guidelines and generally accepted practices. Where applicable, the field services recommended for the project are the minimum necessary to ascertain that the Contractor's work is being carried out in general conformity with KONTUR's recommendations. Any reduction from the level of services normally recommended will result in KONTUR providing qualified opinions regarding adequacy of the work.

6.0 ALTERNATE REPORT FORMAT

When KONTUR submits both electronic file and hard copies of reports, drawings and other documents and deliverables (KONTUR's instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by KONTUR shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancy, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by KONTUR shall be deemed to be the overall original for the Project.

The Client agrees that both electronic file and hard copy versions of KONTUR's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except KONTUR. The Client warrants that KONTUR's instruments of professional service will be used only and exactly as submitted by KONTUR.

The Client recognizes and agrees that electronic files submitted by KONTUR have been prepared and submitted using specific software and hardware systems. KONTUR makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 50.318N 122.758W **User File Reference:** 7362 Pemberton Farm Road Pemberton BC 2022-01-24 15:10 U

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.195	0.124	0.083	0.031
Sa (0.1)	0.290	0.185	0.124	0.046
Sa (0.2)	0.356	0.234	0.161	0.064
Sa (0.3)	0.337	0.228	0.160	0.067
Sa (0.5)	0.292	0.197	0.138	0.058
Sa (1.0)	0.197	0.130	0.089	0.036
Sa (2.0)	0.131	0.083	0.055	0.022
Sa (5.0)	0.051	0.030	0.018	0.006
Sa (10.0)	0.017	0.010	0.007	0.003
PGA (g)	0.165	0.107	0.073	0.027
PGV (m/s)	0.252	0.162	0.107	0.040

Notes: Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information

Traffic Impact Study

Ravens Crest Developments
Traffic Impact Study - FINAL

Prepared By:

Delcan
TRANSPORTATION • INFORMATION TECHNOLOGY • WATER

August 2011
SW1174SWA

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 Background

Delcan has been retained by Ravens Crest Developments to conduct a Traffic Impact Study (TIS) for a phased series of developments served by Pemberton Farm Road within the Village of Pemberton. Pemberton Farm Road is accessed via Highway 99 at an existing stop controlled "T" intersection.

Previous planning studies (Ivey and Mosquito Lake Development, KWL, June 2009) have established potential servicing requirements for development as envisioned in the Pemberton and Area Sub-Regional Land Use Planning Study. The subject study focuses on the transportation requirements of the initial stages of development on the Ravens Crest Properties with consideration for future long term development.

1.2 Description of Development

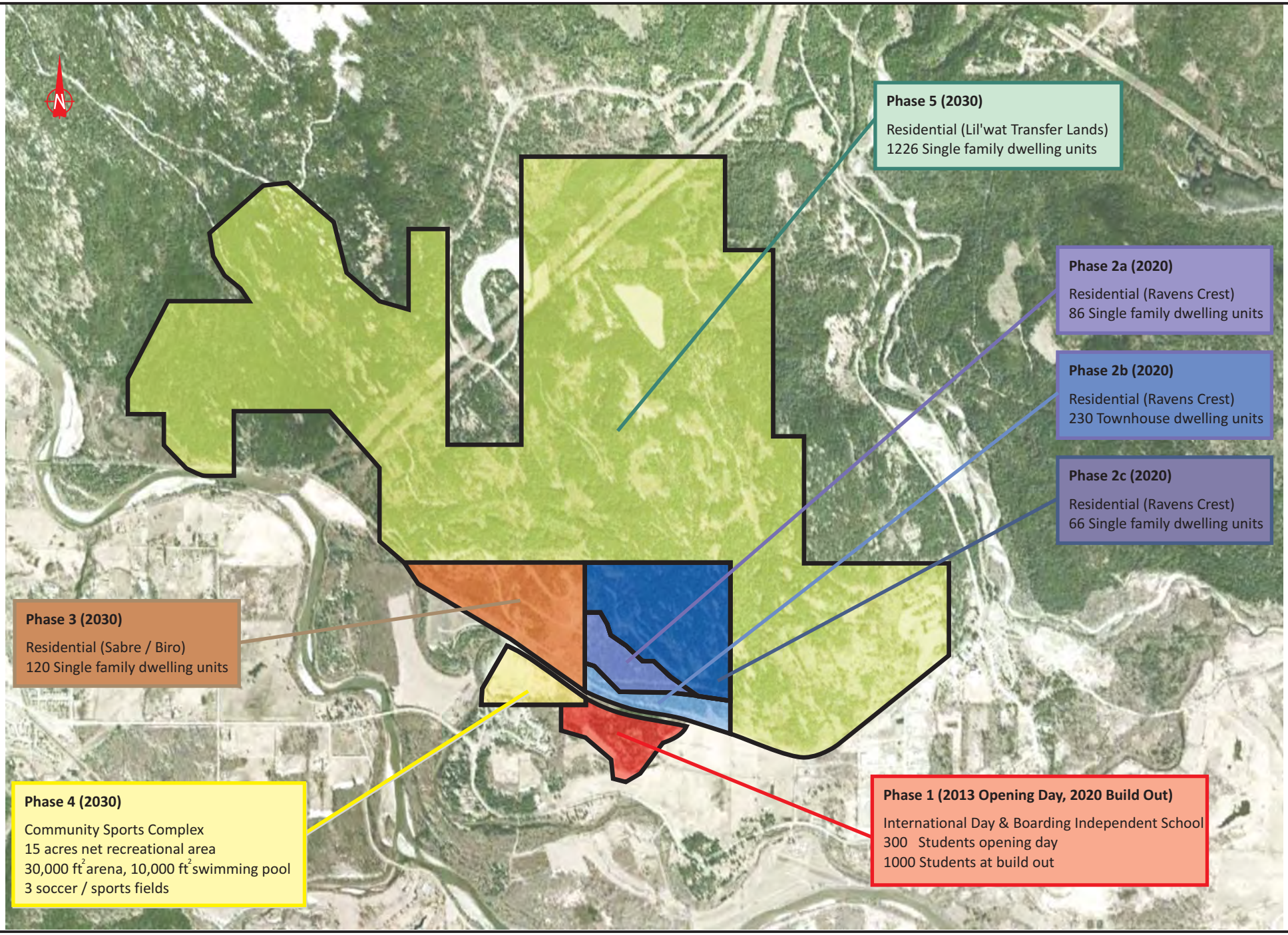
A number of individual developments are proposed in a phased manner. ***Table 1*** summarizes the individual components of the broader area plan while ***Figure 1*** shows the individual development components in their local context.

The density, land use and phasing timelines are based on the most recent assumptions provided by Ravens Crest Developments and are subject to change.

Table 1: Development Phasing Summary

Phase	Independent Variable	Land Use	Assumed Timeline
1	1,000 students at build out (300 opening day)	International Day & Boarding Independent School	2013 opening day, 2020 build out
2a	86 single family dwelling units	Residential (Ravens Crest)	2020
2b	230 townhouse dwelling units	Residential (Ravens Crest)	2020
2c	66 single family dwelling units	Residential (Ravens Crest)	2020
3	120 single family dwelling units	Residential (Sabre / Biro)	2030

Phase	Independent Variable	Land Use	Assumed Timeline
4	15 acres net recreational area, 30,000 ft2 arena, 10,000 ft2 swimming pool. 3 soccer / sports fields.	Community Sports Complex	2030
5	1,226 single family dwelling units	Residential (Lil'wat Transfer Lands)	2030



Delcan

Development Areas and Context

Figure 1

Access to the development sites is assumed to be via Pemberton Farm Road only. For Phase 1, access has conceptually been developed at Pemberton Farm Road approximately 100 m south of the existing east-west CN Rail line.

1.3 Scope of Work

As confirmed with Ravens Crest and the Ministry of Transportation, the scope of work for the subject Traffic Impact Study includes the following items:

- Review previous planning studies and collect AM and PM peak turning movement data at the Pemberton Farm Road / Highway 99 intersection;
- Confirm existing peak hour levels of service and identify any deficiencies in operations at the Pemberton Farm Road / Highway 99 intersection;
- Based on the development forecasts for each of the horizon years (2014, 2020 and 2030) generate peak hour site traffic and assign it to the area road network;
- Review the forecast peak hour levels of service and identify any improvements required to accommodate each horizon year's development traffic;
- Review and refine the Phase 1 site concept plan and its internal / external circulation layout;
- Develop a mitigation matrix for each phase of development identifying changes required and the timelines for implementation; and
- Prepare a TIS report for submission to Ravens Crest and the Ministry of Transportation

2.0 STUDY AREA AND ROAD NETWORK

The study area is immediately north of the Village of Pemberton centre within and adjacent to Agricultural Land Reserve (ALR) property.

The primary road transportation network includes the following facilities:

HIGHWAY 99

This primarily two-lane, undivided provincial highway travels north-south from Whistler to Lillooet and is on an east-west orientation as it passes the study area. The speed limit is currently 80 km/h east of Harrow Road. Passing is prohibited through the

Pemberton Farm Road intersection and shoulders are available on both sides of the road (approximately 0.5 to 1.0 m).

The Pemberton Farm Road / Highway 99 intersection is lighted, with an eastbound left and westbound right-turning lane. The Pemberton Farm Road approach is stop controlled while right-turns to and from Highway 99 are yield controlled and channelized.

PEMBERTON FARM ROAD

This two-lane local roadway is undivided and does not provide for shoulders or sidewalks. The speed limit is assumed to be 50 km/h.

Pemberton Valley Transit provides transit services between downtown Pemberton and the Xit'Olacw Subdivision via Highway 99 on Route 100. A stop is located at the Pemberton Farm Road / Highway 99 intersection. Only 7 trips per day are provided. From downtown Pemberton, a transfer can be made to the Whistler Commuter service.

3.0 EXISTING TRAFFIC CONDITIONS

3.1 Traffic Volumes

Existing traffic volumes on the study area road network were obtained through turning movement data collected by Delcan staff in July 2011. Note that historic permanent count data available from the Ministry of Transportation indicates July is a peak month for Highway 99 traffic volume. Peak hour turning movements are graphically summarized in ***Figure 2*** and the raw traffic data collection sheets are provided in ***Appendix A***. ***Table 2*** summarizes the representative link volumes rounded to the nearest five vehicles.

Table 2: Existing Representative Link Volumes (2011)

Link	AM Peak (vph)		PM Peak (vph)	
	Peak Direction	2-Way Total	Peak Direction	2-Way Total
Highway 99 west of Pemberton Farm Road	150 WB	270	260 WB	490
Highway 99 east of Pemberton Farm Road	125 WB	240	235 WB	435
Pemberton Farm Road north of Highway 99	30 SB	40	30 NB/SB	60

The above representative counts indicate the study area roads are operating within their accepted capacities for major road network elements. Heavy vehicles (including trucks and recreational vehicles) accounted for up to 10% of peak hour volume on Highway 99.

3.2 Levels of Service

Based on the most recent available traffic counts, intersection geometry and traffic control, a capacity analysis was undertaken using the SYNCHRO 6.0 program. ***Table 3*** summarizes the results. Detailed capacity analysis calculation sheets are included in ***Appendix B***. The LoS ratings are based on the highest movement delay for unsignalized intersections. For unsignalized intersections an LoS of better than D is desirable, but not always achievable given practical constraints.

Table 3: Existing Intersection Operations (2011)

Intersection	AM Peak			PM Peak		
	Maximum approach delay (s)	Max. Volume to Capacity Ratio	LoS (based on maximum delay)	Maximum approach delay	Max. Volume to Capacity Ratio	LoS (based on maximum delay)
Highway 99 / Pemberton Farm Road	9.3	0.09	A	10.7	0.19	B

As shown in ***Table 3***, the Highway 99 / Pemberton Farm Road intersection currently operates at a good level of service with minimal delays.

3.3 Recent and Projected Traffic Growth

The Village of Pemberton and the surrounding Squamish Lillooet Regional District (SLRD) are growing at a sustained pace. According to BC Stats, the SLRD has grown at approximately 1.6% per annum over the last ten years. Forecasts to 2036 indicate an average growth rate of 1.8% per annum could be sustained.

This is partially reflected in Average Annual Daily Traffic (AADT) volume growth on Highway 99 north of Whistler. From Ministry permanent counts dating to 2002, traffic growth has averaged a 0.5% increase per annum.

For the purposes of the subject study, it has been conservatively assumed that traffic growth along Highway 99 will increase at 2% per annum. This will account for growth outside of the subject Ravens Crest and surrounding properties.

Delcan

Existing Traffic Volumes

Figure 2

4.0 TRAFFIC GENERATION, DISTRIBUTION AND ASSIGNMENT

4.1 Traffic Generation

Given the unique nature of many of the proposed developments, a number of sources were referenced for traffic generation rates. The standard industry rates (from the Institute of Transportation Engineers) are discussed first, followed by potential adjustments to the standard rates.

For the International Day and Boarding School, no analogous land uses are available for reference in the ITE Traffic Generation Handbook. The closest land uses would be Junior / Community College (Land Use 450) and Private School K-12 (Land Use 536). While both land uses show a small sample size, the Private School was deemed more relevant with the application of a trip reduction factor of 70% to account for the percentage of students that will be boarded on-site. The recreational community centre has been assigned a trip rate proportional to its gross building floor area (Land Use 495), with a supplemental trip generation rate for the three soccer fields (Land Use 488), which are typically not accounted for in a standard recreational community centre trip generation rate. For residential uses, the standard ITE rates for single family (Land Use 210) and townhouse units (Land Use 230) were applied. Proposed trip generation rates are summarized in ***Table 4.***

Table 4: Trip Generation Rates

Phase	Independent Variable	ITE Land Use Code	Trip Rates			
			AM Peak Hour		PM Peak Hour	
1	300 to 1,000 students (70% boarding on-site)	536 – Private School K-12 (reduced by 70% to reflect on-site boarding)	0.24 / student	61% in	0.16 / student	40% in
2a	86 dwelling units	210 – Single Family Detached Housing	0.75 / DU	25% in	1.01 / DU	63% in
2b	230 dwelling units	230 – Residential Condominium / Townhouse	0.44 / DU	17% in	0.52 / DU	67% in
2c	66 dwelling units	210 – Single Family Detached Housing	0.75 / DU	25% in	1.01 / DU	63% in
3	120 dwelling units	210 – Single Family Detached Housing	0.75 / DU	25% in	1.01 / DU	63% in

4	40,000 ft2 building area (3 soccer / sports fields)	495- Recreational Community Centre	1.62 / 1,000 ft2 (1.40 / field)	61% in (50% in)	1.64 / 1,000 ft2 (20.67 / field)	29% in (69% in)
5	1,226 dwelling units	210 – Single Family Detached Housing	0.75 / DU	25% in	1.01 / DU	63% in
Note: the site trip generation rate selected is the rate corresponding with the peak hour of adjacent street traffic where available						

Using the relationships in ***Table 4*** above, ***Table 5*** summarizes the total traffic generation for each phase and horizon year.

Table 5: Total Trip Generation

Phase	Development	AM Peak			PM Peak		
		In	Out	Total	In	Out	Total
1	300 to 1,000 student International Day & Boarding Independent School	44 146	28 94	72 240	19 64	29 96	48 160
2013	*Sub-Total*	*44*	*28*	*72*	*19*	*29*	*48*
2020	*Sub-Total*	*146*	*94*	*240*	*64*	*96*	*160*
2a	86 single family dwelling units	16	48	64	54	32	86
2b	230 townhouse dwelling units	17	84	101	80	40	120
2c	66 single family dwelling units	12	38	50	42	25	67
2020	*Sub-Total*	*45*	*170*	*215*	*176*	*97*	*273*
3	120 single family dwelling units	22	68	90	76	45	121
4	Community Sports Complex & 3 Sports Fields	39 2	26 2	65 4	19 43	47 19	66 62
5	1,226 single family dwelling units	230	689	919	780	458	1,238
2030	*Sub-Total*	*293*	*785*	*1078*	*918*	*569*	*1487*

4.2 Traffic Distribution

Distribution of new site-generated traffic volume was derived from prevailing traffic distribution patterns at Pemberton Farm Road / Highway 99, as well as, a review of regional population and employment distribution.

The broader commuter peak distribution was based on information from Statistics Canada's Place of Work survey which indicates that of the 1,495 labour force in Pemberton, approximately 10% work at home and over 40% work in a different municipality.

For residential components of development, the distribution is estimated as follows:

- 40% to/from the west via Highway 99 (to Squamish / Whistler);
- 10% remain internal to the development (work at home);
- 10% to/from the east via Highway 99 (to Lillooet, Mt. Currie and the Pemberton Industrial Park
- 40% to/from the west via Highway 99 (to downtown Pemberton)

100%

For the Institutional and Recreational components of the development, it has been assumed the distribution is reflective of the local population base, as this is where students, instructors and recreational facility users will be drawn from.

A 90% / 10% west / east distribution has been assumed for the non-residential development components.

5.0 PROJECTED TRAFFIC CONDITIONS

The subsequent analysis determines the levels of service at the study area intersection under a series of phased development scenarios. For each phase, site-generated traffic is superimposed onto base year conditions (2013, 2020 or 2030) which have been adjusted by the appropriate growth factor reflecting a 2% per annum growth rate. Detailed capacity calculation sheets are included in ***Appendix D***. If acceptable performance could not be achieved, physical modifications were identified and/or traffic signal warrants were reviewed (see ***Appendix E***).

Truck percentages were assumed to remain constant throughout the study period. The 2013 and 2020 peak hour factors were assumed to remain unchanged from existing conditions. However, 2030 traffic patterns are expected to vary significantly from existing conditions, thus a Synchro default peak hour factor of 0.92 was assumed.

5.1 Phase 1: Site Plus Background Growth to 2013

Phase 1 accounts for the development of the International Day and Boarding School by 2013 with 300 students. Background traffic on Highway 99 has been factored up by 1.04 reflecting two years of growth at 2% per annum. Site-generated traffic volumes for Phase 1 are graphically illustrated in ***Figure 3*** and total projected traffic volumes are shown in ***Figure 4***.

Table 6 summarizes the projected levels of service for the end of Phase 1.

Table 6: Projected Traffic Conditions (2013, End of Phase 1)

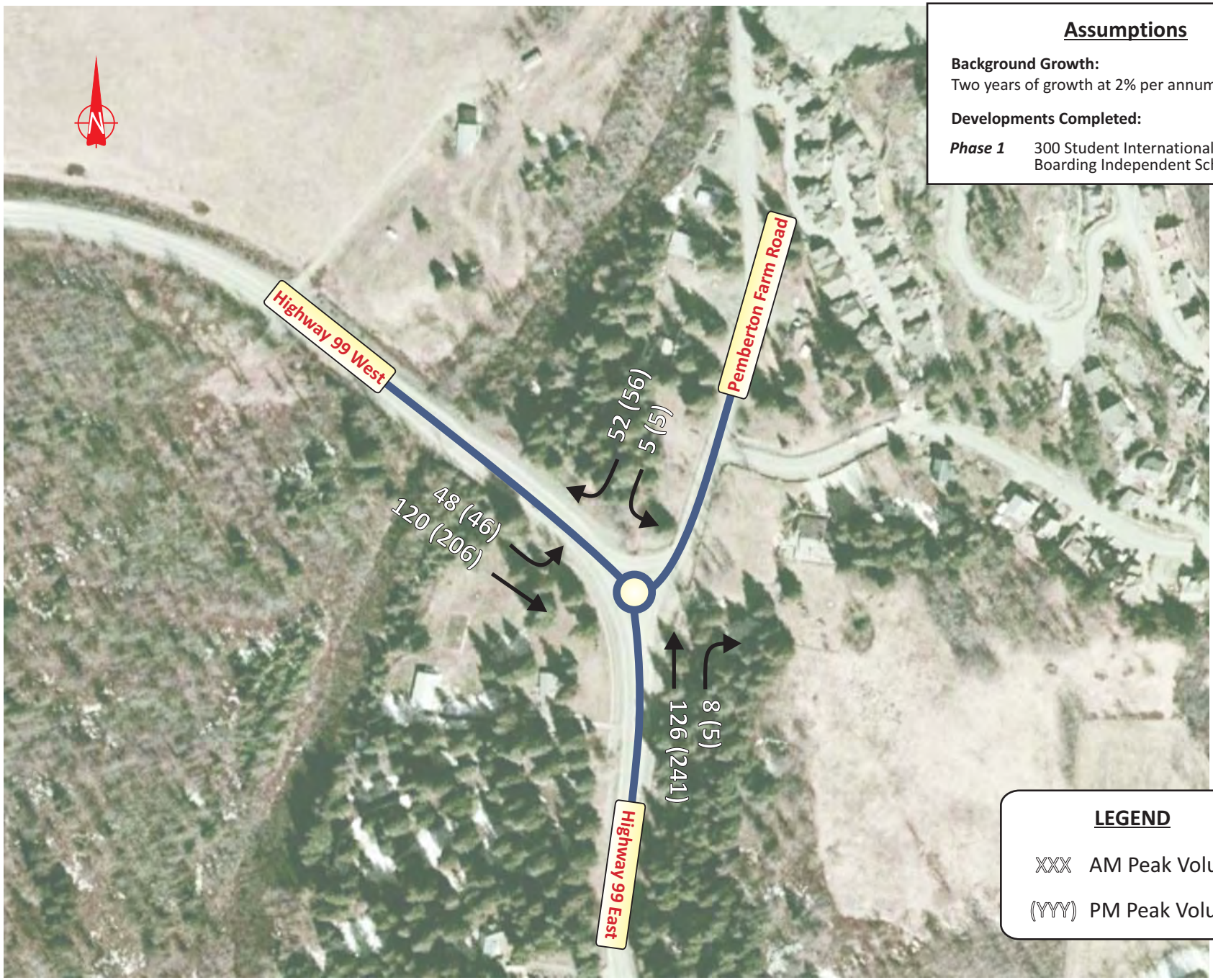
Intersection	AM Peak			PM Peak		
	Maximum approach delay (s)	Max. Volume to Capacity Ratio	LoS (based on maximum delay)	Maximum approach delay	Max. Volume to Capacity Ratio	LoS (based on maximum delay)
Highway 99 / Pemberton Farm Road	9.7	0.09	A	11.3	0.19	B

As shown in ***Table 6***, the addition of background traffic growth and site traffic would have a very slight impact on traffic operations at the intersection. Maximum approach delay would increase by only 0.4 seconds/vehicle in the AM peak and 0.6 seconds/vehicle in the PM peak compared to existing conditions. No physical modifications would be required at the intersection.

Delcan

Phase 1 (2013): Site Generated Traffic Volumes

Figure 3



Assumptions

Background Growth:
Two years of growth at 2% per annum

Developments Completed:

Phase 1 300 Student International Day and Boarding Independent School

LEGEND

XXX AM Peak Volume

(YYY) PM Peak Volume

Delcan

Phase 1 (2013): Total Projected Traffic Volumes

Figure 4

5.2 Phase 2: Site Plus Background Growth to 2020

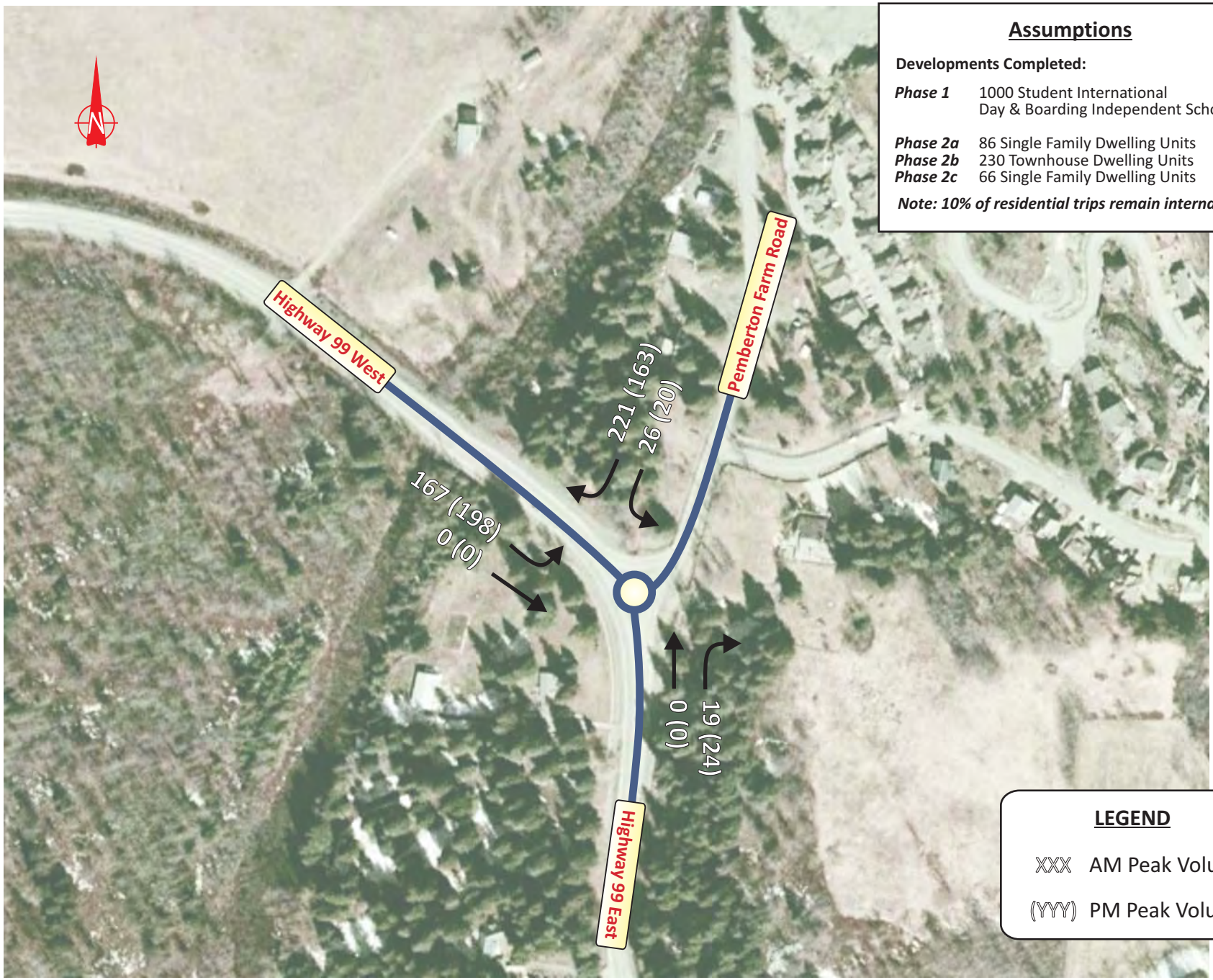
For Phase 2 (Phases 2a through 2c), existing traffic volumes were adjusted to account for nine years of background traffic growth (at 2% per annum for a growth factor of 1.19) before superimposing traffic generated by the International Day and Boarding School (increased enrollment to 1,000 students), 152 single family dwelling units and 230 townhouse dwelling units. Site-generated traffic volumes for the end of Phase 2 are graphically illustrated in ***Figure 5*** and total projected traffic volumes are shown in ***Figure 6***.

Table 7 summarizes the projected levels of service for the end of Phase 2.

Table 7: Projected Traffic Conditions (2020, End of Phase 2)

Intersection	AM Peak			PM Peak		
	Maximum approach delay (s)	Max. Volume to Capacity Ratio	LoS (based on maximum delay)	Maximum approach delay	Max. Volume to Capacity Ratio	LoS (based on maximum delay)
Highway 99 / Pemberton Farm Road	13.1	0.34	B	19.6	0.47	C

As shown in ***Table 7***, the addition of background traffic growth and site traffic would have moderate impacts on traffic operations. Although overall intersection LoS remains at A, maximum approach delays increase by 3.1 seconds/vehicle and 6.9 seconds/vehicle in the AM and PM peaks, respectively, compared to existing conditions. As shown in ***Appendix D***, the SBL and SBR movements from Pemberton Farm Road have LoS's of B and C in the AM and PM peaks respectively. The LoS for these movements suggest the intersection is still capable of handling the new assigned traffic in conjunction with background growth, and as such, no modifications would be required to the existing configuration.



Assumptions

Developments Completed:

Phase 1	1000 Student International Day & Boarding Independent School
Phase 2a	86 Single Family Dwelling Units
Phase 2b	230 Townhouse Dwelling Units
Phase 2c	66 Single Family Dwelling Units

Note: 10% of residential trips remain internal to the site

LEGEND

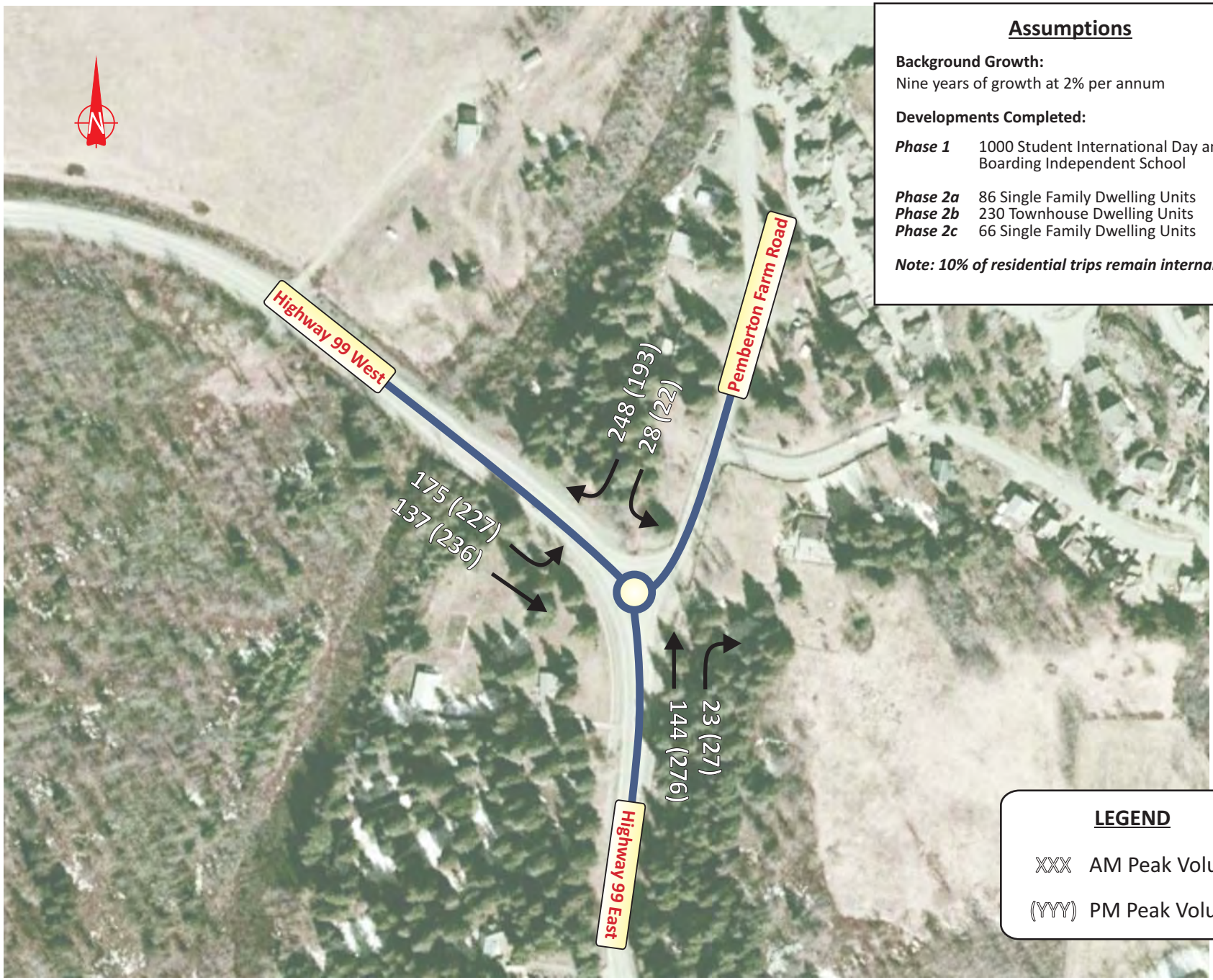
XXX AM Peak Volume

(YYY) PM Peak Volume

Delcan

End of Phase 2a - 2c (2020): Site Generated Traffic Volumes

Figure 5



Assumptions

Background Growth:
Nine years of growth at 2% per annum

Developments Completed:

Phase 1	1000 Student International Day and Boarding Independent School
Phase 2a	86 Single Family Dwelling Units
Phase 2b	230 Townhouse Dwelling Units
Phase 2c	66 Single Family Dwelling Units

Note: 10% of residential trips remain internal to the site

LEGEND

XXX AM Peak Volume

(YYY) PM Peak Volume

Delcan

End of Phase 2a - 2c (2020): Total Projected Traffic Volumes

Figure 6

5.3 Phases 3 - 5: Site Plus Background Traffic 2030

For Phases 3 through 5, existing traffic volumes were adjusted to account for nineteen years of background traffic growth (at 2% per annum for a growth factor of 1.46) before superimposing traffic generated by the International Day and Boarding Independent School (increased enrollment to 1,000 students), 152 single family dwelling units and 230 townhouse dwelling units from the Ravens Crest Development, the Sabre / Biro 120 unit residential subdivision, the Pemberton Community Sports Complex and the 1,226 single family units from the Lil'wat Transfer Lands. Site-generated traffic volumes for the end of Phases 3 to 5 are graphically illustrated in ***Figure 7*** and total projected traffic volumes are shown in ***Figure 8***.

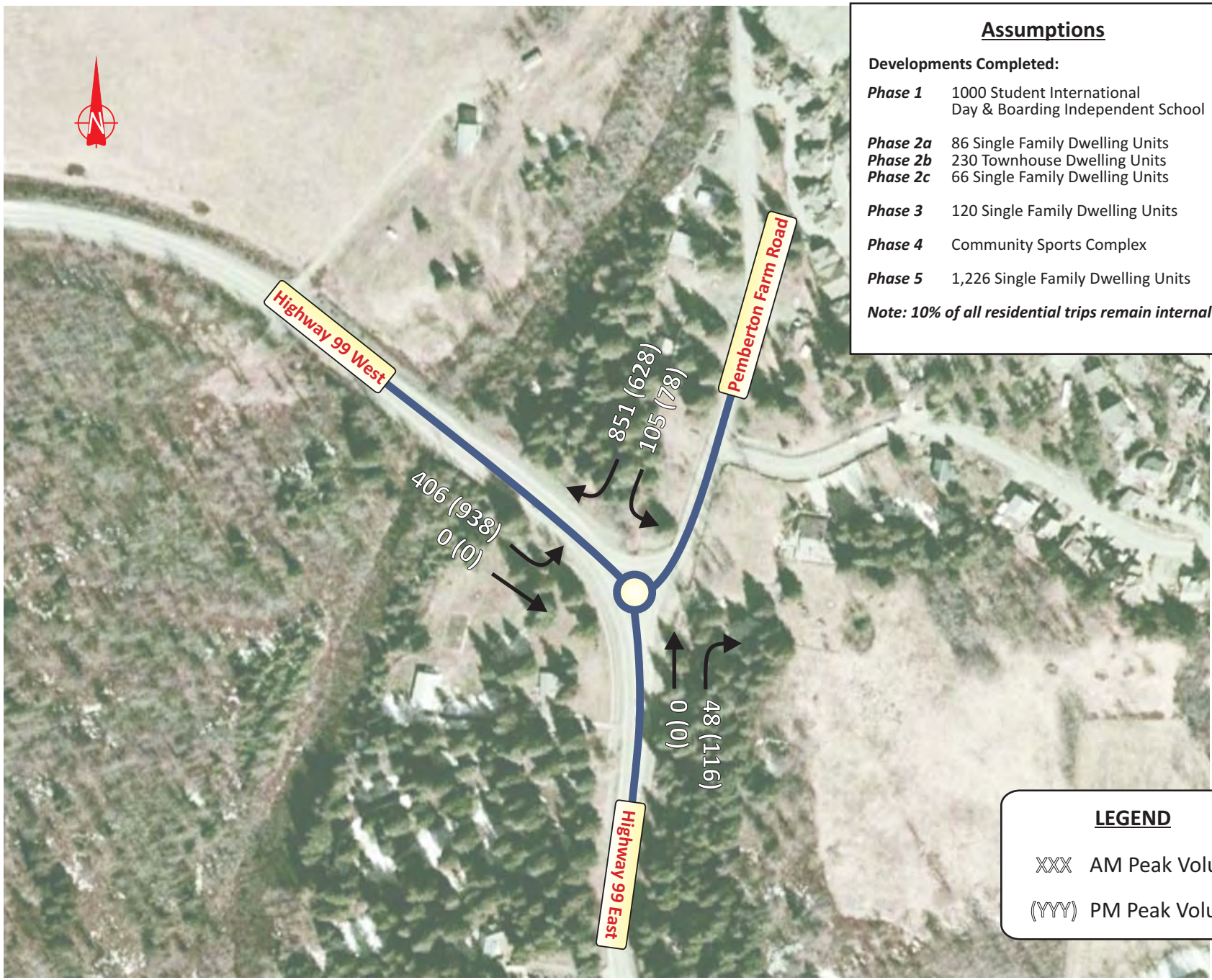
Table 8 summarizes the projected levels of service for the end of Phases 3-5. Mitigated conditions are shown in square brackets.

Table 8: Projected Traffic Conditions (2030, End of Phase 3)

Intersection	AM Peak			PM Peak		
	Maximum approach delay (s)	Max. Volume to Capacity Ratio	LoS (based on delay)	Maximum approach delay	Max. Volume to Capacity Ratio	LoS (based on delay)
Highway 99 / Pemberton Farm Road	>180 [7.8]	1.38 [0.61]	F [A]	>180 [16.0]	>2.0 [0.82]	F [B]

As shown in ***Table 8***, the addition of background traffic growth and site traffic would cause the intersection to fail under existing conditions. In particular, the SB movements from Pemberton Farm Road would experience extremely high delays. Thus, mitigation is required in the form of signalization, provision of double eastbound to northbound left-turn lanes and a southbound to westbound right-turn lane. The results of mitigation are shown in the square brackets in ***Table 8.***

As an alternative mitigation measure, an alternative road connection could be explored between the site and Highway 99 or downtown Pemberton. Depending on the quality of the connection, it could relieve the impacts to the Highway 99 / Pemberton Farm Road intersection and possibly reduce the mitigation requirements.



Assumptions

Developments Completed:

Phase 1	1000 Student International Day & Boarding Independent School
Phase 2a	86 Single Family Dwelling Units
Phase 2b	230 Townhouse Dwelling Units
Phase 2c	66 Single Family Dwelling Units
Phase 3	120 Single Family Dwelling Units
Phase 4	Community Sports Complex
Phase 5	1,226 Single Family Dwelling Units

Note: 10% of all residential trips remain internal to the site

LEGEND

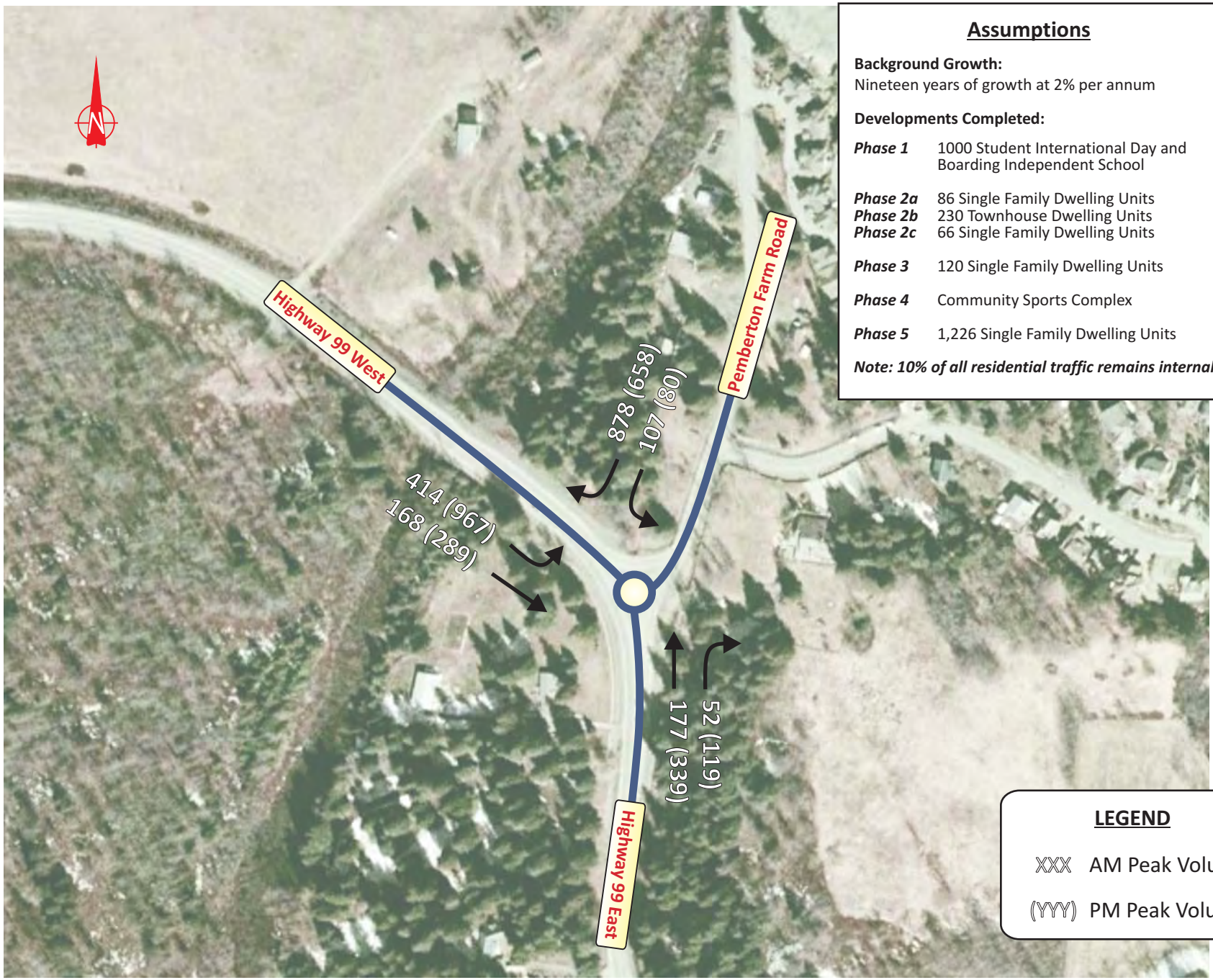
XXX AM Peak Volume

(YYY) PM Peak Volume

Delcan

End of Phase 3 - 5 (2030): Site Generated Traffic Volumes

Figure 7



Assumptions

Background Growth:
Nineteen years of growth at 2% per annum

Developments Completed:

Phase 1	1000 Student International Day and Boarding Independent School
Phase 2a	86 Single Family Dwelling Units
Phase 2b	230 Townhouse Dwelling Units
Phase 2c	66 Single Family Dwelling Units
Phase 3	120 Single Family Dwelling Units
Phase 4	Community Sports Complex
Phase 5	1,226 Single Family Dwelling Units

Note: 10% of all residential traffic remains internal to the site

LEGEND

XXX AM Peak Volume

(YYY) PM Peak Volume

Delcan

End of Phase 3 - 5 (2030): Total Projected Traffic Volumes

Figure 8

ROAD-RAIL CROSSING ANALYSIS

For Phase 1, no traffic will be crossing the CN at-grade crossing located to the north as there is no outlet to connecting highways. For future phases, however, additional traffic will be using the crossing and this may increase daily road-rail cross products to a level requiring a crossing upgrade. Note that only the new residential traffic (discounted by 10% to reflect work at home) is assumed to cross the CN railway as both the Boarding School and the Recreational Centre will have an access located south of the crossing.

It is assumed that CN currently runs 4 trains a day on average through the Pemberton Farm Road crossing. This is based on information obtained in 2008, however, this number may increase or decrease based on CN's business plans.

Table 9 summarizes forecast cross-products on the Pemberton Farm Road / CN Rail crossing. Daily volumes on Pemberton Farm Road have been estimated using a peak hour to daily factor of 10 and are multiplied by four (trains per day) to obtain the estimated cross product.

Table 9: Road-Rail Cross Products

Phase	Pemberton Farm Road at CN Rail Cross Product (daily vehicles x daily trains)
1 (2013)	n/a – generated traffic remains south of the rail crossing
2 (2020)	2,220 vpd x 4 tpd = 8,880
3-5 (2030)	16,020 vph x 4 tpd = 64,080

As shown in ***Table 9***, cross products of road and rail volumes are expected to increase as a result of development. Currently, rail crossings are STOP-controlled only. Transport Canada thresholds for upgraded signalization are based on cross products with a cross product of over 1,000 or more warranting bells and signals, and over 50,000 warranting gate controls. If the cross product forecasts are realized, this would require bells and signals by the end of 2020 and gates by the end of 2030.

6.0 MITIGATION MEASURES

Based on the foregoing analysis, a number of road modifications have been recommended. They have been summarized by scenario in ***Table 10***.

Table 10: Mitigation Matrix

Development	Implementation Timeframe		
	Opening Day (2013)	Short Term (2020)	Long Term (2030)
Baseline	n/a	n/a	n/a
Total development (including background traffic growth)	n/a	n/a	• Provide signalized control at intersection of Highway 99 and Pemberton Farm Road • Provide dual left turn lanes with 150m storage lengths, on Highway 99 Eastbound • Provide two NB lanes on Pemberton Farm Road for approximately 150 m • Provide 35m storage bay for SB Left turn from Pemberton Farm Road • Provide 60 m acceleration lane from Pemberton Farm Road southbound to Highway 99 westbound

Based on the 2030 build-out turning movement volumes, the required storage lengths were calculated for key intersections using the 95th percentile queue as reported by Synchro or 1.5 times the average number of vehicles to be stored per cycle for signalized intersections (whichever is higher). The acceleration distance was calculated from TAC Table 2.3.10.1.

ROAD CROSS SECTION IMPLICATIONS

Forecast laning requirements are based on directional link volumes. With a peak directional volume of 1,070 vph immediately north of Highway 99, by 2030 the developed section of Pemberton Farm Road should be upgraded to major collector standards to accommodate link flows.

7.0 SITE ACCESS AND CIRCULATION

Although the proposed site plans have not been developed in detail, based on the preliminary layout of the Phase 1 Independent School and the Community Recreation Centre shown in Appendix E, the following are some general comments:

- The main access to/from the Independent School is spaced approximately 100 m from the CN rail line which and is in a clear line of sight which will allow for minimal impacts to the rail line. Future accesses to/from additional development phases should be located at a very minimum 30 m from the rail line or where traffic analysis indicates queuing will not be an issue.
- The access point to/from the Community Sports Complex should be designed to protect adequate sight triangles given that it lies on the inside of a curve.
- As the residential community builds out, the selection of an appropriate roadway cross-section and neighborhood layout should take into consideration design elements to facilitate pedestrian and cyclist connectivity, control vehicle speeds and allow for a safe, but context-sensitive roadway footprint.
- The size of the potential new residential community may warrant transit service in the future and roadway cross sections and turning radii should accommodate these vehicles and their stops at key junctions.

8.0 PEDESTRIAN AND BICYCLE NETWORK

With the implementation of roadway improvements to service planned development there is an opportunity to enhance safety and convenience for these modes of travel. With the potential upgrade of Pemberton Farm Road to a major collector standard, it is recommended that wider shoulder lanes be provided to facilitate on-road cycling. Sidewalks should be provided on a minimum of one side of the road to allow walking connectivity with the proposed school and recreational sites. For long term community development, it is suggested than an alternative multi-use pathway connection between the site and downtown be explored. One alternative corridor would be alongside the CN rail crossing of the Lillooet River (a possible extension of the Friendship Trail).

9.0 FINDINGS AND RECOMMENDATIONS

Based on the foregoing analysis, the following findings and recommendations are provided:

1. Over the next 19 years, a multi-phase mix of development may be completed along Pemberton Farm Road. These consist of a 1,000 student International Day & Boarding Independent School, up to 1,698 residential dwelling units and a 40,000 ft2 Community Sports Complex including 3 soccer / sports fields.
2. The Pemberton Farm Road / Highway 99 intersection is the sole proposed access point for all subject developments. Based on July 2011 traffic counts, this stop-controlled intersection currently operates at a very good level of service.
3. The Squamish Lillooet Regional District is forecast to grow at just under 2.0% per annum over the next 19 years. Background traffic growth along Highway 99 is assumed to increase proportionally.
4. Using the most analogous ITE trip generation rates and appropriate discount factors, by 2013 the International Day & Boarding Independent School Site will generate up to 72 vph in the AM peak hour. By 2020, the addition of 382 residential dwelling units will add an additional 273 vph, along with an additional 168 vph generated by increased enrollment at the Indepedent School. By 2030, an additional 1,346 dwelling units will increase traffic by 1,358 vph and a new Community Sports Complex will increase traffic by 128 vph. Note that 10% of all residential trips are assumed to remain internal to the site (i.e. work at home) as per prevailing trends.
5. For the 2013 horizon year, minimal impacts to levels of service at Pemberton Farm Road / Highway 99 are expected and no mitigation measures are required as a result of development traffic.
6. For the 2020 horizon year, moderate impacts to levels of service at Pemberton Farm Road / Highway 99 are expected and no mitigation measures are required as a result of development traffic.
7. For the 2030 horizon year, significant deterioration in levels of service at Pemberton Farm Road / Highway 99 are expected to trigger the following mitigation measures:
    - Provide signalized control at intersection of Highway 99 and Pemberton Farm Road
    - Provide dual left turn lanes with 150m storage lengths, on Highway 99 Eastbound
    - Provide two NB lanes on Pemberton Farm Road for approximately 150 m

- Provide 35m storage bay for SB Left turn from Pemberton Farm Road
- Provide 60 m acceleration lane from Pemberton Farm Road southbound to Highway 99 westbound

8. Based on the estimated current number of daily train crossings of Pemberton Farm Road, an upgrade of the crossing control to bells and flashers by 2020 and to gates by 2030 is potentially required according to Transport Canada standards.
9. Both the upgrades to the Pemberton Farm Road / Highway 99 intersection and the Pemberton Farm Road / CN Rail crossing could be avoided or deferred through the provision of an alternative connection to either Highway 99 or downtown Pemberton.
10. By 2030, if assumed development levels are realized, Pemberton Farm Road should be upgraded to a major collector standard with wide shoulder lanes for on-road cycling and sidewalks in the vicinity of the school and recreational sites.
11. As the preliminary concept plans are refined in more detail, consider locating future accesses at a very minimum 30 m from the rail line or where traffic analysis indicates queuing will not be an issue. The access point to/from the Community Recreation Centre should be designed to protect adequate sight triangles given that it lies on the inside of a curve. The selection of an appropriate roadway cross-section and neighborhood layout should take into consideration design elements to facilitate pedestrian and cyclist connectivity, control vehicle speeds and allow for a safe, but context-sensitive roadway footprint.

APPENDIX A

Existing Traffic Counts

TRAFFIC COUNT

N/S Street Pemberton Farm Road
E/W Street Highway 99
Date: July 1, 2020
Day: Wednesday
Weather: Wet, Not Raining, Cloudy, Full Cover

GP

Time Starting	SBL	SBR	EBL	EBT	WBT	WBR
7:30 AM	0	7	3	14	15	0
7:45 AM	0	9	1	17	31	0
8:00 AM	2	3	2	21	30	1
8:15 AM	1	5	2	25	22	0
8:30 AM	0	8	3	15	29	1
8:45 AM	0	8	0	26	33	1
9:00 AM	1	5	3	37	26	1
9:15 AM	1	7	2	20	24	0
9:30 AM	0	5	4	22	25	0

Heavy Vehicles

Time Starting	SBL	SBR	EBL	EBT	WBT	WBR
7:30 AM	0	0	0	0	1	0
7:45 AM	0	0	0	0	2	0
8:00 AM	0	0	0	2	3	0
8:15 AM	0	0	0	4	0	0
8:30 AM	0	0	0	2	4	1
8:45 AM	0	0	0	4	3	0
9:00 AM	0	1	0	2	4	0
9:15 AM	0	1	0	3	0	0
9:30 AM	0	0	0	0	1	0

TOTAL

Time Starting	SBL	SBR	EBL	EBT	WBT	WBR
7:30 AM	0	7	3	14	16	0
7:45 AM	0	9	1	17	33	0
8:00 AM	2	3	2	23	33	1
8:15 AM	1	5	2	29	22	0
8:30 AM	0	8	3	17	33	2
8:45 AM	0	8	0	30	36	1
9:00 AM	1	6	3	39	30	1
9:15 AM	1	8	2	23	24	0
9:30 AM	0	5	4	22	26	0

TRAFFIC COUNT

N/S Street Pemberton Farm Road
E/W Street Highway 99
Date: July 1, 2019
Day: Tuesday
Weather: Sunny with clouds

GP

Time Starting	SBL	SBR	EBL	EBT	WBT	WBR
3:00 PM	1	7	7	32	40	1
3:15 PM	4	1	1	24	31	2
3:30 PM	1	2	7	31	34	0
3:45 PM	1	3	4	32	29	2
4:00 PM	2	3	7	47	49	0
4:15 PM	1	8	8	44	67	1
4:30 PM	0	11	4	52	39	2
4:45 PM	0	5	6	43	46	0
5:00 PM	1	4	10	50	53	0
5:15 PM	0	2	8	41	52	0
5:30 PM	0	7	17	29	34	1
5:45 PM	1	1	7	45	31	1

Heavy Vehicles

Time Starting	SBL	SBR	EBL	EBT	WBT	WBR
3:00 PM	0	0	0	4	4	0
3:15 PM	1	0	0	2	5	1
3:30 PM	0	0	0	3	5	0
3:45 PM	0	0	1	2	9	1
4:00 PM	0	1	1	8	5	0
4:15 PM	0	1	0	1	12	0
4:30 PM	0	1	0	3	4	0
4:45 PM	0	0	0	3	6	0
5:00 PM	0	0	1	2	5	0
5:15 PM	0	0	0	1	3	1
5:30 PM	0	0	0	2	5	0
5:45 PM	0	1	1	2	6	0

TOTAL

Time Starting	SBL	SBR	EBL	EBT	WBT	WBR
3:00 PM	1	7	7	36	44	1
3:15 PM	5	1	1	26	36	3
3:30 PM	1	2	7	34	39	0
3:45 PM	1	3	5	34	38	3
4:00 PM	2	4	8	55	54	0
4:15 PM	1	9	8	45	79	1
4:30 PM	0	12	4	55	43	2
4:45 PM	0	5	6	46	52	0
5:00 PM	1	4	11	52	58	0
5:15 PM	0	2	8	42	55	1
5:30 PM	0	7	17	31	39	1
5:45 PM	1	2	8	47	37	1

APPENDIX B

Existing Conditions Capacity Analysis

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	2	27	121	4	8	115
Peak Hour Factor	0.50	0.84	0.84	0.50	0.67	0.74
Hourly flow rate (vph)	4	32	144	8	12	155
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	323	144			144	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	323	144			144	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	96			99	
cM capacity (veh/h)	669	898			1451	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	36	144	8	12	155
Volume Left	4	0	0	12	0
Volume Right	32	0	8	0	0
cSH	1010	1700	1700	1451	1700
Volume to Capacity	0.04	0.08	0.00	0.01	0.09
Queue Length 95th (m)	0.9	0.0	0.0	0.2	0.0
Control Delay (s)	9.3	0.0	0.0	7.5	0.0
Lane LOS	A			A	
Approach Delay (s)	9.3	0.0		0.5	
Approach LOS	A				

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	16.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	2	30	232	3	29	198
Peak Hour Factor	0.50	0.63	0.73	0.38	0.66	0.90
Hourly flow rate (vph)	4	48	318	8	44	220
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	626	318			318	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	626	318			318	
tC, single (s)	6.4	6.3			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.2	
p0 queue free %	99	93			96	
cM capacity (veh/h)	435	711			1237	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	52	318	8	44	220
Volume Left	4	0	0	44	0
Volume Right	48	0	8	0	0
cSH	771	1700	1700	1237	1700
Volume to Capacity	0.07	0.19	0.00	0.04	0.13
Queue Length 95th (m)	1.7	0.0	0.0	0.9	0.0
Control Delay (s)	10.7	0.0	0.0	8.0	0.0
Lane LOS	B			A	
Approach Delay (s)	10.7	0.0		1.3	
Approach LOS	B				

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	28.9%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX C

Trip Generation Rates

Private School (K-12)
(536)

Average Vehicle Trip Ends vs: Students
On a: Weekday,
A.M. Peak Hour

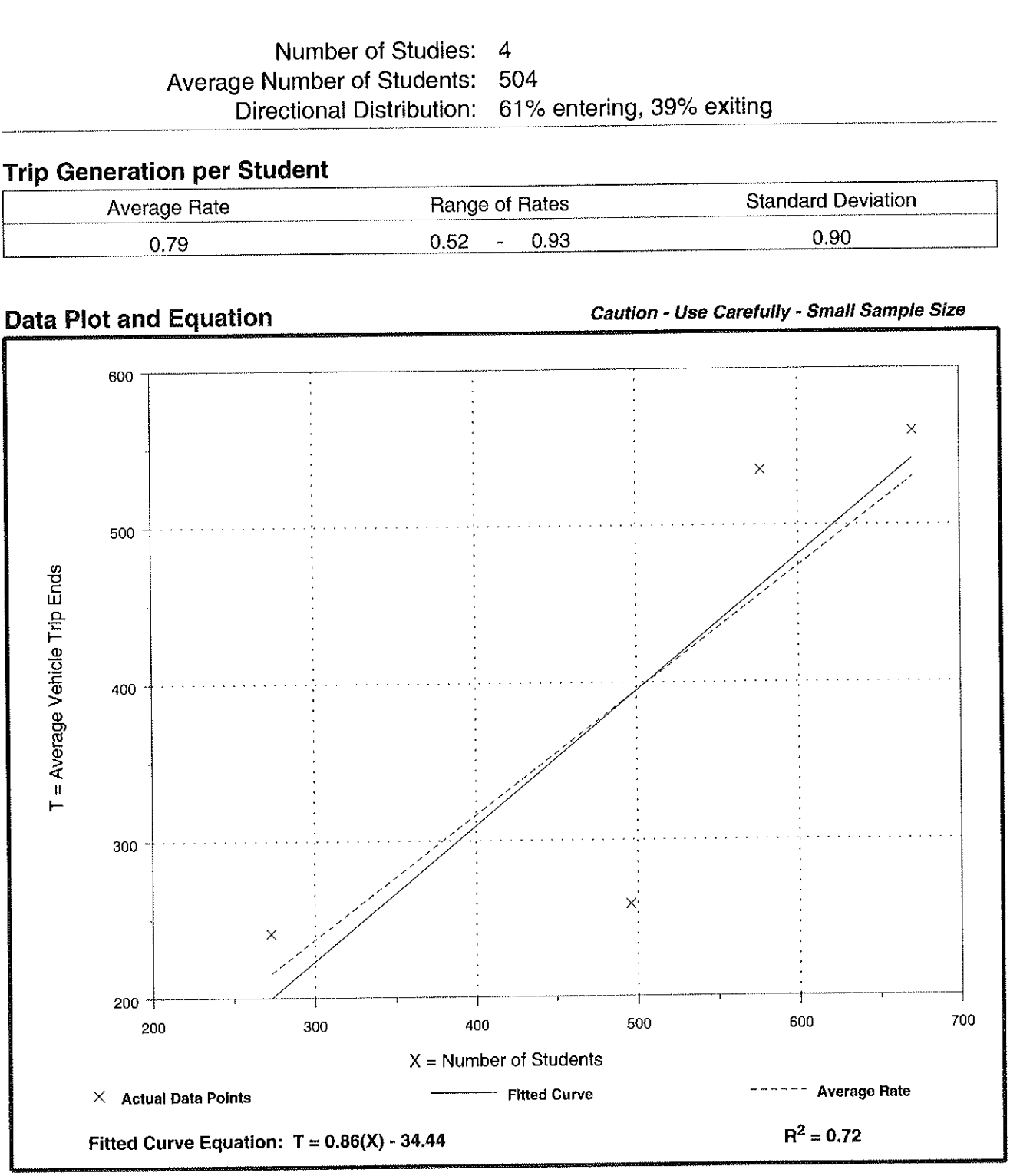
Number of Studies: 4
Average Number of Students: 504
Directional Distribution: 61% entering, 39% exiting

Trip Generation per Student

Average Rate	Range of Rates	Standard Deviation
0.79	0.52 - 0.93	0.90

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: T = 0.86(X) - 34.44

R^2 = 0.72

Private School (K-12)
(536)

Average Vehicle Trip Ends vs: Students
On a: Weekday,
P.M. Peak Hour of Generator

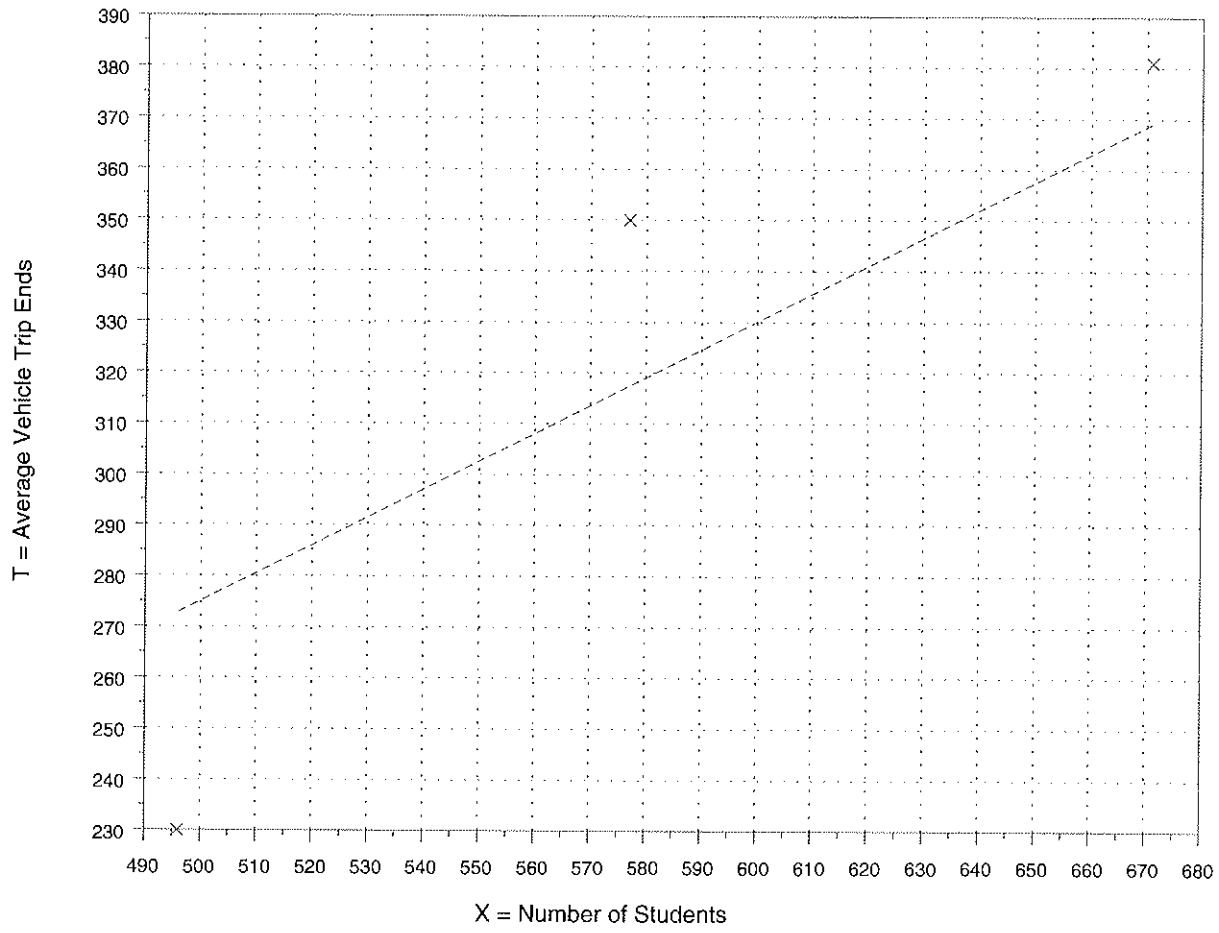
Number of Studies: 3
Average Number of Students: 581
Directional Distribution: 41% entering, 59% exiting

Trip Generation per Student

Average Rate	Range of Rates	Standard Deviation
0.55	0.46 - 0.61	0.74

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Soccer Complex
(488)

Average Vehicle Trip Ends vs: **Fields**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

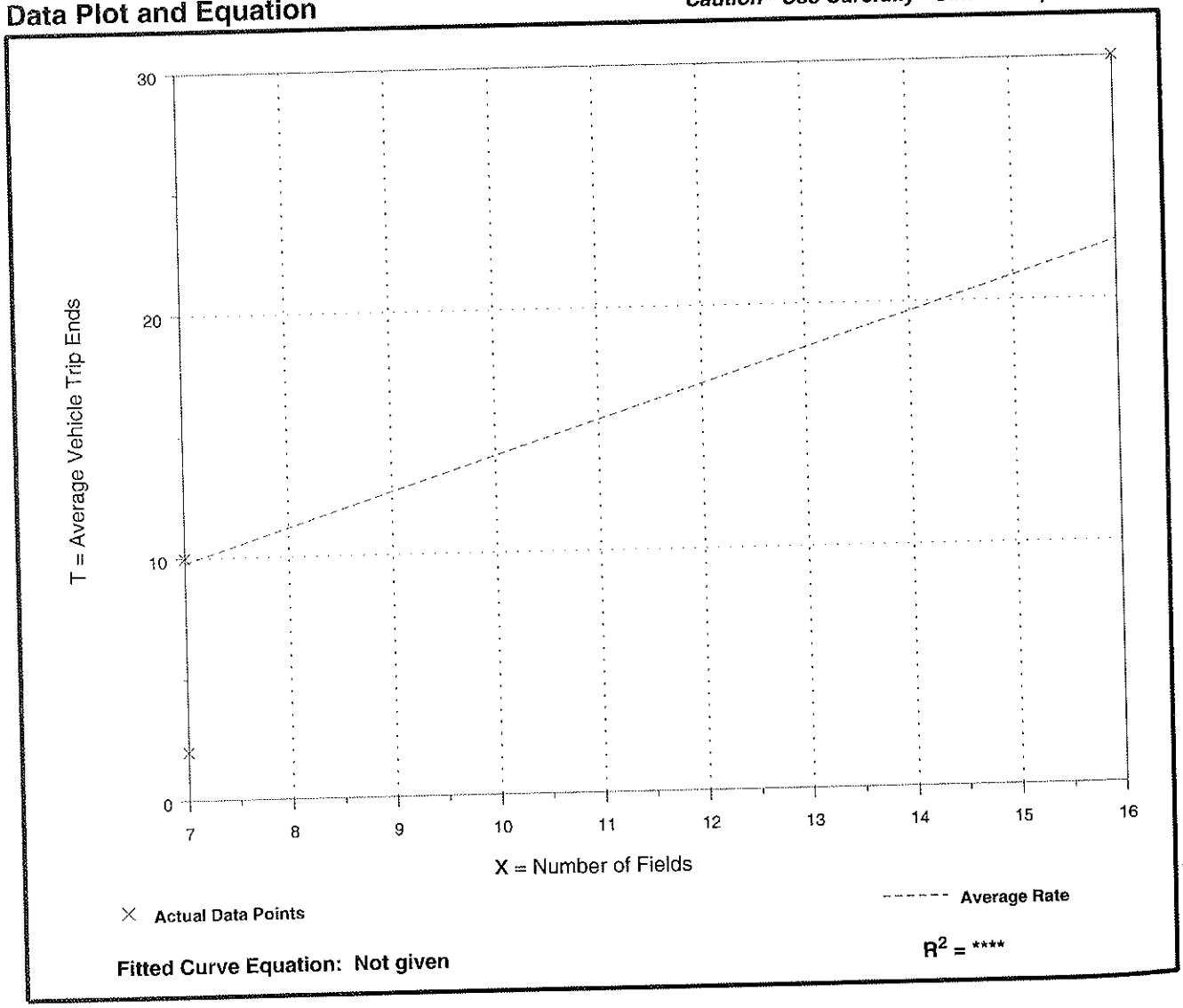
Number of Studies: 3
Average Number of Fields: 10
Directional Distribution: 50% entering, 50% exiting

Trip Generation per Field

Average Rate	Range of Rates	Standard Deviation
1.40	0.29 - 1.88	1.32

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Soccer Complex
(488)

Average Vehicle Trip Ends vs: **Fields**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

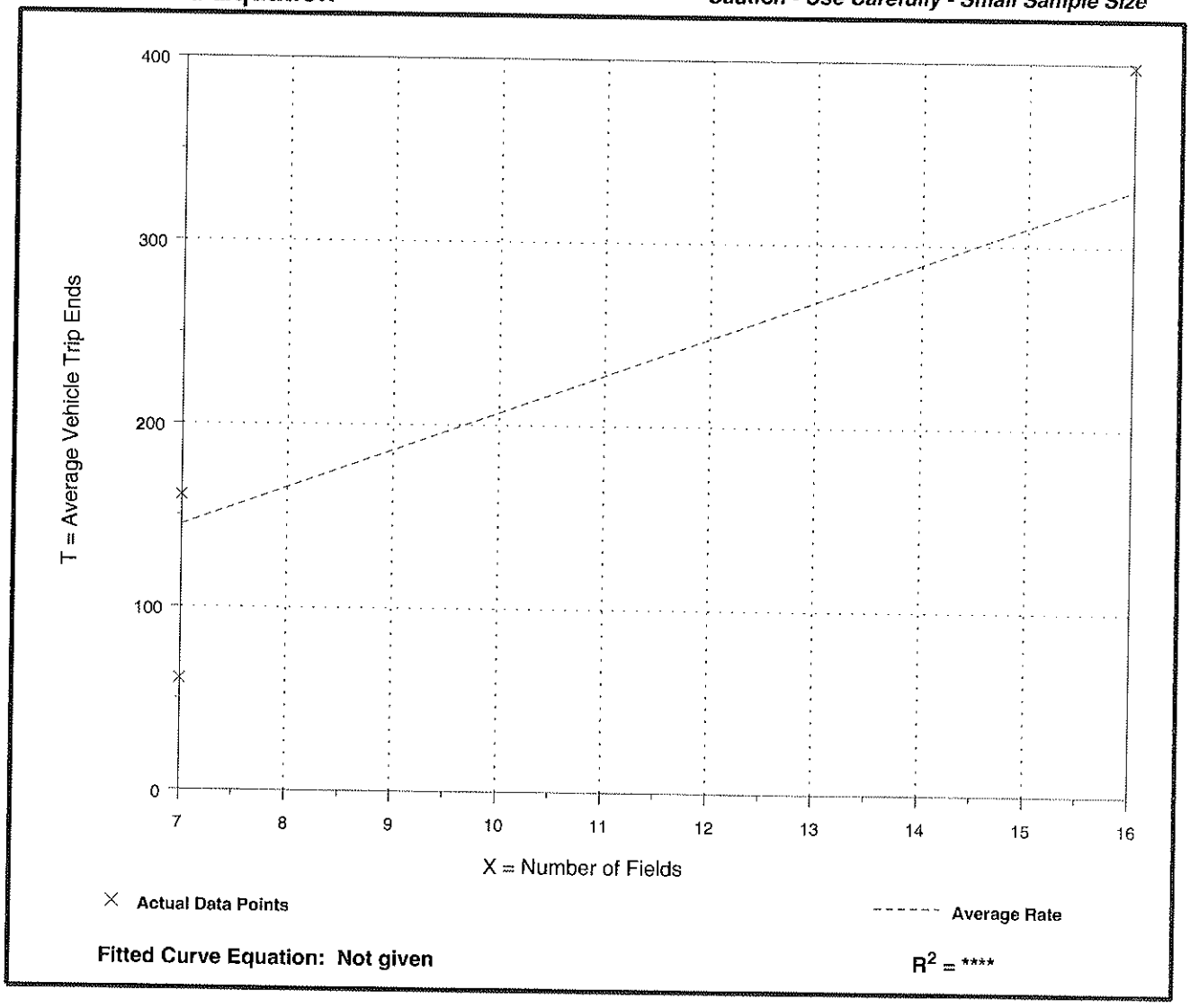
Number of Studies: 3
Average Number of Fields: 10
Directional Distribution: 69% entering, 31% exiting

Trip Generation per Field

Average Rate	Range of Rates	Standard Deviation
20.67	8.71 - 24.88	8.06

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Recreational Community Center
(495)

Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Floor Area**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

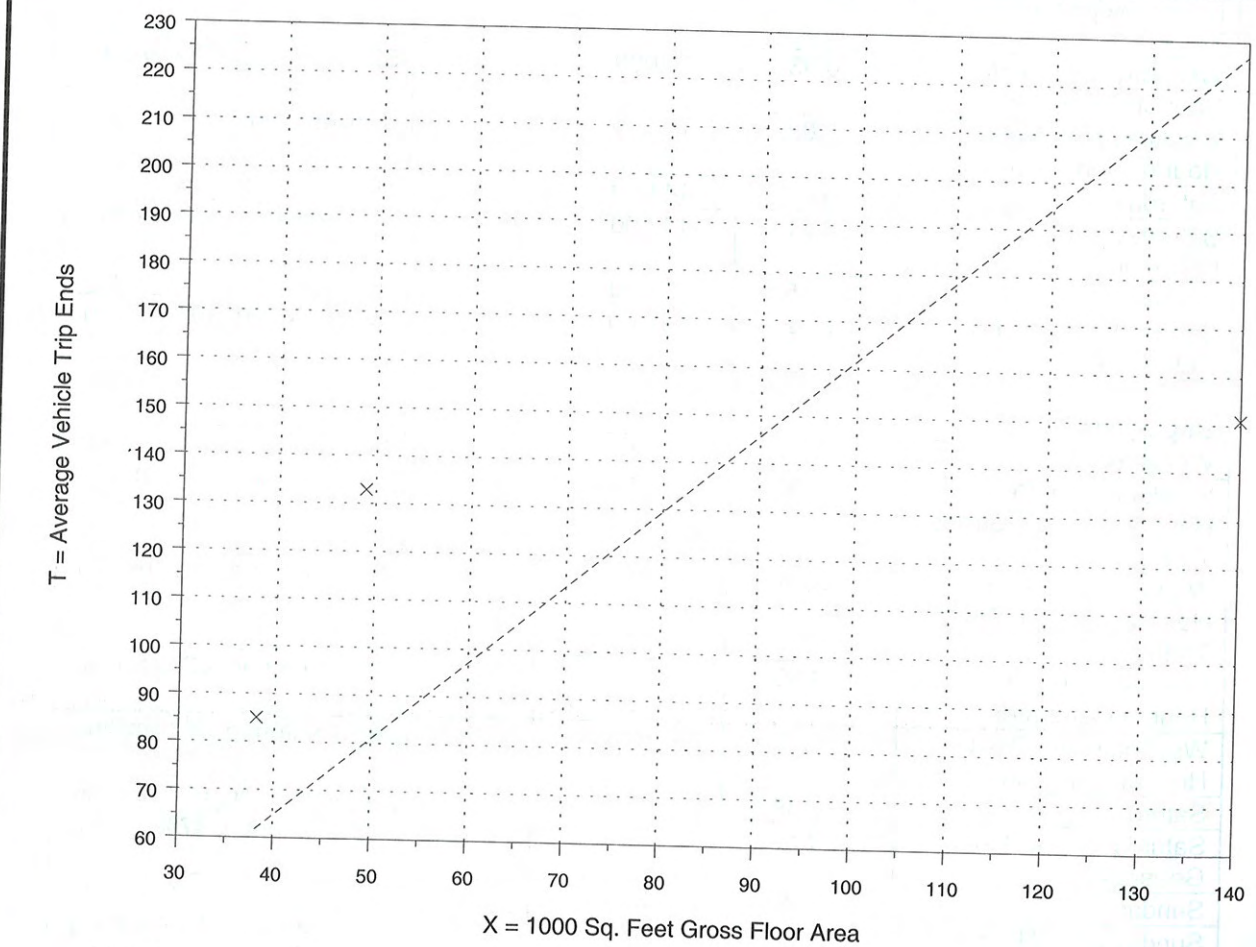
Number of Studies: 3
Average 1000 Sq. Feet GFA: 76
Directional Distribution: 61% entering, 39% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
1.62	1.08 - 2.71	1.45

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Recreational Community Center
(495)

Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Floor Area**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

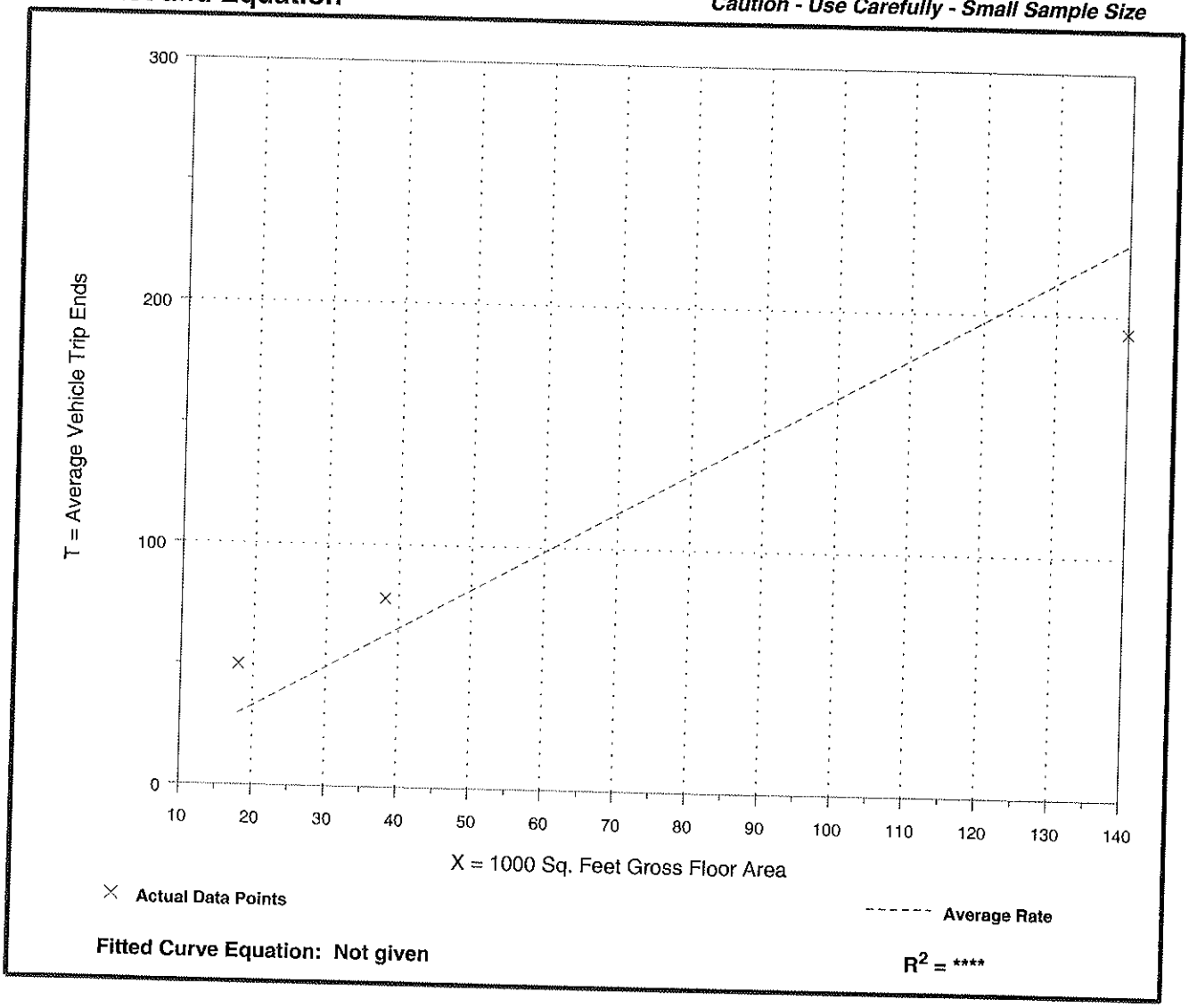
Number of Studies: 3
Average 1000 Sq. Feet GFA: 65
Directional Distribution: 29% entering, 71% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
1.64	1.38 - 2.78	1.35

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

Residential Condominium/Townhouse
(230)

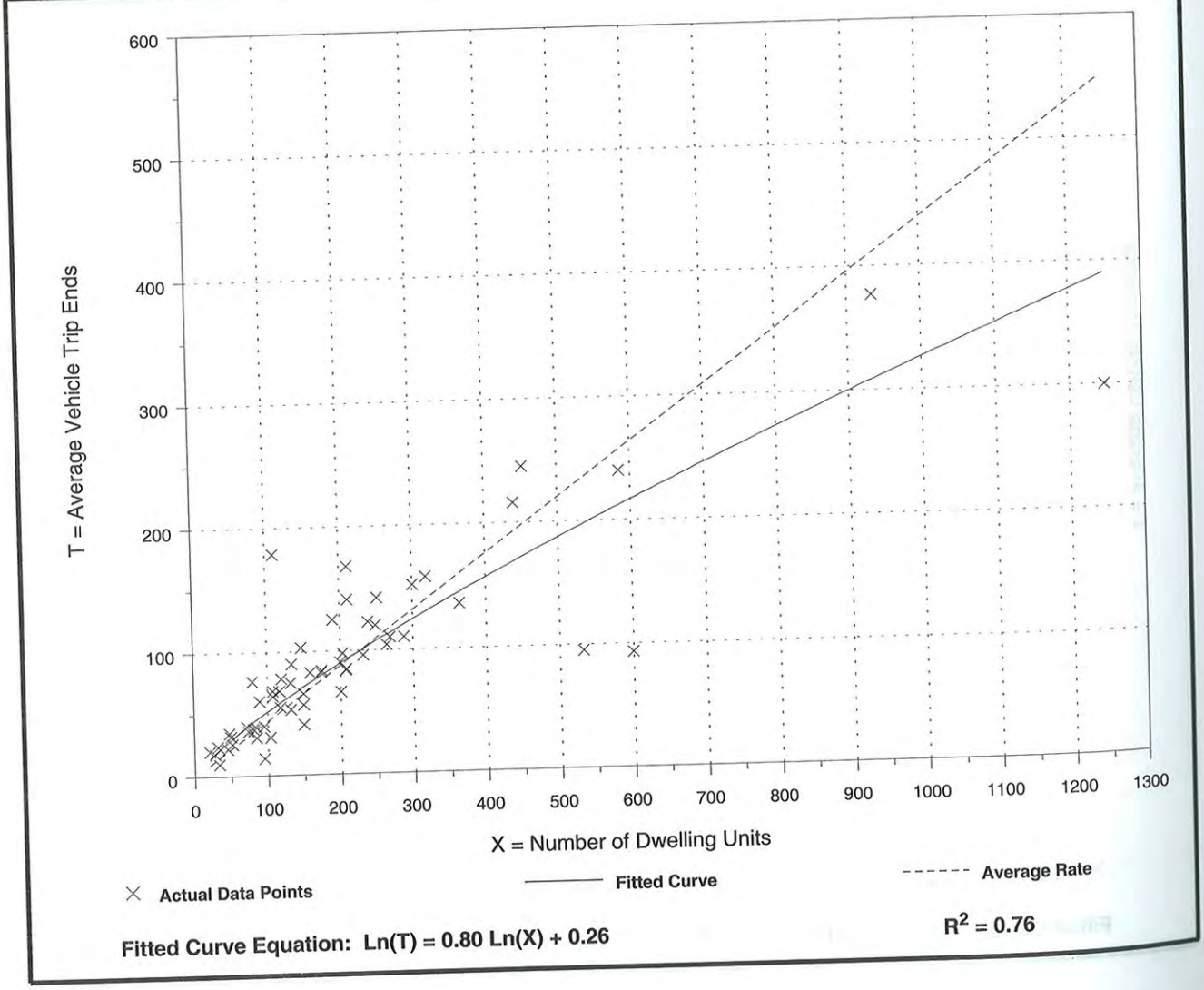
Average Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 59
Avg. Number of Dwelling Units: 213
Directional Distribution: 17% entering, 83% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.44	0.15 - 1.61	0.69

Data Plot and Equation



Fitted Curve Equation: $Ln(T) = 0.80\ Ln(X) + 0.26$

$R^2 = 0.76$

Residential Condominium/Townhouse
(230)

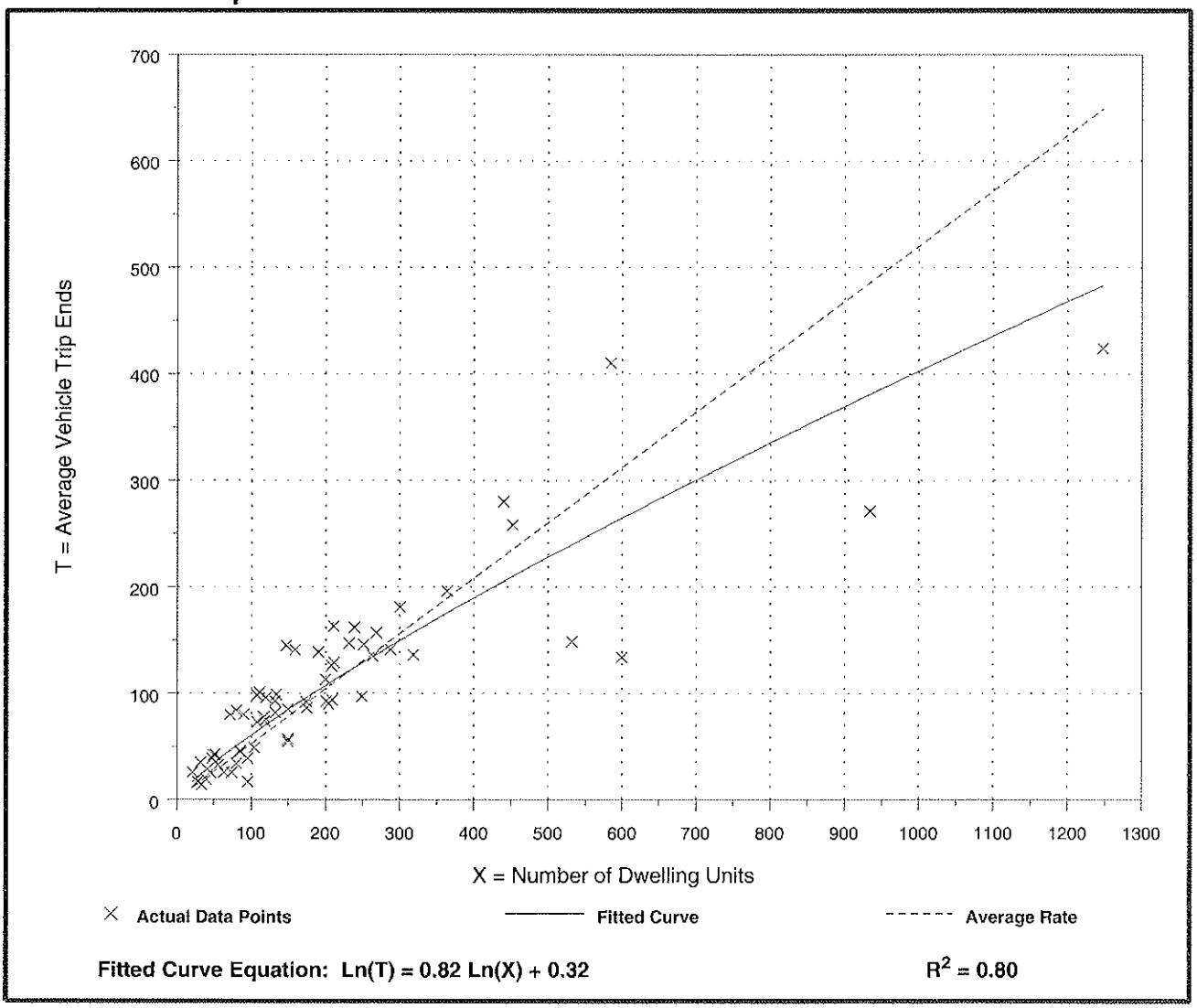
Average Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 62
Avg. Number of Dwelling Units: 205
Directional Distribution: 67% entering, 33% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.52	0.18 - 1.24	0.75

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.82 Ln(X) + 0.32

R^2 = 0.80

Single-Family Detached Housing
(210)

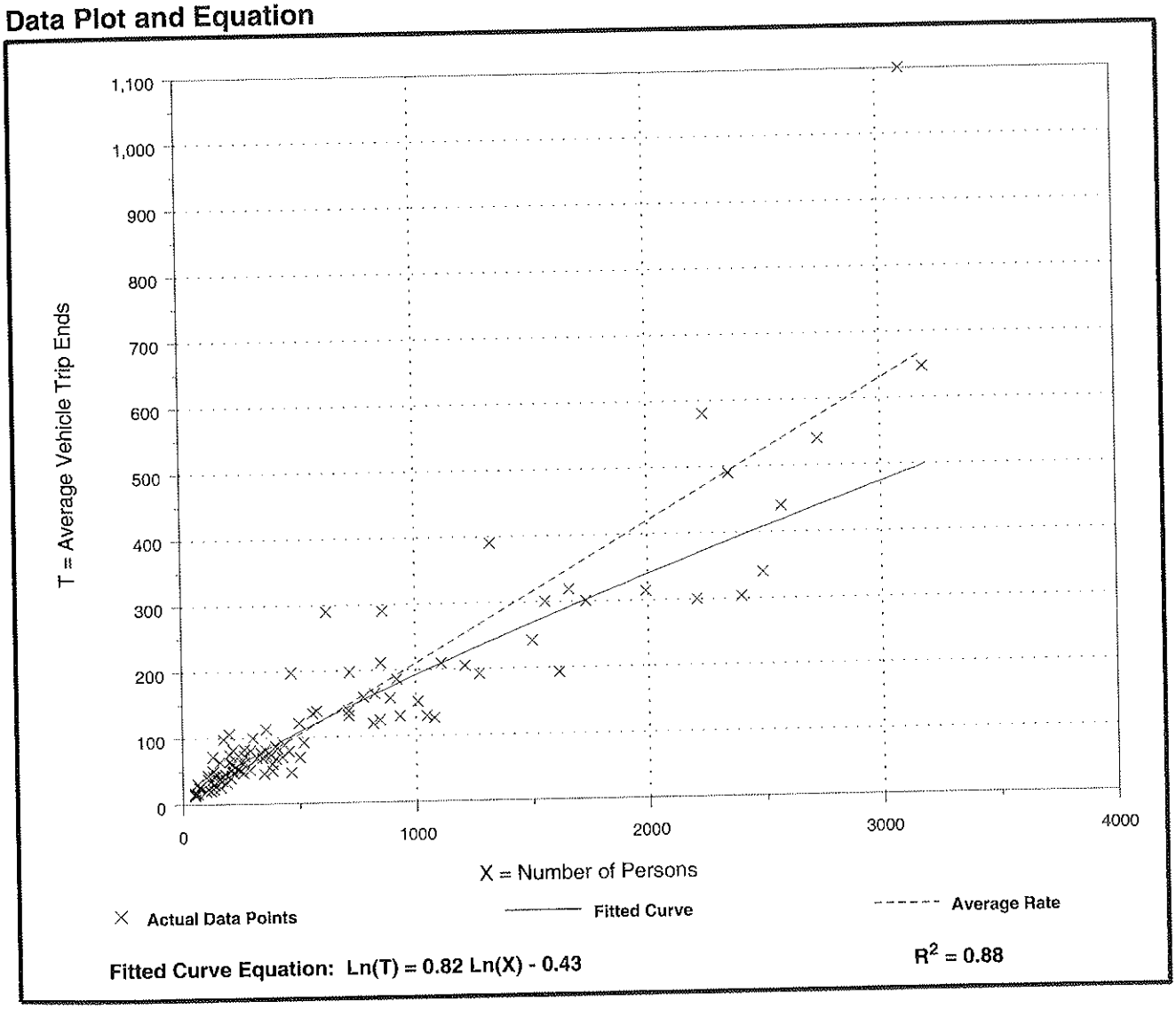
Average Vehicle Trip Ends vs: **Persons**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Number of Studies: 111
Average Number of Persons: 632
Directional Distribution: 31% entering, 69% exiting

Trip Generation per Person

Average Rate	Range of Rates	Standard Deviation
0.21	0.10 - 0.56	0.46

Data Plot and Equation



Fitted Curve Equation: $Ln(T) = 0.82\ Ln(X) - 0.43$

$R^2 = 0.88$

Single-Family Detached Housing
(210)

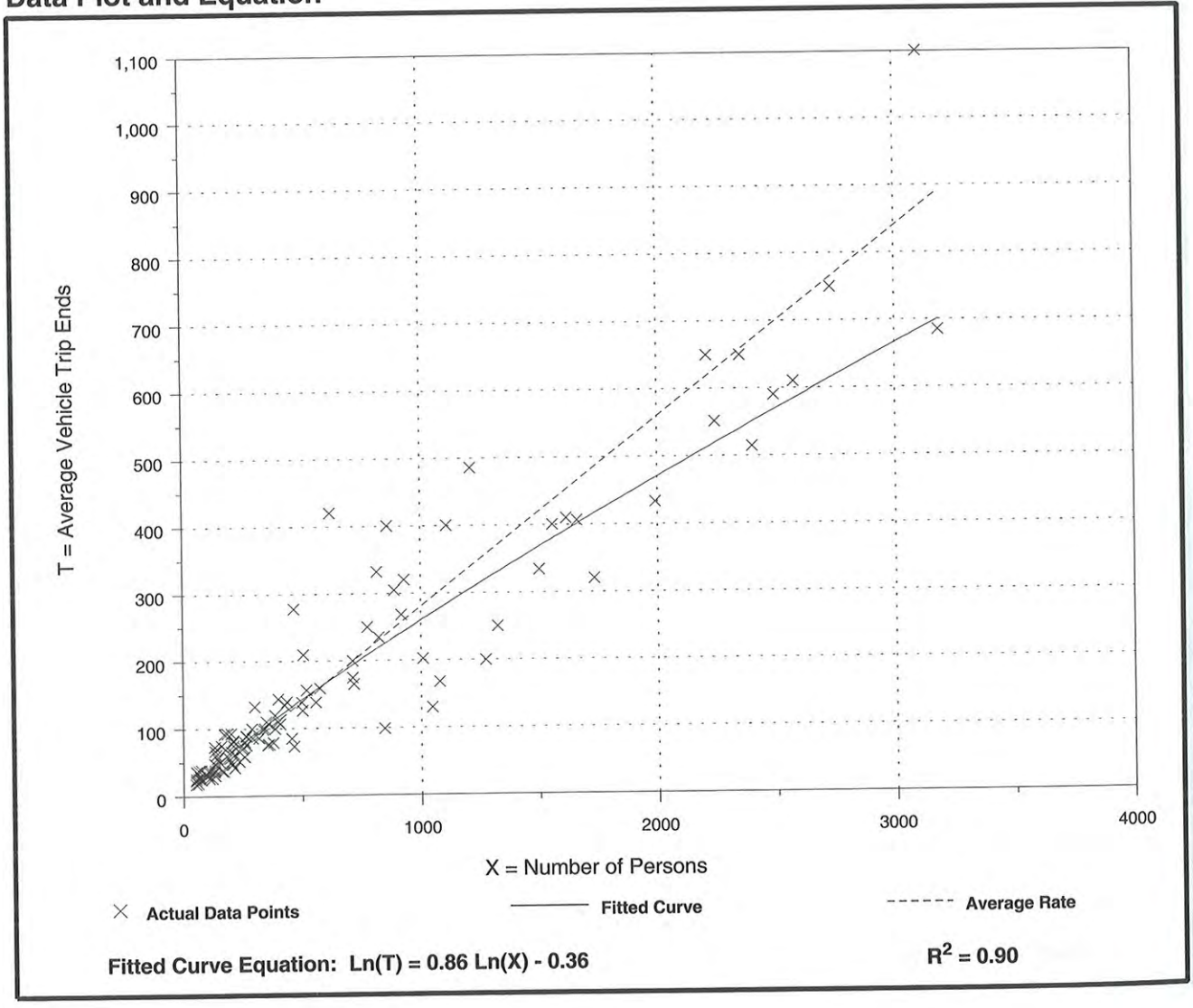
Average Vehicle Trip Ends vs: **Persons**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 111
Average Number of Persons: 629
Directional Distribution: 66% entering, 34% exiting

Trip Generation per Person

Average Rate	Range of Rates	Standard Deviation
0.28	0.12 - 0.68	0.53

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.86 Ln(X) - 0.36

R^2 = 0.90

APPENDIX D

Projected Conditions Capacity Analysis

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	5	52	126	8	48	120
Peak Hour Factor	0.50	0.84	0.84	0.50	0.67	0.74
Hourly flow rate (vph)	10	62	150	16	72	162
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	455	150			150	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	455	150			150	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	93			95	
cM capacity (veh/h)	538	891			1444	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	72	150	16	72	162
Volume Left	10	0	0	72	0
Volume Right	62	0	16	0	0
cSH	1035	1700	1700	1444	1700
Volume to Capacity	0.07	0.09	0.01	0.05	0.10
Queue Length 95th (m)	1.8	0.0	0.0	1.3	0.0
Control Delay (s)	9.7	0.0	0.0	7.6	0.0
Lane LOS	A			A	
Approach Delay (s)	9.7	0.0		2.3	
Approach LOS	A				

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	23.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	5	56	241	5	46	206
Peak Hour Factor	0.50	0.63	0.73	0.38	0.66	0.90
Hourly flow rate (vph)	10	89	330	13	70	229
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	698	330			330	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	698	330			330	
tC, single (s)	6.4	6.3			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.2	
p0 queue free %	97	87			94	
cM capacity (veh/h)	386	700			1224	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	99	330	13	70	229
Volume Left	10	0	0	70	0
Volume Right	89	0	13	0	0
cSH	779	1700	1700	1224	1700
Volume to Capacity	0.13	0.19	0.01	0.06	0.13
Queue Length 95th (m)	3.5	0.0	0.0	1.4	0.0
Control Delay (s)	11.3	0.0	0.0	8.1	0.0
Lane LOS	B			A	
Approach Delay (s)	11.3	0.0		1.9	
Approach LOS	B				

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	29.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	28	248	144	23	175	137
Peak Hour Factor	0.50	0.84	0.84	0.50	0.67	0.74
Hourly flow rate (vph)	56	295	171	46	261	185
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	879	171			171	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	879	171			171	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	79	66			82	
cM capacity (veh/h)	262	867			1418	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	351	171	46	261	185
Volume Left	56	0	0	261	0
Volume Right	295	0	46	0	0
cSH	1032	1700	1700	1418	1700
Volume to Capacity	0.34	0.10	0.03	0.18	0.11
Queue Length 95th (m)	12.2	0.0	0.0	5.4	0.0
Control Delay (s)	13.1	0.0	0.0	8.1	0.0
Lane LOS	B			A	
Approach Delay (s)	13.1	0.0		4.7	
Approach LOS	B				

Intersection Summary			
Average Delay	6.6		
Intersection Capacity Utilization	30.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	22	193	276	27	227	236
Peak Hour Factor	0.50	0.63	0.73	0.38	0.66	0.90
Hourly flow rate (vph)	44	306	378	71	344	262
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1328	378			378	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1328	378			378	
tC, single (s)	6.4	6.3			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.2	
p0 queue free %	64	53			71	
cM capacity (veh/h)	122	658			1175	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	350	378	71	344	262
Volume Left	44	0	0	344	0
Volume Right	306	0	71	0	0
cSH	752	1700	1700	1175	1700
Volume to Capacity	0.47	0.22	0.04	0.29	0.15
Queue Length 95th (m)	19.9	0.0	0.0	9.8	0.0
Control Delay (s)	19.6	0.0	0.0	9.3	0.0
Lane LOS	C			A	
Approach Delay (s)	19.6	0.0		5.3	
Approach LOS	C				

Intersection Summary			
Average Delay	7.2		
Intersection Capacity Utilization	40.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	107	878	177	52	414	168
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	116	954	192	57	450	183
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1275	192			192	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1275	192			192	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	8	0			68	
cM capacity (veh/h)	126	844			1393	

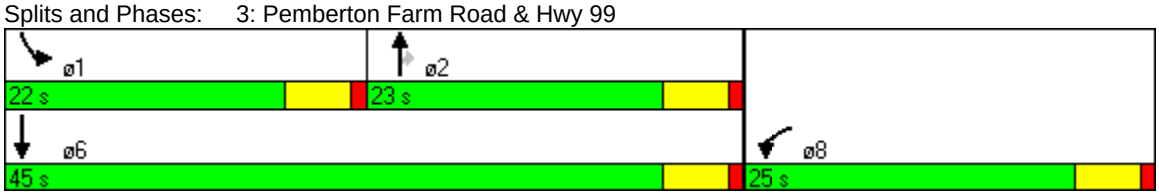
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	1071	192	57	450	183
Volume Left	116	0	0	450	0
Volume Right	954	0	57	0	0
cSH	777	1700	1700	1393	1700
Volume to Capacity	1.38	0.11	0.03	0.32	0.11
Queue Length 95th (m)	364.5	0.0	0.0	11.3	0.0
Control Delay (s)	195.5	0.0	0.0	8.8	0.0
Lane LOS	F			A	
Approach Delay (s)	195.5	0.0		6.3	
Approach LOS	F				

Intersection Summary			
Average Delay	109.2		
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1805	1553	1743	1292	3502	1727
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1805	1553	1743	1292	3502	1727
Satd. Flow (RTOR)		877		57		
Volume (vph)	107	878	177	52	414	168
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	4%	9%	25%	0%	10%
Lane Group Flow (vph)	116	954	192	57	450	183
Turn Type		Free		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		Free		2		
Detector Phases	8		2	2	1	6
Minimum Initial (s)	7.0		10.0	10.0	6.0	10.0
Minimum Split (s)	21.0		21.0	21.0	11.0	21.0
Total Split (s)	25.0	0.0	23.0	23.0	22.0	45.0
Total Split (%)	35.7%	0.0%	32.9%	32.9%	31.4%	64.3%
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None		Min	Min	None	Min
Act Effct Green (s)	9.8	41.7	13.4	13.4	12.0	32.3
Actuated g/C Ratio	0.21	1.00	0.32	0.32	0.29	0.77
v/c Ratio	0.30	0.61	0.34	0.13	0.45	0.14
Control Delay	19.5	1.8	16.4	6.2	15.5	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.5	1.8	16.4	6.2	15.5	3.8
LOS	B	A	B	A	B	A
Approach Delay	3.7		14.1			12.1
Approach LOS	A		B			B

Intersection Summary	
Cycle Length: 70	
Actuated Cycle Length: 41.7	
Natural Cycle: 55	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.61	
Intersection Signal Delay: 7.8	Intersection LOS: A
Intersection Capacity Utilization 37.1%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Pemberton Farm Road & Hwy 99



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	80	658	339	119	967	289
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	87	715	368	129	1051	314
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	2785	368			368	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2785	368			368	
tC, single (s)	6.4	6.3			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.2	
p0 queue free %	0	0			11	
cM capacity (veh/h)	2	666			1185	

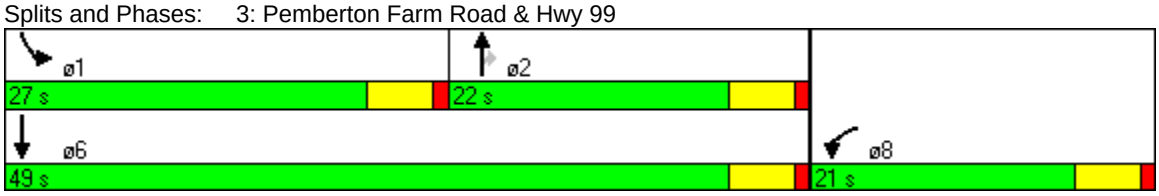
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	802	368	129	1051	314
Volume Left	87	0	0	1051	0
Volume Right	715	0	129	0	0
cSH	21	1700	1700	1185	1700
Volume to Capacity	37.60	0.22	0.08	0.89	0.18
Queue Length 95th (m)	Err	0.0	0.0	105.5	0.0
Control Delay (s)	Err	0.0	0.0	25.8	0.0
Lane LOS	F			D	
Approach Delay (s)	Err	0.0		19.8	
Approach LOS	F				

Intersection Summary			
Average Delay	3019.7		
Intersection Capacity Utilization	85.8%	ICU Level of Service	E
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1805	1509	1696	1615	3400	1810
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1805	1509	1696	1615	3400	1810
Satd. Flow (RTOR)		715		100		
Volume (vph)	80	658	339	119	967	289
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	7%	12%	0%	3%	5%
Lane Group Flow (vph)	87	715	368	129	1051	314
Turn Type		Free		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		Free		2		
Detector Phases	8		2	2	1	6
Minimum Initial (s)	7.0		10.0	10.0	6.0	10.0
Minimum Split (s)	21.0		21.0	21.0	11.0	21.0
Total Split (s)	21.0	0.0	22.0	22.0	27.0	49.0
Total Split (%)	30.0%	0.0%	31.4%	31.4%	38.6%	70.0%
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lead/Lag			Lag	Lag	Lead	
Lead-Lag Optimize?			Yes	Yes	Yes	
Recall Mode	None		Min	Min	None	Min
Act Effct Green (s)	9.7	57.2	16.8	16.8	21.7	44.1
Actuated g/C Ratio	0.16	1.00	0.29	0.29	0.38	0.77
v/c Ratio	0.30	0.47	0.74	0.24	0.82	0.23
Control Delay	26.2	1.1	31.7	8.0	24.5	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.2	1.1	31.7	8.0	24.5	3.6
LOS	C	A	C	A	C	A
Approach Delay	3.8		25.6			19.7
Approach LOS	A		C			B

Intersection Summary	
Cycle Length: 70	
Actuated Cycle Length: 57.2	
Natural Cycle: 75	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.82	
Intersection Signal Delay: 16.0	Intersection LOS: B
Intersection Capacity Utilization 61.3%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 3: Pemberton Farm Road & Hwy 99



APPENDIX E

Site Plan

GEMS School

Future Ravens Crest
Residential Neighbourhood

Edge of Ravens Crest Property

Existing Railway Line

Recreation Centre
Final configuration to be confirmed

Tennis
Baseball
Soccer
Track
Soccer
Football
Softball
Soccer
22.
23
12.

New Storm Water Pond

School Farm Garden

Existing Neighbourhood

Road to Pemberton

Forest

Existing Wetlands

Hay Field

Existing Forest

New Irrigation Pond

Equestrian Centre

Hay Field

Hay Fields

Existing Storm Ditch

New Trees

Farm Access

To Town of Mt. Currie

Friendship Trail

Edge of Ravens Crest Property

1. Temporary School Building
2. Temporary Gym and Auditorium
3. Main School Entry and Administration
4. Gymnasium
5. Auditorium and Physical Plant
6. Workshops/Labs
7. Classrooms
8. Dining Hall
9. Residential Wings
10. Bridge
11. Future Soccer / Playing Field
12. Grass Paver Parking Field
13. Entrance Drive way
14. Existing Farm Crossing
15. Outdoor Assembly area / Open Field
16. Horse Stables
17. Hay Barn
18. Indoor Riding Area
19. Tack Room and Gathering Room
20. Outdoor Riding Area
21. New Riding Trail
22. Indoor Ice Rink
23. Indoor Swimming Pool

N

0 100 200 300 400 500 600 700 m

ISL Water Modeling Report

Date November 6, 2012

Our Reference: 30387

Village of Pemberton
PO Box 100
7400 Prospect Street
Pemberton, BC V0N 2L0

Attention: Caroline Lamont, Manager of Development Services

Dear Madam:

Reference: Village of Pemberton Water Servicing Analysis
Final Report

1.0 Introduction

As requested, a hydraulic network analysis has been conducted for the Village of Pemberton's water system. The purpose of the analysis was to determine the performance of the Village's water system and identify any improvements that may be needed. In particular, the hydraulic analysis was conducted for the following scenarios:

- The existing Village of Pemberton water system,
- The existing water system and the Sunstone Ridge Development Phase 1, and
- The existing water system and the Sunstone Ridge Development Phase 1 plus future developments in the area.

2.0 Design Criteria

The design criteria for the analysis were taken from the Village of Pemberton Subdivision and Control Bylaw 677 and the Master Municipal Construction Document (MMCD).

From the Village bylaw the system pressures and design water demands must meet the following criteria:

System Pressure:	
Minimum System Pressure at Peak Demand	300 kPa
Maximum Allowable Pressure	850 kPa
Maximum Allowable Pressure (by approval)	1035 kPa
Minimum Fire Hydrant Pressure	150 kPa
Design Water Demands:	
Average Daily Demand (ADD)	455L/c/d
Maximum Daily Demand (MDD)	910 L/c/d
Peak Hour Demand (PHD)	1820 L/c/d

For fire flows the Village has adopted the MMCD guidelines and they are as follows:

Development	Minimum Fire Flows (L/s)
Single Family	60
Apartments, Townhouses	90
Commercial	150
Institutional	150
Industrial	225

3.0 Model Set Up

The hydraulic network analysis was carried out using Bentley's WaterCAD Version 8.

Each model scenario was simulated for the following system demands:

- Average Daily Demand (ADD)
- Peak Hour Demand (PHD)
- Maximum Daily Demand (MDD) + Fire flows

It should be noted that the model was not calibrated as information regarding fire flow tests and water meter data were not available at the time of the assessment. Any changes or updates to the model are noted for each model scenario.

4.0 The Existing Water System

The Village's water system is current fed from an existing 1600 m^3 reservoir located near the Benchlands development. The existing water system currently services the Village of Pemberton, a regional area to the north of the Village, and the airport. The industrial park area is currently serviced by the First Nations community to the east and is not part of the existing water system. It should be noted that the existing WaterCAD model that we received accounted for the future demands (immediate and short term) as listed in Table 4.4 of the 2007 Associated Engineering report for the Village. In addition, the exact demand requirements for the area north of the Village are not known at the time of analysis.

Figure 1 shows the existing water network.

Updates to the existing water model include:

- The Pemberton wells off-line during all model simulations
- The Plateau Strata booster pump was active for all scenarios
- The Plateau Strata fire pump was active for the fire flow analysis
- Used the system constraint option in calculating the fire flow analysis and increased the fire flow upper limit to 300 L/s

The results of the existing water system model simulations for ADD, PHD, and MDD + FF are shown in Figures 2 to 4.

From Figures 2 and 3, the model results suggest that the existing water system has adequate pressure for ADD. For PHD, there are some deficiencies located within the Village Core. As

the existing reservoir water level is set at 289.4 m and some the areas in the Village core are at higher elevations (at 251 m) the maximum expected pressure at the highest location would be 149 kPa.

Figure 4 shows the model results for the existing MDD + FF analysis. As commercial areas are much disbursed through the Village, the 150 L/s criterion is used. The existing system can provide around 60-100 L/s in the Village core and to the area east of the Village core. To the east of the BC Railway, there is a small area that meets the fire flow requirement of 150 L/s. For the areas south east of the Plateau Strata and towards the airport the fire flows are between 50 to 60 L/s.

5.0 The Existing Water System with Future Developments

5.1 Sunstone Ridge Development Phase 1

Phase 1 of the Sunstone Ridge Development (SRD) is located 3 km east of the Village core, north of the CN railway. The SRD site will be the first of a number of developments in the Sunstone Ridge area and will consist of single family and multi-family units. The total demands identified for SRD were taken from the Delcan Technical Memorandum dated April 4, 2012 and are as follows:

- ADD = 3.9 L/s
- MDD + FF = 7.8 L/s + FF varies for different types of development
- PHD = 15.5 L/s

The full Technical Memorandum can be found in Appendix B of the report.

With the development of the SRD site, a new reservoir is proposed. A further discussion on the total required demands for the new reservoir, sizing and operation can be found under Section 6.0 of the report.

Updates to the model include:

- Used the proposed pipe network for SRD Phase 1 as per Figure 2 of Delcan's Technical Memorandum
- Provided a looped connection to the Airport and industrial park with the additional of a 300 mm line between the SRD and the industrial park and airport. Therefore, the existing First Nations reservoir in the model was made to be offline for all model scenarios
- Added a PRV to the line that connects to the airport (PRV – 800)
- Created three new pressure zones PZ –360 and PZ – 305 (in SRD) and PZ - 285 (for the line industrial park and airport). Added three pressure reducing valves – PRV 281, PRV 282, and PRV – 284.
- The proposed pipe sizes for the SRD range from 200 mm to 300 mm and are shown in Figure 5.
- The SRD booster pump was added to the model but was turnoff for all model scenarios
- PVC pipes were used with a Hazen-Williams coefficient of 120

The results of the existing water system plus SRD Phase 1 model simulations for ADD, PHD, and MDD + FF are shown in Figures 6 to 8.

From Figures 6 and 7, the model results suggest that the existing water system plus SRD Phase 1 has adequate pressure for ADD and PHD.

Figure 8 shows the model results existing MDD + FF analysis. The fire flow criteria used for SRD Phase 1 is 60 L/s for single family units and 90 L/s for multi-family units. For the airport the fire flow requirement is 150 L/s and for the industrial park the fire flow requirement is 225 L/s. The 150 L/s fire flow requirement is used for the Village core as described in Section 4.0.

The addition of the SRD reservoir helped improve the fire flow conditions for the Village core and for the area east of the Village core. Fire flows for these areas went from around 60 – 100 L/s to around 150 L/s in the Village core and the area east of the Village Core. In SRD the fire flow range from 131 L/s to 159 L/s which is more than sufficient to meet the minimum fire flow requirements. The fire flow flows for the airport are around 176 L/s which is an improvement from the less than 60 L/s without the SRD reservoir. The fire flows for the industrial park range from 159 L/s to 175 L/s and are lower than the required 225 L/s.

5.2 SRD Phase 1 plus Future Developments

Future development areas in addition to the SRD Phase 1 are outlined in Table 1 of Delcan's Technical Memorandum and include a school site, recreational facility, Biro site, commercial site, 22 SF site, and SRD Phase 2. The total demands from the Technical Memorandum are summarized as follows:

Site	ADD (L/s)	MDD (L/s)	PHD (L/s)
SRD Phase 1	3.9	7.8	15.5
School Site	4	8.1	16.1
Recreation Facility	1.6	3.3	6.5
Biro Site	2.9	5.8	11.6
Commercial Site	0.1	0.4	0.9
22 SF Units	0.5	0.9	1.9
SRD Phase 2	2.7	5.5	11

Fire flow requirements vary based on the type of development.

Updates to the model:

- Proposed pipe layout for future development areas in addition to SRD Phase 1 is based on Figure 1 of Delcan's Technical Memorandum
- Added 2 more PRVs - one in the Biro site development – PRV-286 and one near the school site - PRV-288
- Elevations for the Biro site were extrapolated from the Biro Concept Elevations drawing dated March 1, 2012 from Crosland Doak
- Elevations for SRD Phase 2 were taken from the drawing Ravens Crest 2. It should be noted that SRD Phase 2 is located at a higher elevation than the proposed reservoir (SRD Phase 2 highest elevation is about 430 m). From Delcan's Technical Memorandum, the balancing and emergency storage of the SRD Phase 2 development will be provided in a future reservoir at a higher elevation. Thus, SRD Phase 2 was not included in this analysis.
- The proposed pipe sizes for the future development area range from 200 mm to 250 mm and are shown in Figure 9.
- PVC pipes were used with a Hazen-Williams coefficient of 120

The results of the existing water system plus SRD Phase 1 and future development model simulations for ADD, PHD, and MDD + FF are shown in Figures 10 to 12.

From Figures 10 and 11, the model results suggest that the existing water system plus SRD Phase 1 and future development has adequate pressure for ADD and PHD.

Figure 12 shows the model results existing MDD + FF analysis. The fire flow criteria used are as follows:

- Biro Site 60 L/s for single family and 90 L/s for multi-family
- School site, Commercial, and Recreational 150 L/s
- 22 SF Units 60 L/s
- All other areas have the same fire flow requirements as described in Section 5.1.

The available fire flows for the Biro Site and SRD Phase 1 range from around 160 L/s to 300 L/s. This is more than sufficient to meet the required fire flows. The fire flow for the School Site, Commercial and Recreational Facility meet the 150 L/s required fire flow. The fire flows for the airport range from around 190 to 244 L/s while the fire flows for the industrial park range from 166 L/s to 228 L/s and are in most places lower than the required 225 L/s.

6.0 Sunstone Ridge Reservoir

6.1 Reservoir Flows

As briefly mentioned in Section 5.1 a new reservoir is proposed to service SRD Phase 1, future development in the areas as shown Figure 1 of Delcan's Technical Memorandum, airport, and industrial park and to provide fire flows to the Village Core. This new reservoir is to be located in the NW corner of the SRD site with a top of water elevation proposed to be 360.5 m. The total demands for the entire service area of the SRD reservoir are:

- ADD = 21 L/s
- MDD + FF = 45 L/s + FF varies for different types of development
- PHD = 135 L/s (this includes servicing the Village core)

6.2 Reservoir Sizing

The proposed SRD reservoir has been sized based on the MMCD guidelines as follows:

Minimum reservoir size = A + B + C

A = Fire storage
B = Equalization storage (25% of MDD)
C = Emergency storage (25% of A + B)

The storage requirement calculations are shown below:

Existing Reservoir			
Type of Storage		**Calculation**	**Required Storage (m^3)**
A	Fire	2hrs * 150 L/s	1080
B	Equalization	25%*62 L/s MDD*24 hrs	1339
C	Emergency	25%*(A+B)	605
		Total:	3024
		Available Storage:	1600
		Deficit:	(1424)
Proposed SRD Reservoir			
Type of Storage		**Calculation**	**Required Storage (m^3)**
A	Fire	2hrs * 225 L/s	1620
B	Equalization	25%*45 L/s MDD*24 hrs	972
C	Emergency	25%*(A+B)	648
		Total:	3240
Overall Village of Pemberton Storage Requirements			
Type of Storage		**Calculation**	**Required Storage (m^3)**
A	Fire	2hrs * 225 L/s	1620
B	Equalization	25%*107 L/s MDD*24 hrs	2311
C	Emergency	25%*(A+B)	983
		Total Required Storage:	4914
		Available Storage in Existing Reservoir:	1600
		Minimum Required Storage for SRD:	3314

The above calculations are based on the simulated maximum day demands for each reservoir and illustrate the need for the SRD Reservoir to supplement the existing reservoir during fire flow conditions.

Based on the above, a design storage volume of 3400 m^3 is recommended for the SRD Reservoir.

6.3 Reservoir Operation

In order to connect the SRD reservoir to the existing water system, the existing water line along Pemberton Farm Road from the Plateau Strata is extended north until the CN rail line where it heads east. A 250 mm fill line connects the existing system to the SRD reservoir.

In order to replenish the SRD reservoir, it is expected that the reservoir will be filled primarily overnight. With the addition of the SRD reservoir the system will be more complex to operate and it is critical that PRV settings are carefully selected to avoid the risk of emptying out the SRD reservoir. Additional modeling is required to confirm PRV settings for proper reservoir operation.

7.0 Potential Improvements

Based on the above simulations some potential improvements to the water system could include:

- Even with the addition of the Ravens Crest reservoir there are still some deficiencies in meeting the fire flow requirements. Within the Village Core some of these deficiencies can be improved by pipe twinning (for 150mm pipes) and/or adding a booster station for areas that are located in higher elevations to improve fire flow to 150 L/s. However, it would be most cost effective to identify first what the required fire flow is for these localized areas.
- A 300mm loop between the line to the airport will improve fire flows in the industrial park from (166 L/s – 225 L/s) to (223 L/s – 262 L/s)

The timing of these additional improvements will depend on the Village's budget and rationale for upgrading. It may be possible to implement these as part of a long term infrastructure upgrading strategy.

8.0 Conclusions

The following conclusions are made based on the above:

- The addition of the SRD reservoir will have a dramatic impact in improving the fire flows in the Village core, the area east of the Village core, the airport and industrial park.
- Additional assessment of the SRD reservoir operation is required prior to the detailed design of the reservoir and connecting piping.
- The accuracy of the results is dependent on the input parameters and it would be beneficial to confirm the regional water demands to the north of the Village.
- Additional hydraulic analysis is needed prior to finalizing the reservoir design.

9.0 Closure

This report is submitted in draft format for your review and comments. With your approval, ISL would like to assess the reservoir filling operation in more detail prior any reservoir design activities commencing. Please contact me at 780.438.9000 if you have any further questions.

Prepared by,

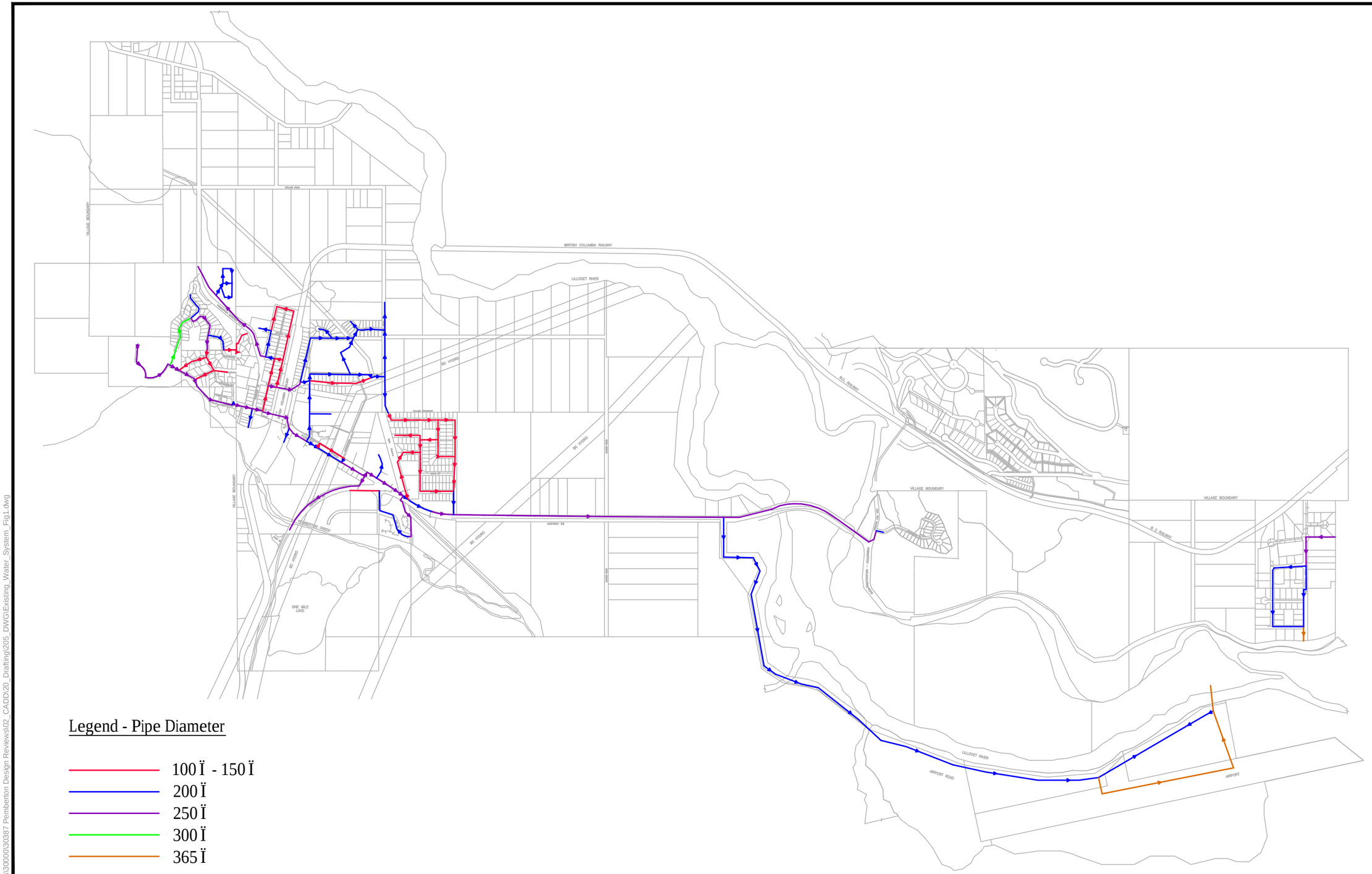
Lily Dam, P.Eng.
Water Resources Engineer

[redacted]

Graham Schulz, P.Eng.
Senior Project Engineer

Attachments

Appendix A – Figures



Legend - Pipe Diameter

- 100 Ï - 150 Ï
- 200 Ï
- 250 Ï
- 300 Ï
- 365 Ï

T:\Projects\30000\30387 Pemberton Design Reviews\02_CADD\20_Drafting\205_DWG\Existing_Water_System_Fig1.dwg

ISL Engineering and Land Services

PEMBERTON DESIGN REVIEWS

EXISTING WATER SYSTEM

FIGURE 1

30387

HORZ 1:20 000 — 0 200 400 600 800m

August, 2012

Legend -Pressure

- <=100 kPa
- <=250 kPa
- <=400 kPa
- <=550 kPa
- <=700 kPa
- <=850 kPa

T:\Projects\30000\30387 Pemberton Design Reviews\02_CADD\20_Drafting\205_DWG\Existing_System_ADD_Contours_Fig2.dwg

ISL Engineering and Land Services

PEMBERTON DESIGN REVIEWS

EXISTING SYSTEM

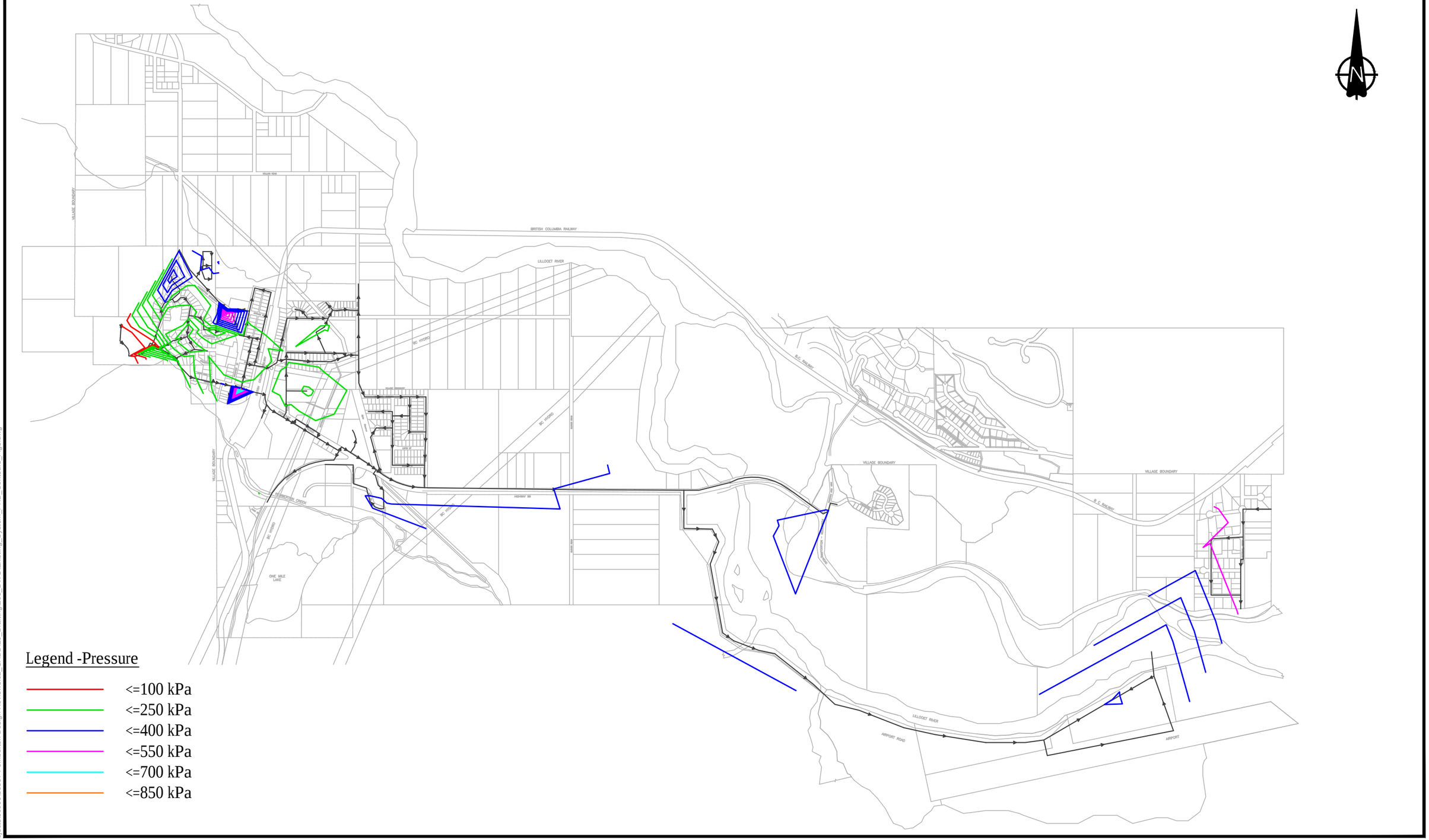
AVERAGE DAY DEMAND CONTOURS

FIGURE 2

30387

HORZ 1:20 000 — 0 200 400 600 800m

August, 2012



Legend -Pressure

- <=100 kPa
- <=250 kPa
- <=400 kPa
- <=550 kPa
- <=700 kPa
- <=850 kPa

T:\Projects\30000\30387 Pemberton Design Reviews\02_CADD\20_Drafting\205_DWG\Existing_System_PHD_Contours_Fig3.dwg

ISL Engineering and Land Services

PEMBERTON DESIGN REVIEWS

EXISTING SYSTEM

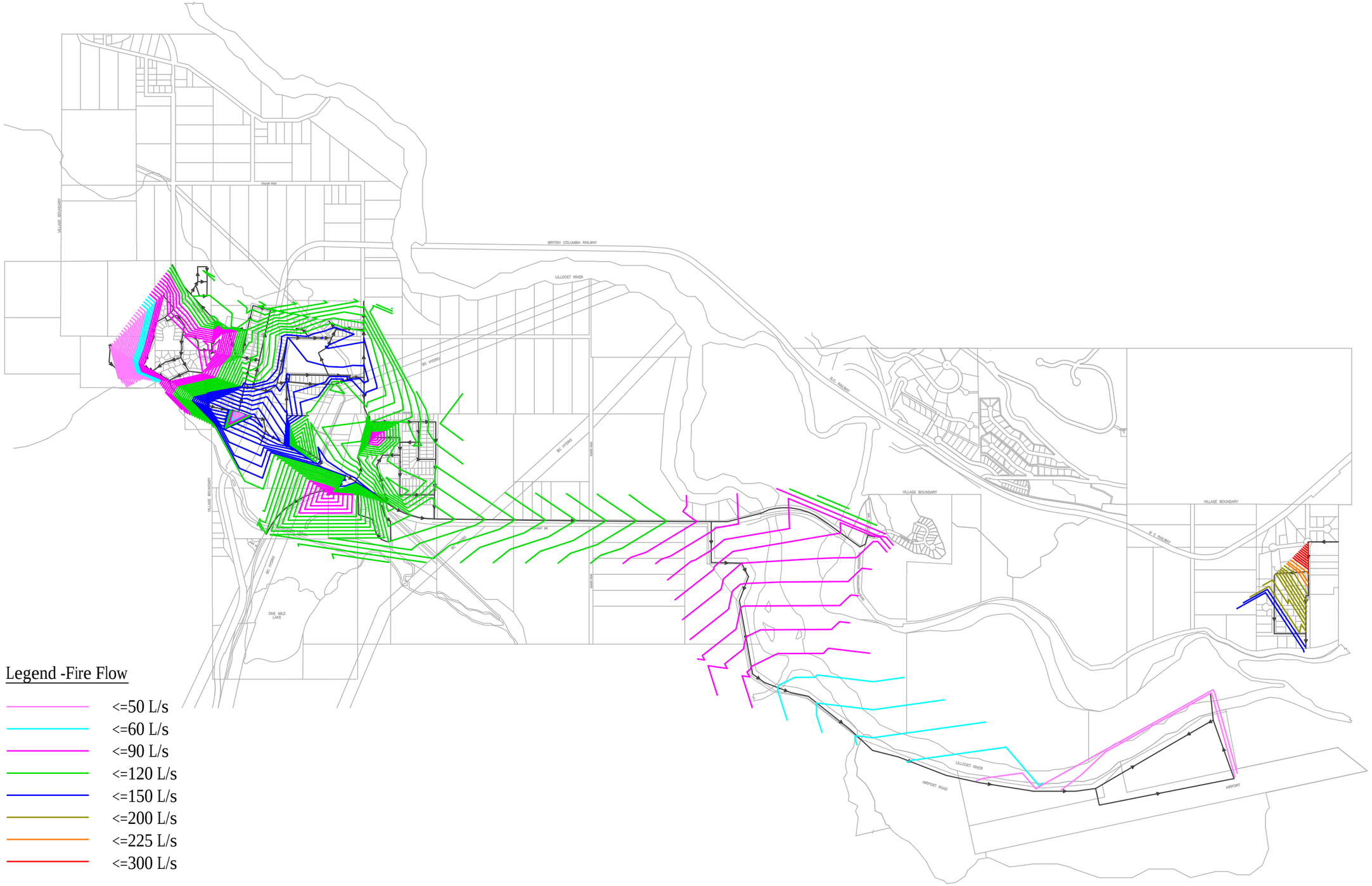
PEAK HOUR DEMAND CONTOURS

FIGURE 3

30387

HORZ 1:20 000 0 200 400 600 800m

August, 2012



Legend -Fire Flow

- <=50 L/s
- <=60 L/s
- <=90 L/s
- <=120 L/s
- <=150 L/s
- <=200 L/s
- <=225 L/s
- <=300 L/s

T:\Projects\30000\30387 Pemberton Design Reviews\02_CADD\20_Drafting\205_DWG\Existing_System_MDD_FF_Contours_Fig4.dwg

ISL Engineering and Land Services

PEMBERTON DESIGN REVIEWS

EXISTING SYSTEM

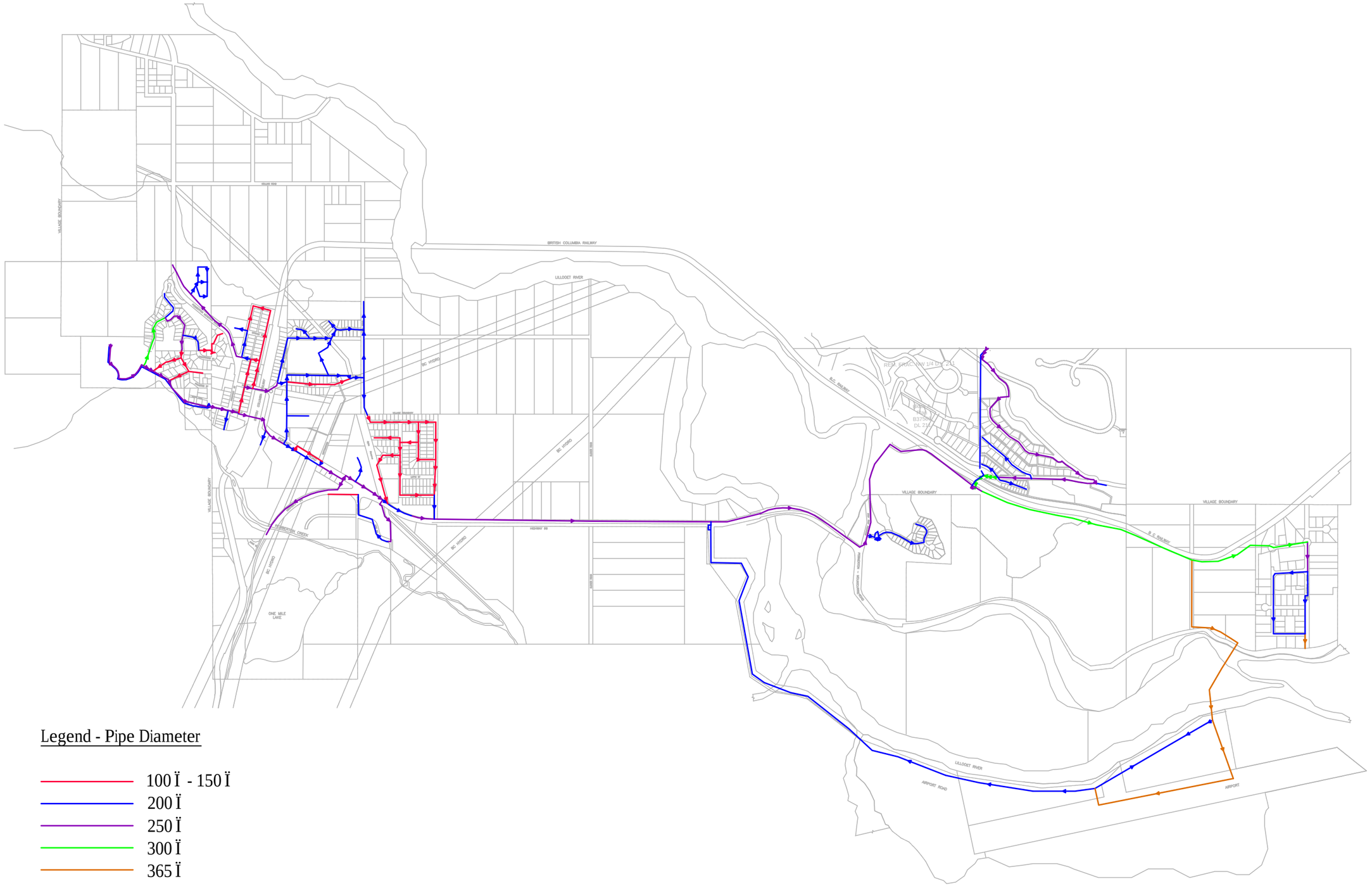
MAXIMUM DAY DEMAND & FIRE FLOW CONTOURS

FIGURE 4

30387

HORZ 1:20 000 0 200 400 600 800m

August, 2012



Legend - Pipe Diameter

- 100 Ï - 150 Ï
- 200 Ï
- 250 Ï
- 300 Ï
- 365 Ï

T:\Projects\30000\30387 Pemberton Design Reviews\02_CADD\20_Drafting\205_DWG\Raven_Water_System.dwg

ISL Engineering and Land Services

PEMBERTON DESIGN REVIEWS

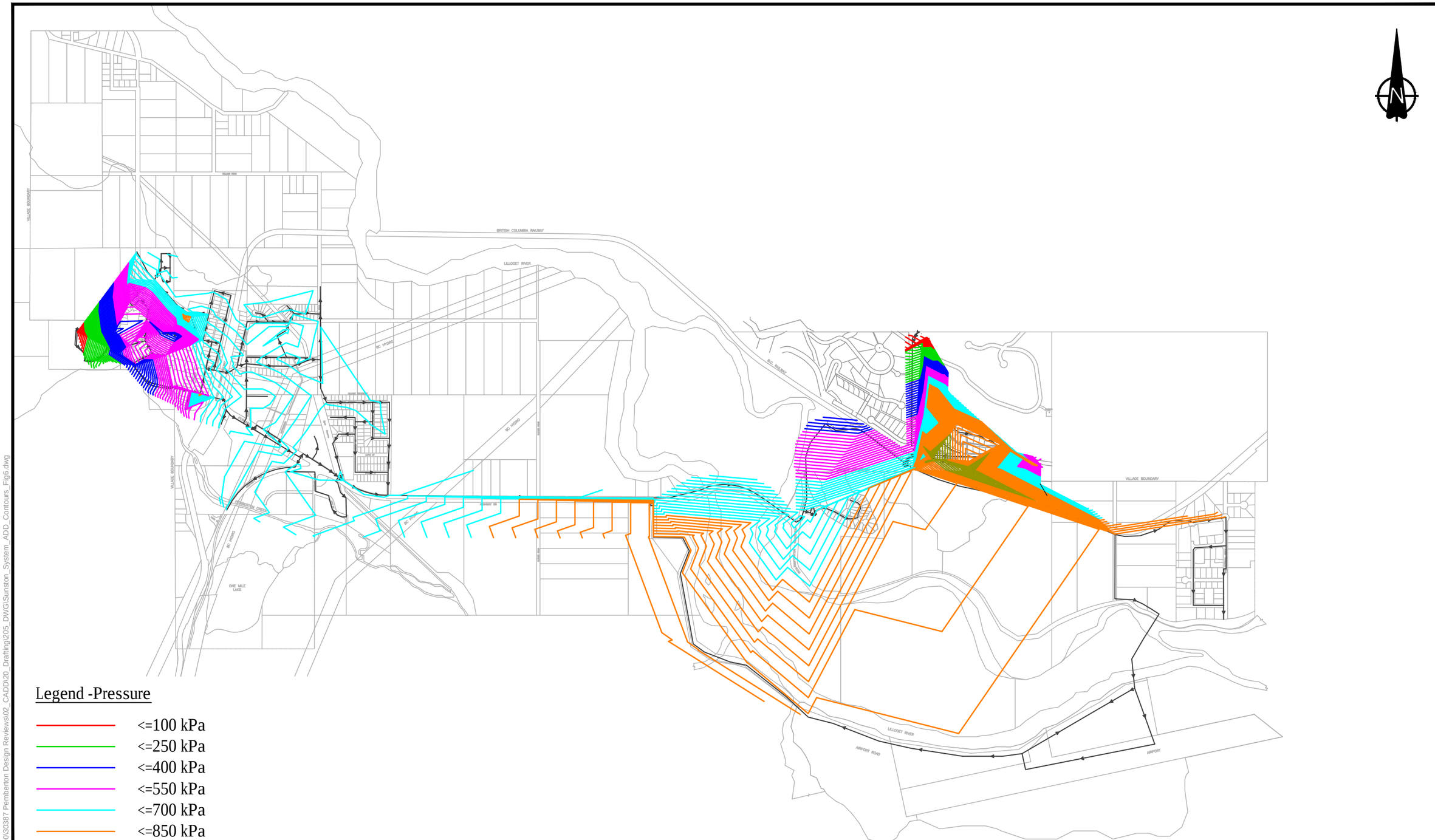
EXISTING WATER SYSTEM INCLUDING RAVENSCREST

FIGURE 5

30387

HORZ 1:20 000 0 200 400 600 800m

August, 2012



Legend -Pressure

- <=100 kPa
- <=250 kPa
- <=400 kPa
- <=550 kPa
- <=700 kPa
- <=850 kPa
- <=1035 kPa

T:\Projects\3000\30387 Pemberton Design Reviews\02_CADD\20_Drafting\205_DWG\Sunston_System_ADD_Contours_Fig6.dwg

ISL Engineering and Land Services

PEMBERTON DESIGN REVIEWS

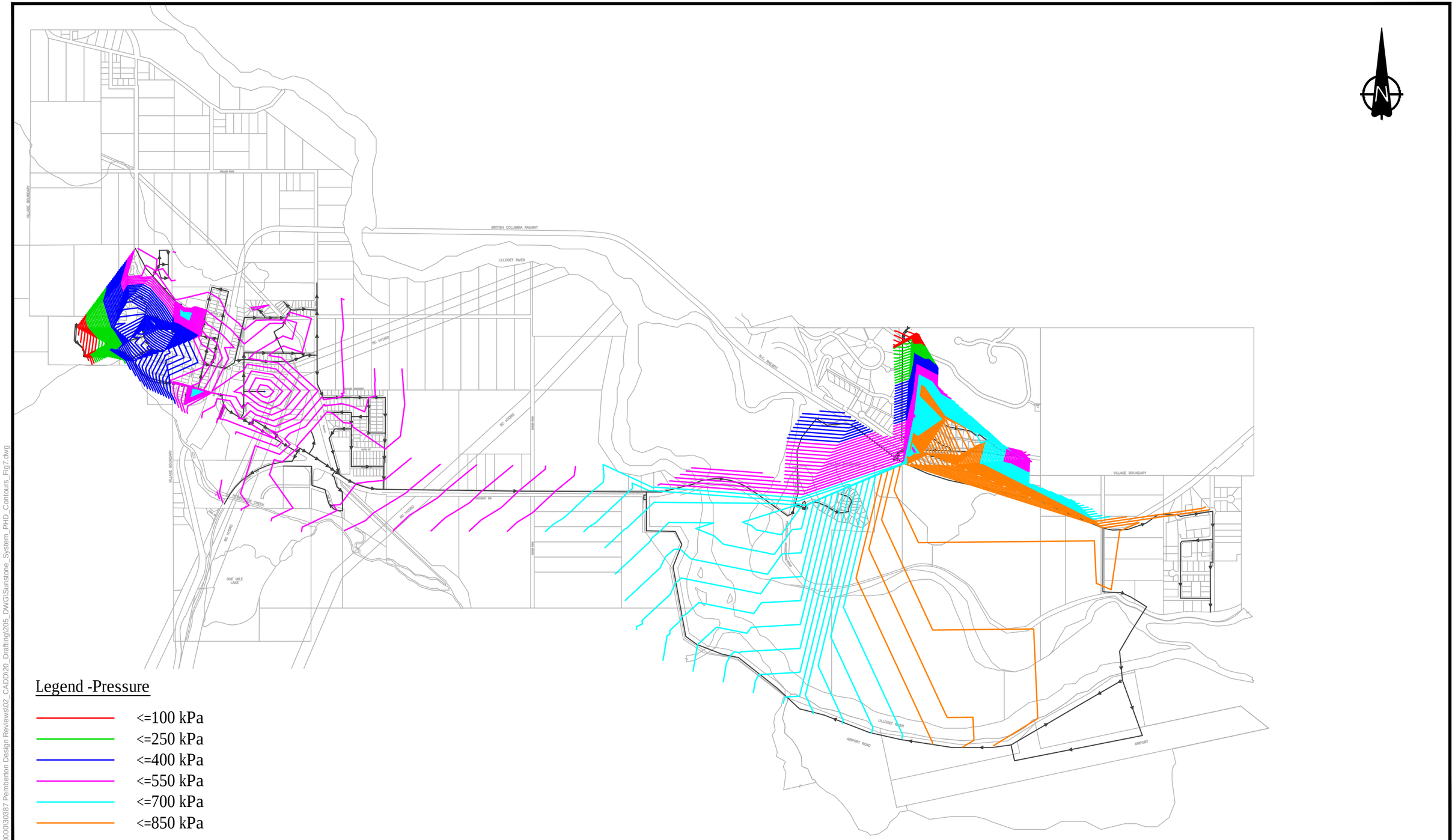
SUNSTONE RIDGE
AVERAGE DAY DEMAND CONTOURS

FIGURE 6

30387

HORZ 1:20 000 — 0 200 400 600 800m

August, 2012



Legend -Pressure

- <=100 kPa
- <=250 kPa
- <=400 kPa
- <=550 kPa
- <=700 kPa
- <=850 kPa

T:\Projects\30000\30387 Pemberton Design Reviews\02_CADD\20_Drafting\205_DWG\Sunstone_System_PHD_Contours_Fig7.dwg

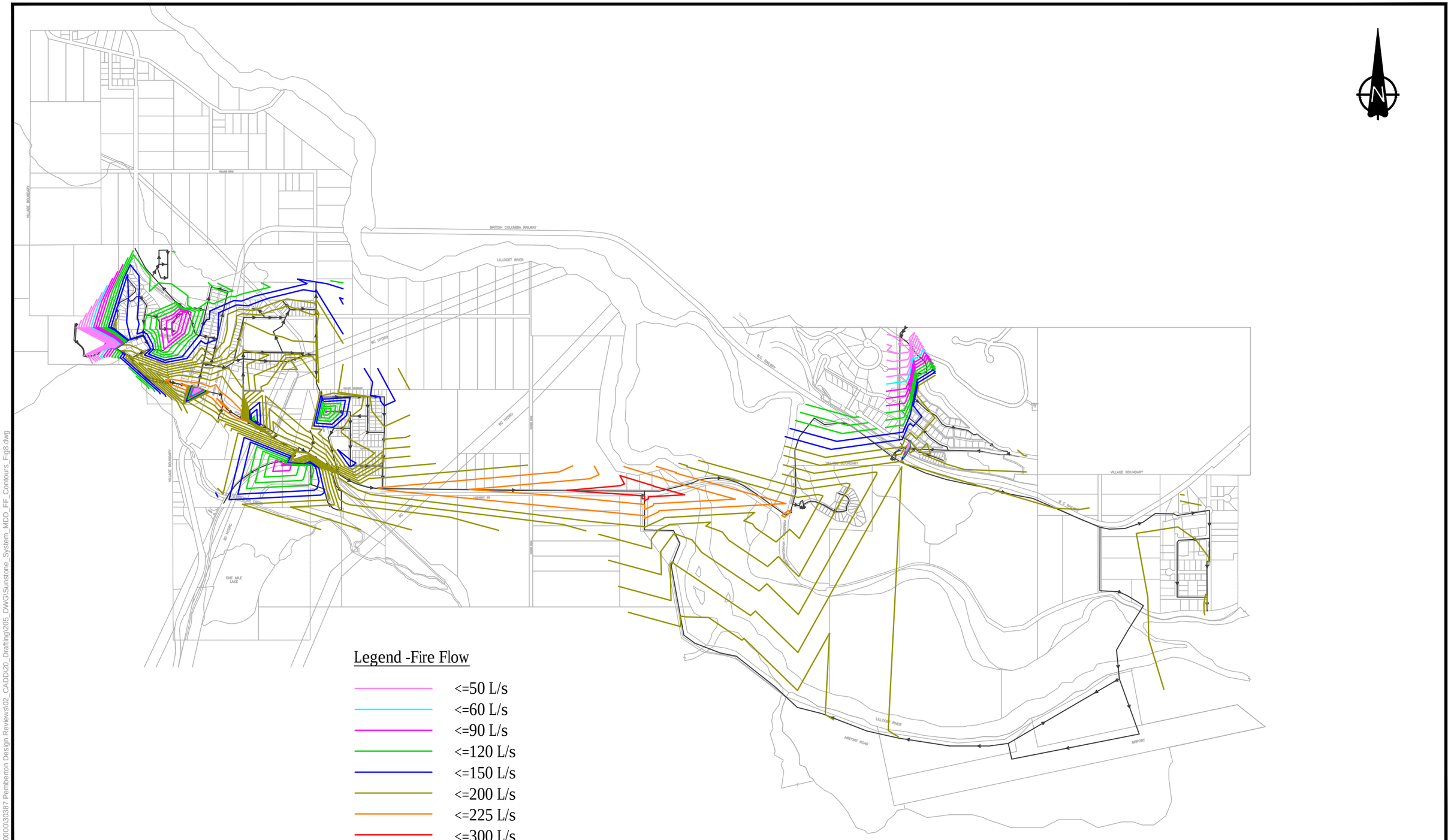
ISL Engineering and Land Services

PEMBERTON DESIGN REVIEWS
SUNSTONE RIDGE
PEAK HOUR DEMAND CONTOURS

FIGURE 7
30387

HORZ 1:20 000 0 200 400 600 800m

August, 2012



T:\Projects\30000\30387 Pemberton Design Reviews\02_CADD\20_Drafting\205_DWG\Sunstone_System_MDD_FF_Contours_Fig8.dwg

ISL Engineering and Land Services

PEMBERTON DESIGN REVIEWS

SUNSTONE RIDGE

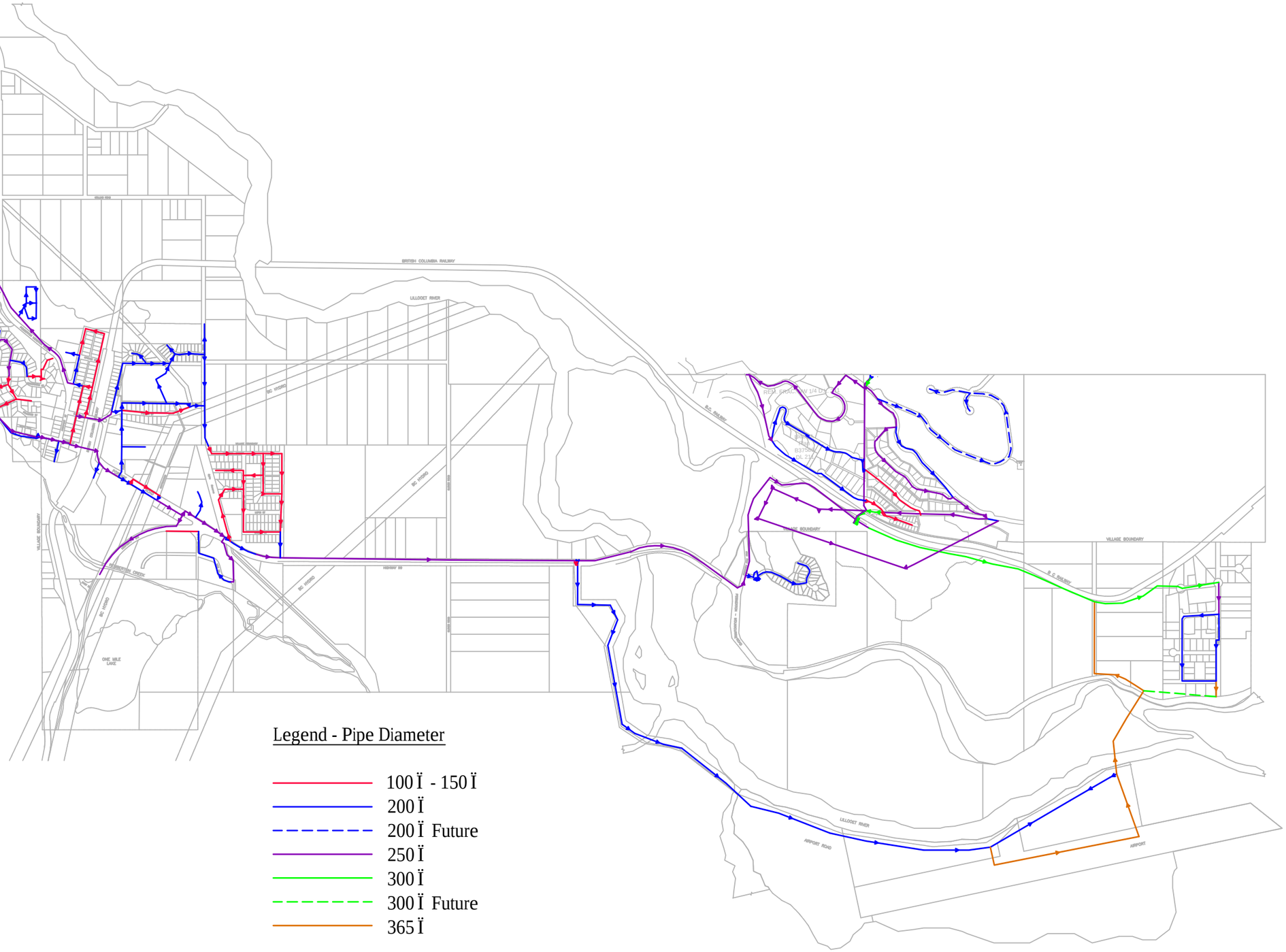
MAXIMUM DAY DEMAND & FIRE FLOW CONTOURS

FIGURE 8

30387

HORZ 1:20 000 — 0 200 400 600 800m

August, 2012



T:\Projects\30000\30387 Pemberton Design Reviews\02_CADD\20_Drafting\205_DWG\Raven&Sunstone_Water_System_Fig9.dwg

ISL Engineering and Land Services

PEMBERTON DESIGN REVIEWS

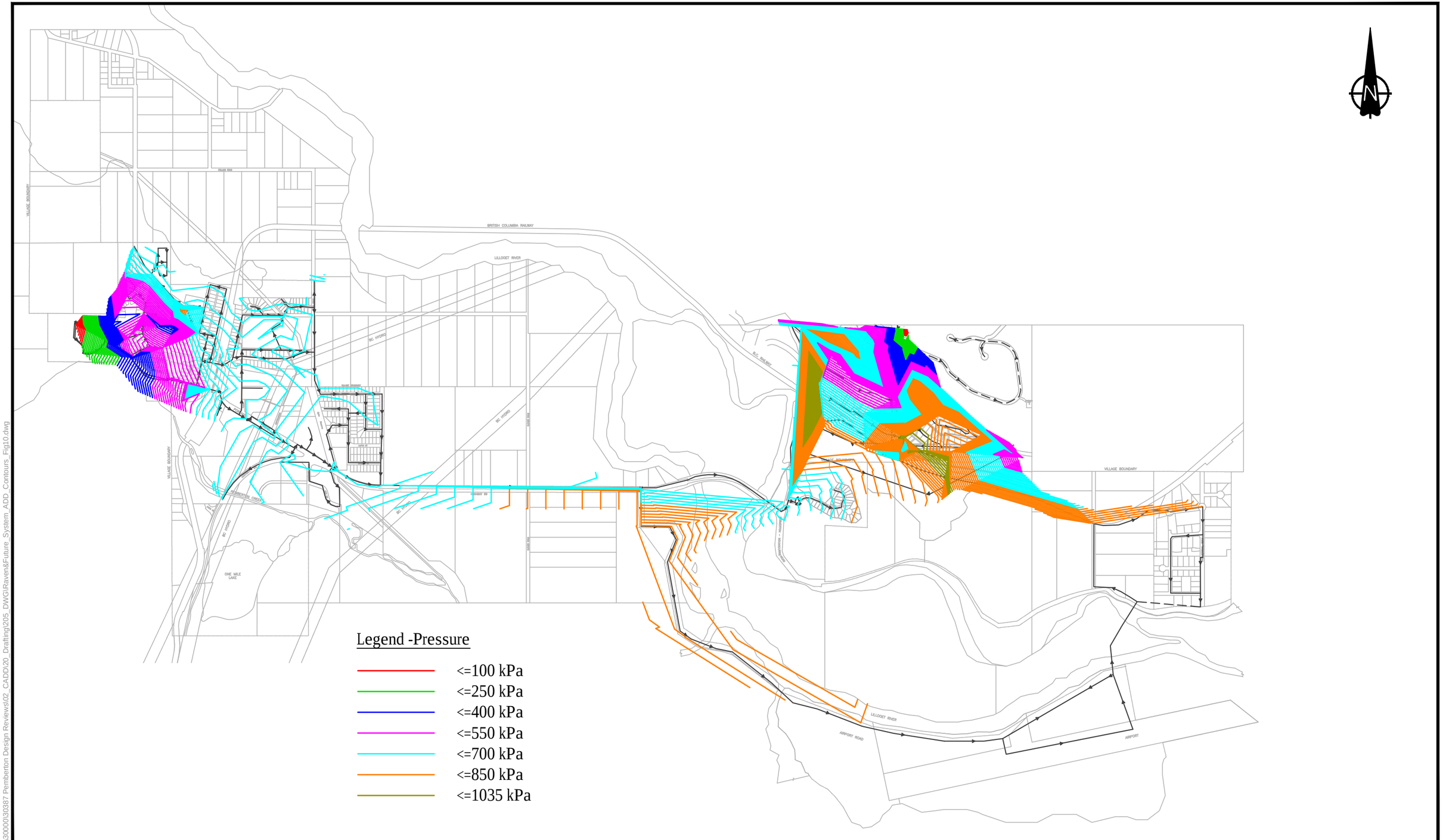
EXISTING WATER SYSTEM INCLUDING SUNSTONE RIDGE, BIRO SITE & RECREATION FACILITY

FIGURE 9

30387

HORZ 1:20 000 0 200 400 600 800m

August, 2012



T:\Projects\30000\30387 Pemberton Design Reviews\02_CADD\20_Drafting\205_DWG\Raven&Future_System_ADD_Contours_Fig10.dwg

ISL Engineering and Land Services

PEMBERTON DESIGN REVIEWS

RAVENSCREST & FUTURE DEVELOPMENT

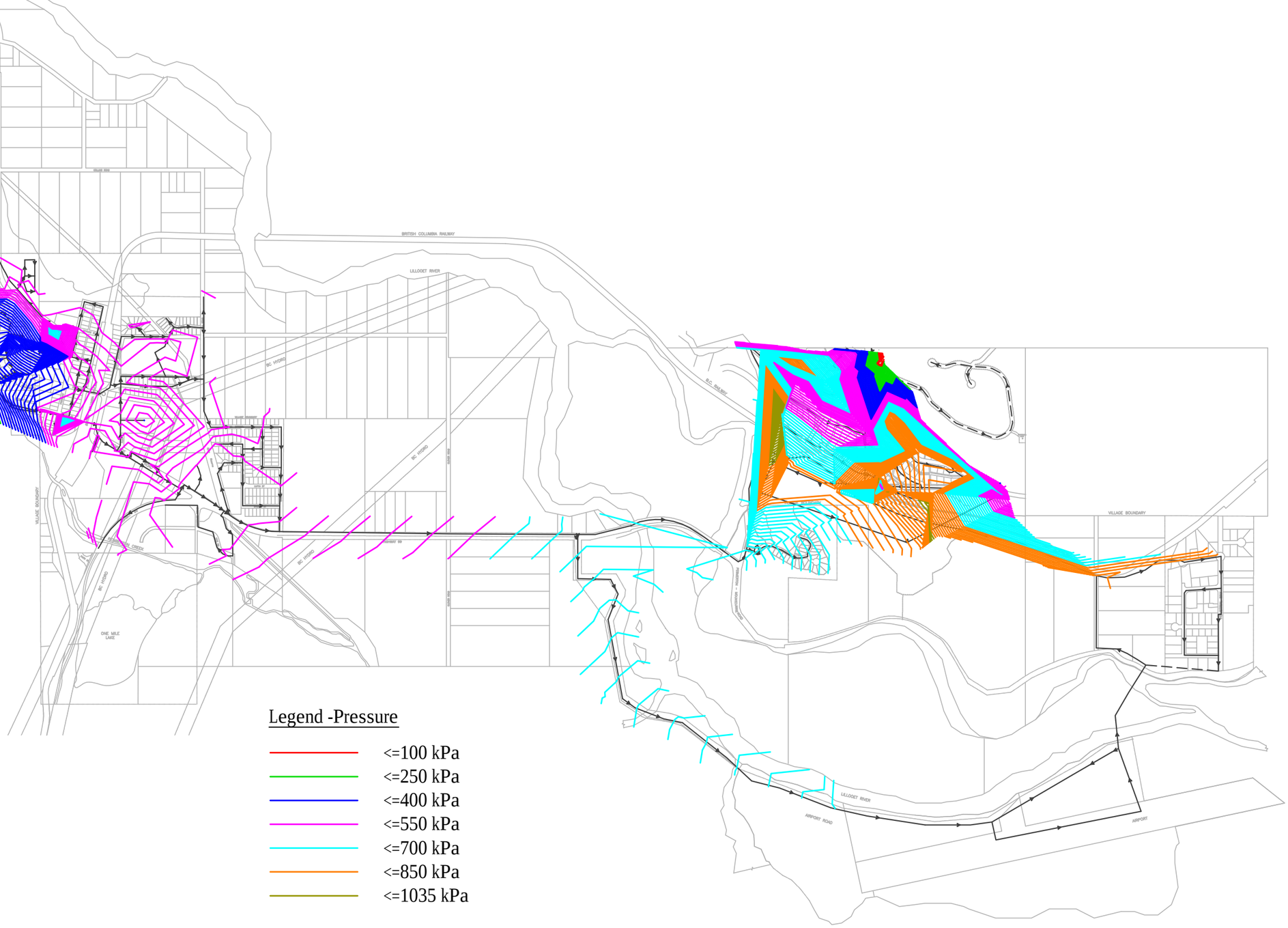
AVERAGE DAY DEMAND CONTOURS

FIGURE 10

30387

HORZ 1:20 000 — 0 200 400 600 800m

August, 2012



T:\Projects\30000\30387 Pemberton Design Reviews\02_CADD\20_Drafting\205_DWG\Raven8Future_System_PHD_Contours\Fig11.dwg

ISL Engineering and Land Services

PEMBERTON DESIGN REVIEWS

SUNSTONE RIDGE & FUTURE DEVELOPMENT

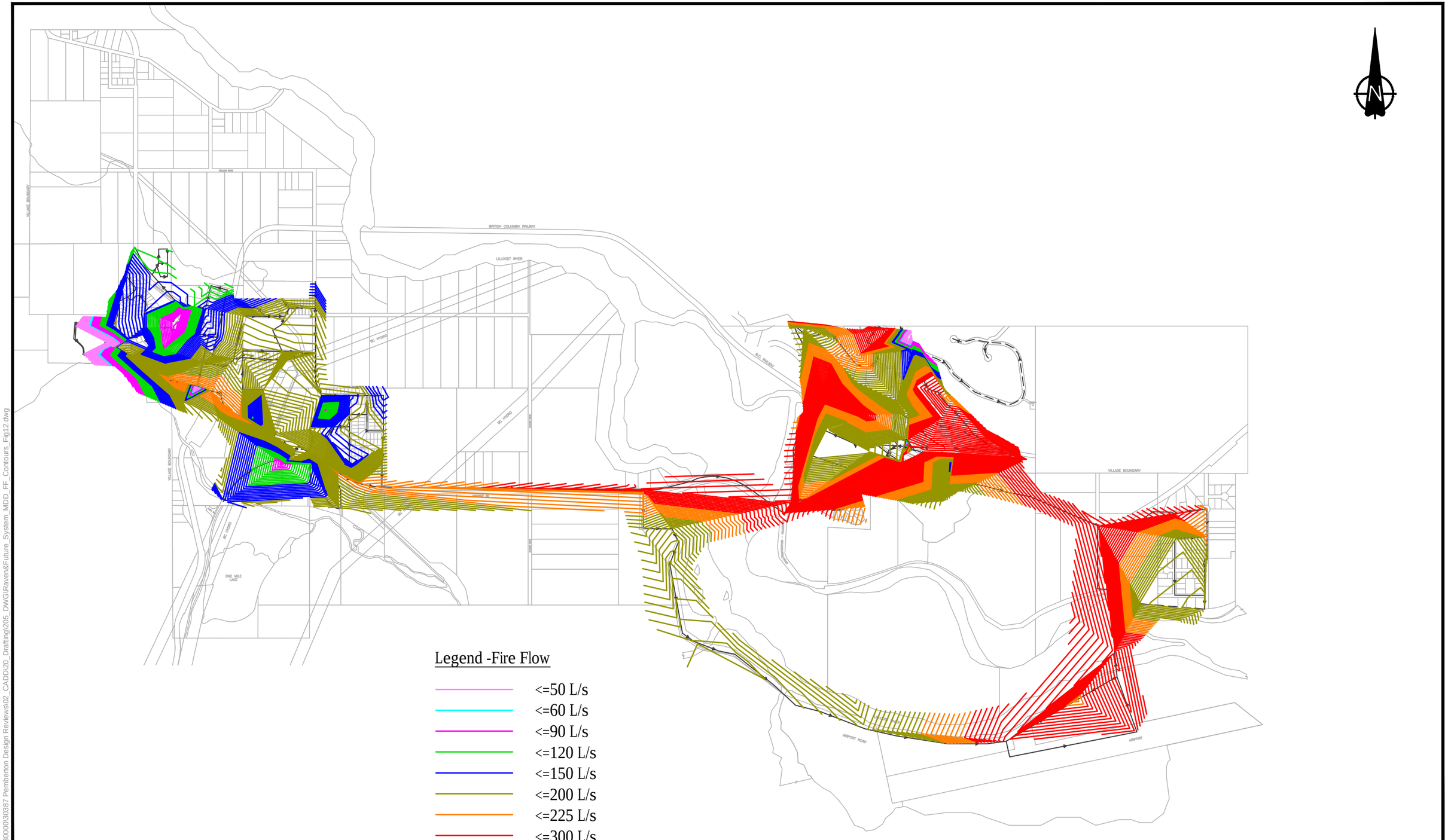
PEAK HOUR DEMAND CONTOURS

FIGURE 11

30387

HORZ 1:20 000 0 200 400 600 800m

August, 2012



T:\Projects\30000\30387 Pemberton Design Reviews\02_CADD\20_Drafting\205_DWG\Raven&Future_System_MDD_FF_Contours_Fig12.dwg

ISL Engineering and Land Services

PEMBERTON DESIGN REVIEWS

SUNSTONE RIDGE & FUTURE DEVELOPMENT

MAXIMUM DAY DEMAND & FIRE FLOW CONTOURS

FIGURE 12

30387

HORZ 1:20 000 0 200 400 600 800m

August, 2012

Appendix B – Delcan Technical Memorandum

Technical Memorandum

To:	Graham Schulz, P.Eng ISL Engineering	Date:	April 04, 2012
cc:	Cam McIvor, Project Manager / Grant Campbell, P.Eng		
From:	Colin Kristiansen, P.Eng Todd Bowie, P.Eng	Our Ref:	EB3766

RE: Sunstone Ridge Development – Water Demand Assessment & Preliminary Servicing Arrangements

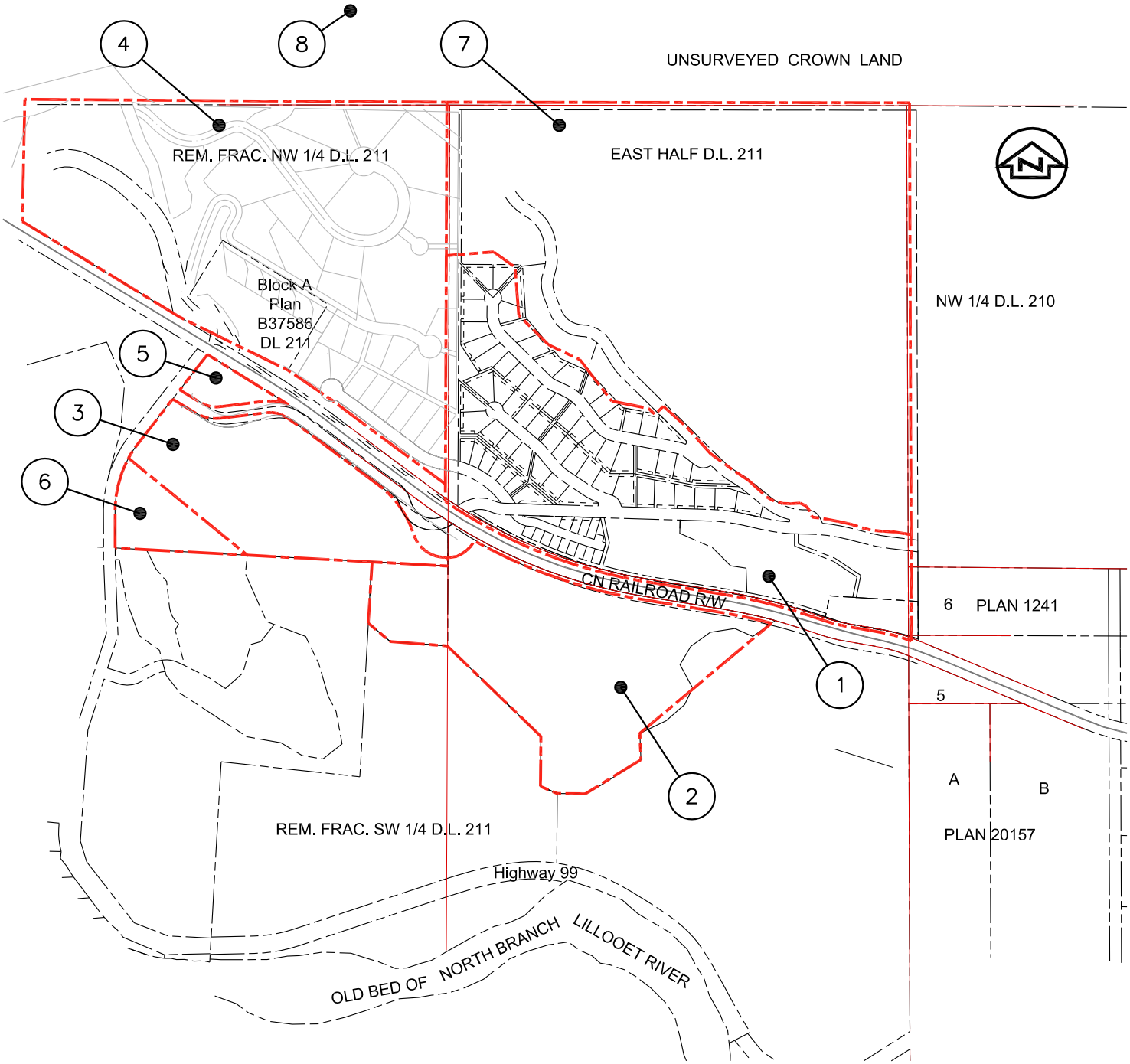
Delcan has been retained to provide engineering services for the development of Phase 1 of the Sunstone Ridge Development (SRD), located in the Village of Pemberton, 3 km east of the Village Centre.

The purpose of this Technical Memorandum is to present the design basis for the water demand assessment, identify the water demands for the SRD site and other surrounding potential short term development sites, and present preliminary storage reservoir sizes.

Development Plan

The SRD site is anticipated to be the first phase of a number of developments in the Sunstone Ridge area. The location of the SRD site and proposed surrounding developments are shown in **Figure 1**. Details on the development plans are as follows:

1.	Sunstone Ridge Development Site (Phase 1)	78 single-family units 142 multi-family units
2.	School Site	1200 student school building 800 student boarding building
3.	Recreation Facility Site	30,000 ft^2 ice arena building 12,000 ft^2 swimming pool building
4.	Biro Site	31 single-family units 77 multi-family units Resort Hotel
5.	Commercial Site	100,000 ft^2 neighbourhood commercial
6.	22 SF Site	22 single-family units
7.	Sunstone Ridge Development Site (Phase 2)	130 units



POTENTIAL DEVELOPMENT SITES

1	SUNSTONE RIDGE SITE	4	BIRO SITE	7	SUNSTONE RIDGE PHASE 2
2	SCHOOL SITE	5	COMMERCIAL	8	LIL'WAT DEVELOPMENT (LONG TERM)
3	RECREATION FACILITY	6	22 SF UNITS		

Design Parameters

The following documents were referenced to predict the water demands of the SRD site and surrounding short-term development sites:

Village of Pemberton Subdivision and Development Control Bylaw #677, 2011

Squamish Lillooet Regional District (SLRD) Subdivision and Development Servicing Bylaw #741, 2002.

MMCD Design Guideline Manual, 2005.

Water Supply for Public Fire Protection, Fire Under Writers Survey (FUS), 1999.

Sewerage System Standard Practice Manual (SSSPM) Version 2, 2007.

Key parameters used in the assessment are summarized below:

Parameter	Value	Reference
Population per Dwelling	Single Family = 4 people/unit Multi Family = 3 people/unit	SLRD Bylaw #741
Per Capita Demand (litres/capita/day)	Average Daily Demand (ADD) = 455 l/c/d Maximum Daily Demand (MDD) = 910 l/c/d Peak Hour Demand (PHD) = 1820 l/c/d	Pemberton Bylaw #677
Other Demands	Students = 70 L/student/day Boarders = 400 L/boarder/day Arena = 85,000 L/day Swimming Pool = 50 L/m^2 Shopping Center = 0.1 L/m^2 Restaurant = 150 L/seat	MMCD MMCD MMCD SSSPM MMCD MMCD
Minimum Fire Flow Requirements	Single Family (non-sprinkled) = 60 L/sec Multi Family (non-sprinkled) = 90 L/sec Commercial (non-sprinkled) = 150 L/sec	MMCD Design Guidelines
Minimum Fire Storage Requirements	Single Family (non-sprinkled) = 216,540 L Multi Family (non-sprinkled) = 567,540 L Commercial (non-sprinkled) = 1,080,000 L	FUS Manual
Minimum Reservoir Size (A+B+C)	A = Fire Storage; B = Equalization Storage (25% of MDD) C = Emergency Storage (25% of A+B)	MMCD

Water Demand & Storage Assessment

Two preliminary servicing designs are being developed for the SRD site, one for servicing only the SRD site, and one for servicing all of the short term potential development sites. This will establish the difference in facilities and costs associated with the SRD site and the neighbouring properties, and may form the basis for cost sharing arrangements such as latecomers' fees. Predicted water demands from each of the individual sites are summarized in **Table 1.**

Table 1: Summary of Water Demand Predictions

Site	ADD (L/sec)	MDD (L/sec)	PHD (L/sec)
1. SRD Site (Phase 1)	3.9	7.8	15.5
2. School Site	4.0	8.1	16.1
3. Recreation Facility	1.6	3.3	6.5
4. Biro Site	2.9	5.8	11.6
5. Commercial Site	0.1	0.4	0.9
6. 22 SF Units	0.5	0.9	1.9
7. SRD Site (Phase 2)	2.7	5.5	11.0
Totals	**15.8**	**31.7**	**63.5**

* assumed incl. 50 seat restaurant

Servicing Arrangement 1 - SRD Phase 1 Site Only

The first servicing arrangement is limited to only the SRD site. The arrangement would involve a connection to the Village of Pemberton water system at Pemberton Farm Road. Water would be pumped to a proposed reservoir in the north-west corner of the SRD site. The proposed reservoir would supply the SRD development. Two strategies for this servicing arrangement are presented below: A) fire flows provided by connection to Village system; and, B) fire flows provided by on-site reservoir.

Strategy A:

The connection to the Village system would provide both fire demand flows and storage. The connection to the Village system, the proposed pump station, and the reservoir fill line would be sized to accommodate the MDD + fire flows. Minimum fire flow for the development would be 90 L/sec for the townhouse sites.

Village Connection Flow Requirements: 97.8 L/sec
Reservoir Storage Requirement: 210,000 L

Strategy B:

The proposed reservoir would provide both peak hour balancing storage and fire demand storage. The connection to the Village system, the proposed pump station, and the reservoir fill line would be sized to accommodate the MDD. Minimum fire flow for the development would be 90 L/sec for the townhouse sites.

Village Connection Flow Requirements:	7.8 L/sec
Reservoir Storage Requirement:	920,000 L

Servicing Arrangement 2: All Short Term Development Sites

The second servicing arrangement includes the SRD site and the surrounding short term development sites. The overall servicing arrangement would be the same as arrangement 1 with a connection to the Village of Pemberton water system at Pemberton Farm Road and water pumped to a proposed reservoir in the north-west corner of the SRD site. It is assumed that balancing and emergency storage for the SRD Phase 2 development will be provided in future reservoir at a higher elevation. Similar to arrangement 1, there are two strategies for this servicing arrangement: A) fire flows provided by connection to Village system; and, B) fire flows provided by on-site reservoir.

Strategy A:

The connection to the Village system would provide both fire demand flows and storage. The connection to the Village system, the proposed pump station, and the reservoir fill line would be sized to accommodate the MDD + fire flows. Minimum fire flow for the development would be 150 L/sec for the commercial and institutional sites.

Village Connection Flow Requirements:	181.7 L/sec
Reservoir Storage Requirement:	710,000 L

Strategy B:

The proposed reservoir would provide both peak hour balancing storage and fire demand storage. The connection to the Village system, the proposed pump station, and the reservoir fill line would be sized to accommodate the MDD. Minimum fire flow for the development would be 150 L/sec for the commercial and institutional sites.

Village Connection Flow Requirements:	31.7 L/sec
Reservoir Storage Requirement:	2,060,000 L

Preliminary Servicing Layout

The preliminary water serving layout for the SRD site is shown in **Figure 2**. Pipe sizes for the four servicing strategies are summarized in **Figures 3 – 6**.

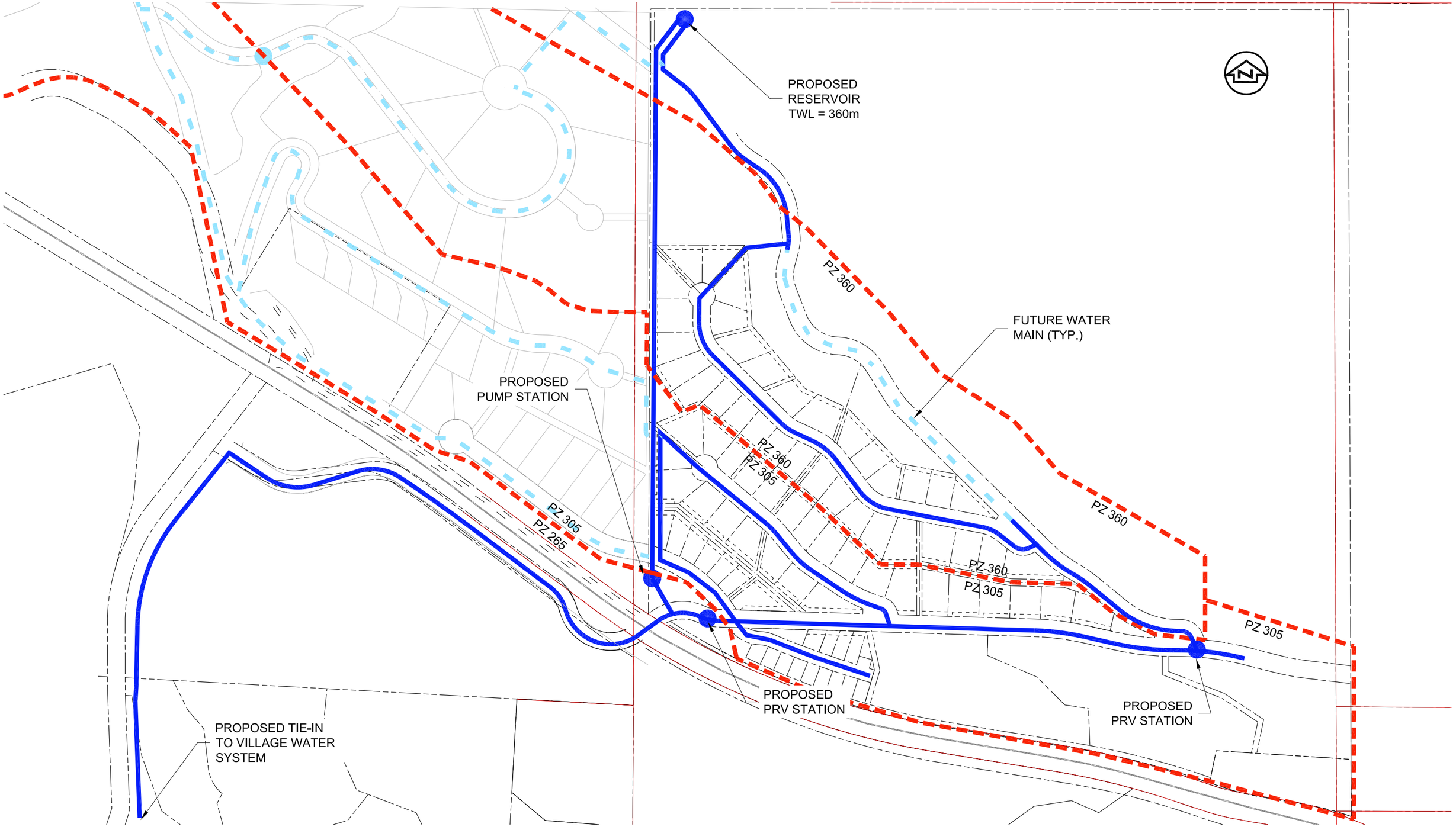


Figure 2: Water Servicing Concept

Figure 3: Servicing Arrangement 1-A
(SRD Site Only, Fire Flow from Village)

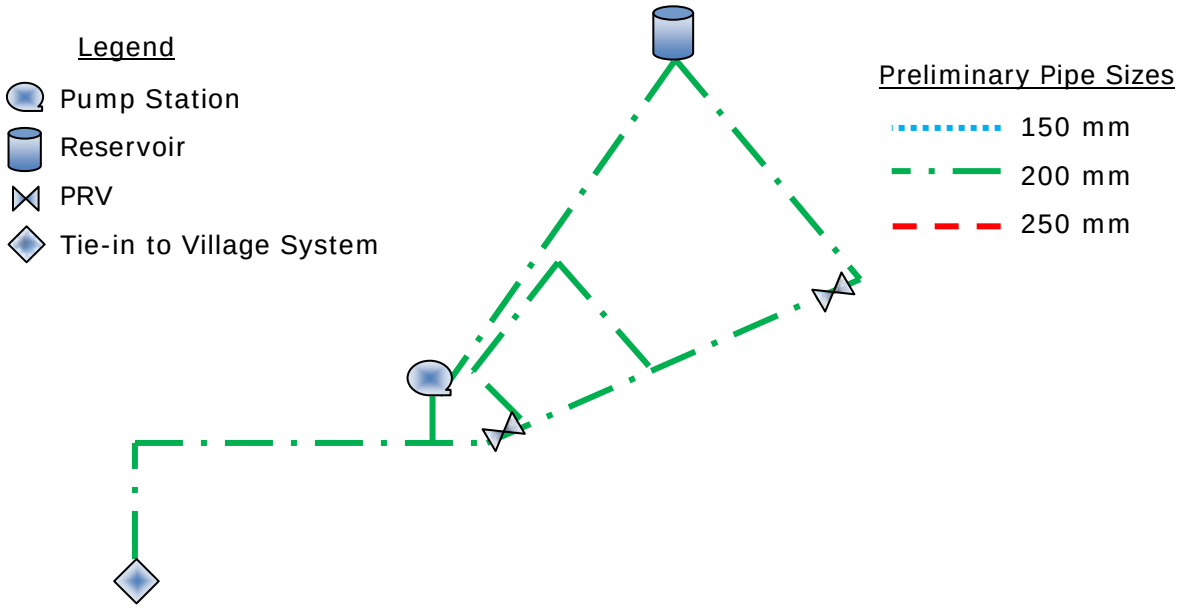


Figure 4: Servicing Arrangement 1-B
(SRD Site Only, Fire Flow from Reservoir)

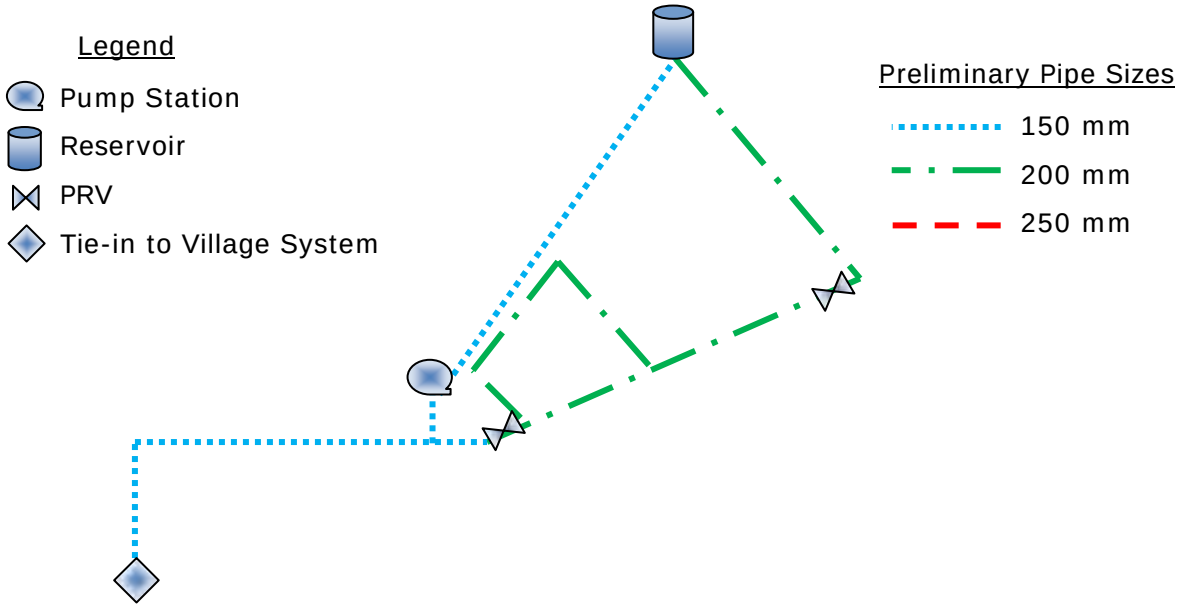


Figure 5: Servicing Arrangement 2-A
(All Short Term Development, Fire Flow from Village)

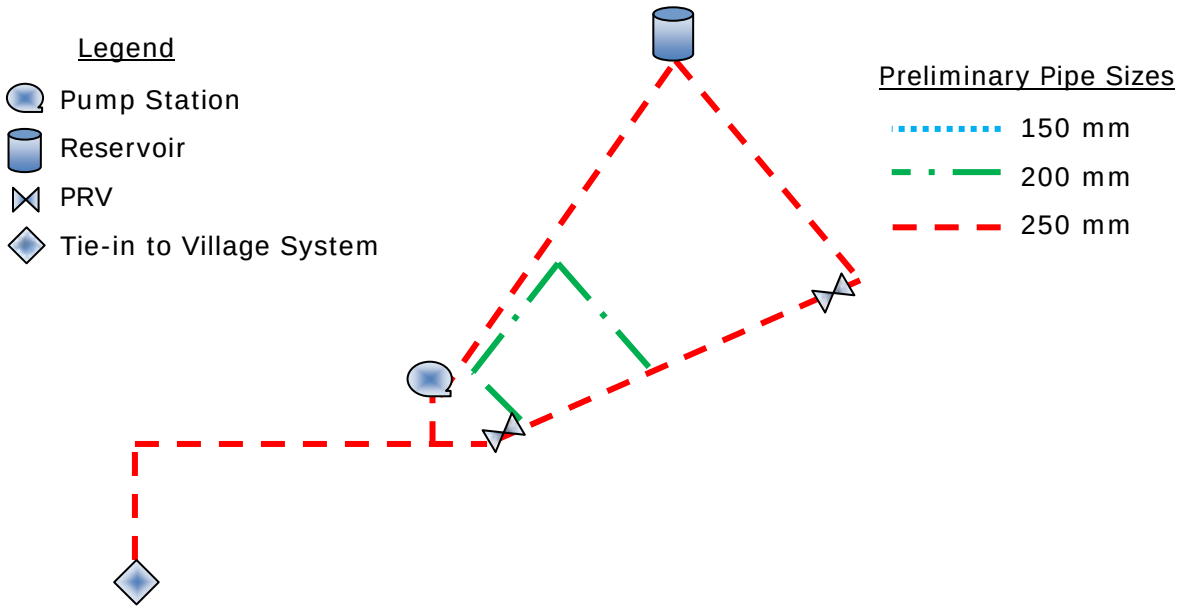
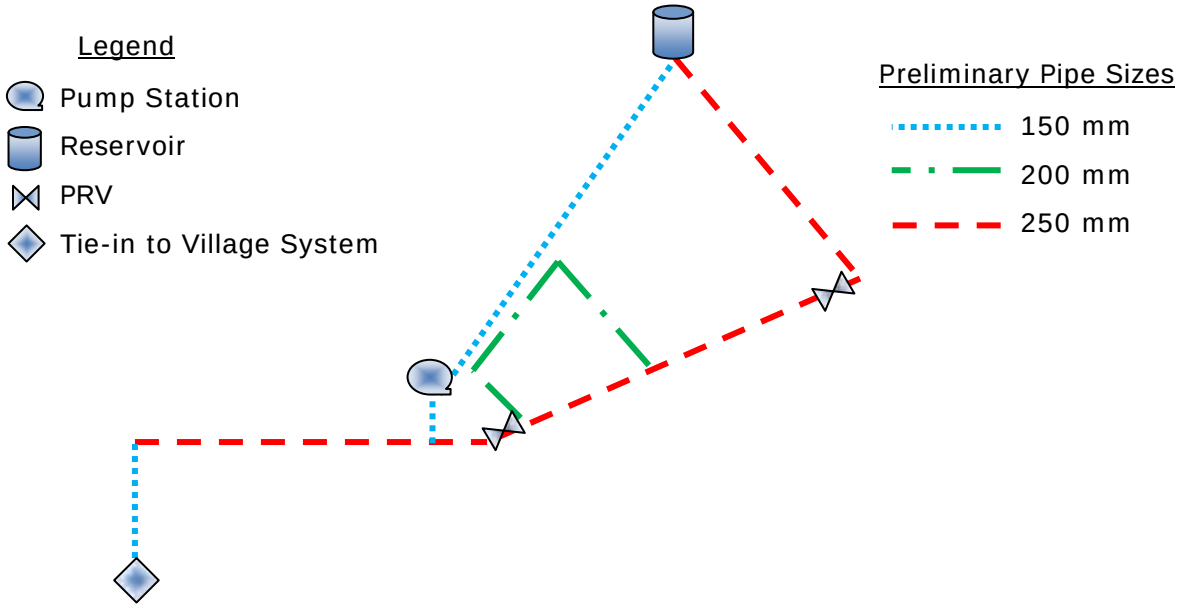


Figure 6: Servicing Arrangement 2-B
(All Short Term Development, Fire Flow from Reservoir)



Conclusions

To proceed with preliminary design of the water supply infrastructure required for the SRD development, the minimum available pressure at the proposed connection to the Village Water System at Old Farm Road is required for the following flows: 7.8 L/sec; 31.7 L/sec; 97.8 L/sec; and, 181.7 L/sec.

Following confirmation of the available flow and pressure at the Village connection, Delcan will proceed with laying out the details of the preliminary design. Details will include: hydrant locations, pipe sizes, air valve locations, valve locations, service connection locations, pumping requirements, and reservoir sizing requirements.

ISL Sewer Modeling Report

Date November 06, 2012

Our Reference: 30387

Village of Pemberton
PO Box 100
7400 Prospect Street
Pemberton, BC V0N 2L0

Attention: Caroline Lamont, Manager of Development Services

Dear Madam:

Reference: Village of Pemberton Sanitary Sewer Forcemain Analysis

---

1.0 Introduction

As requested, an analysis has been conducted on the Village of Pemberton's sanitary forcemain system and wastewater treatment plant. The purpose of the analysis was to determine if there is capacity in the existing sanitary forcemain and treatment plant to accept the proposed sanitary sewer flows anticipated from the proposed development. In particular, an analysis was conducted for the following scenarios

- The existing flow conditions of the Village of Pemberton forcemain system,
- The existing flow conditions plus the Sunstone Ridge Development Phase 1, and
- The existing flow conditions plus the Sunstone Ridge Development Phase 1 & 2 plus future developments in the area.

2.0 Design Criteria

The design criteria for the analysis were taken from the Village of Pemberton Subdivision and Control Bylaw 677 and the Master Municipal Construction Document (MMCD).

3.0 The Existing Sanitary System

The Village's sanitary system, as it relates to this analysis, consists of a sewage pump station located at industrial park and a forcemain running from the pump station to the treatment plant. The forcemain generally runs west from the industrial park along Highway #99 until a bend at Sturdy's Farm approximately 500m west of the intersection of Industrial Park and Highway #99. According to record drawings, there is a 200x200x200 HDPE Tee with 200mm blind flange immediately upstream of the bend at Sturdy's farm. From Study's Farm, the forcemain runs south to cross under the Lillooet River and into the Village treatment plant adjacent to Airport Road.

According to record information, the existing forcemain pipe characteristics are shown in the table below:

Pipe Section	Diameter, Type, Class	Length (m)	Pressure Rating (psi)
Industrial Park to River	200mm HDPE DR26	1120	64
River Crossing	200mm HDPE DR11	220	160
River to WWTP	200mm HDPE DR26	140	64

According to record information, the pump motors at the Industrial Park pump station is currently operating with Myers pumps identified as:

Manufacturer Myers
Model 4RCX
Type 20Hp, 3450 RPM, 3 phase 208 volts
Capacity 16 L/s @ 30m head

3.1 Capacity Review of Forcemain

The sanitary flows from the Industrial Park are 26 L/s including existing and future long term build-out capacities. An analysis was conducted on the existing forcemain using the 26 L/sec flow rate with the following summary of results;

Pipe Pressure Rating	**64 psi**
Normal Operating Pressure:	23 psi
Available capacity	64%
Short Term Pipe Rating (during surge occurrences)	**96 psi**
Surge Pressure:	39 psi
Total Pressure (operating + surge)	62 psi
Available capacity	35%

Based on the above analysis, the existing forcemain is sufficient for current and future flows anticipated from the Industrial Park pump station. The existing pumps will, however, need to be replaced or modified to meet long term build-out requirements.

3.2 Capacity Review of WWTP

The Village of Pemberton wastewater treatment plant, commissioned in 2005, was originally designed for a population of 5,000 people with the following design criteria:

- Average Dry Weather Flow (ADWF) 1,530 m^3/d
- Maximum Daily Flow (MDF) 3,060 m^3/d (or, 2*ADWF)
- Peak Wet Weather Flow (PWWF) 53 L/s

The Village maintains daily records of the flows received by the WWTP. Records indicate daily flows of up to 2,400 m^3/d.

Capacity constraints of the treatment plant needs to be reviewed further in order to access the affects of the proposed development on the existing system. High inflow and infiltration rates may have significant impacts to the available capacity at the existing treatment plant.

4.0 The Existing Sanitary System with Future Developments

4.1 Sunstone Ridge Development Phase 1

Phase 1 of the Sunstone Ridge Development (SRD) is located approximately 3 km east of the Village core, north of the CN railway. The SRD site will be the first of a number of developments in the Sunstone Ridge area and will consist of single family and multi-family units. The total demands identified for SRD were taken from the Delcan Technical Memorandum dated April 16, 2012 and are as follows:

- ADWF = 3.5 L/s
- I&I = 3.9 L/s
- PWWF = 15.3 L/s

The full Technical Memorandum can be found in Appendix B of this report.

With the development of the SRD site, a new pump station and forcemain is proposed. The forcemain tie-in is proposed at the existing forcemain on Highway #99 near Sturdy's Farm.

The analysis of the existing forcemain capacity as it relates to Phase 1 proposed development with existing flows from Industrial Park is summarized below:

Pipe Pressure Rating	**64 psi**
Normal Operating Pressure:	28 psi
Available capacity	56%
Short Term Pipe Rating (during surge occurrences)	**96 psi**
Surge Pressure:	61 psi
Total Pressure (operating + surge):	89 psi
Available capacity	7%

4.2 Sunstone Ridge Development Phase 1 & 2 plus Future Developments

Future development areas in addition to the SRD Phase 1 are outlined in Table 1 of Delcan's Technical Memorandum and include a school site, recreational facility, Biro site, commercial site, 22 SF site, and SRD Phase 2. The total demands from the Technical Memorandum are summarized in the following table.

Site	ADWF (L/s)	I&I (L/s)	PWWF (L/s)
SRD Site (Phase 1)	3.5	3.9	15.3
School Site	4.0	1.1	14.0
Recreation Facility	1.6	1.5	7.2
Biro Site	2.7	3.4	14.4
Commercial Site	0.1	0.1	0.5
22 SF Units	0.4	0.3	2.0
SRD Site (Phase 2)	2.5	5.6	13.9

The analysis of the existing forcemain capacity as it relates to Phase 1 & 2 and future developments with existing flows from Industrial Park is summarized below:

Pipe Pressure Rating	**64 psi**
Normal Operating Pressure:	64 psi
Available capacity	0%
Short Term Pipe Rating (during surge occurrences)	**96 psi**
Surge Pressure:	127 psi
Total Pressure (operating + surge)	191 psi
Available capacity *(capacity is exceeded)*	0%

5.0 Conclusions

The following conclusions are made based on the above:

- Phase 1 of the Sunstone Ridge Development may be accommodated with the existing forcemain.
- Only the portion of existing forcemain under the Lillooet River (160 psi pipe rating) can accommodate Phase 1 & 2 and future developments.
- The portion of the existing forcemain (64 psi pipe rating) cannot accommodate all flows anticipated from Phase 1 & 2 and future development.
- An evaluation of the treatment plant capacity needs to be completed to assess the effects of the proposed development. This may include completion of an inflow and infiltration study.

6.0 Recommendations

1. Although the first phase of SRD may be accommodated with the existing forcemain, it is recommended that that any proposed connection to the existing forcemain be made downstream of the transition between the existing DR 26 and DR 11 forcemain pipe. In addition, the forcemain section on the south of the Lillooet River requires upgrading or a second parallel pipe be installed to the treatment plant to accommodate build-out plans beyond Phase 1 of the Sunstone Ridge Development.

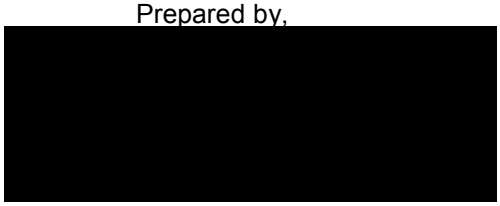
2. An evaluation of the treatment plant capacity is recommended to determine the affects of future development impacts.

3. An inflow and infiltration study may be required to determine the contribution of stormwater or groundwater to the sanitary sewer flows.

7.0 Closure

This report is prepared in response to the Draft Technical Memoradum prepared by Delcan dated April 16, 2012. Please contact the undersigned if you have any questions.

Prepared by,

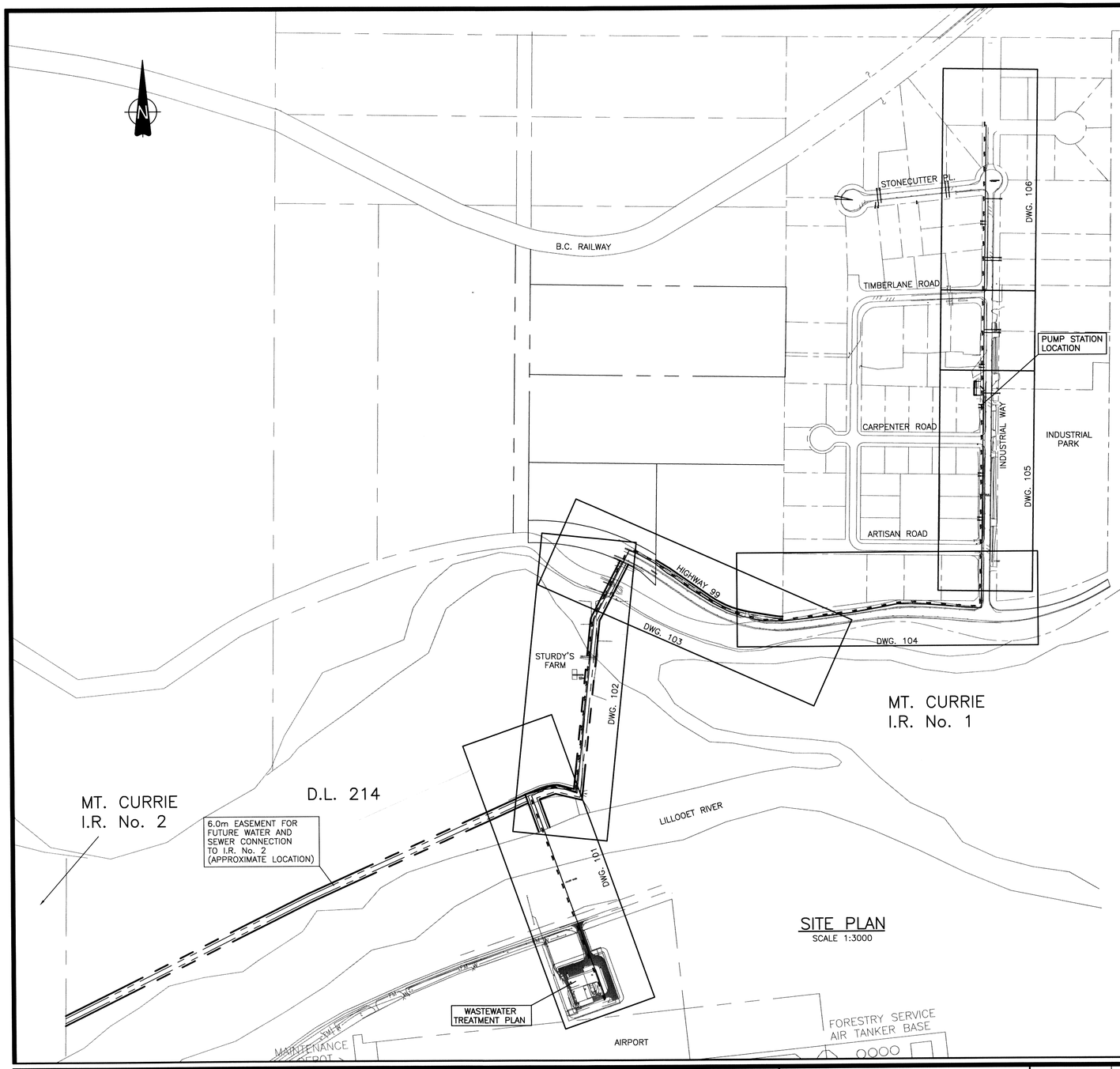


Richard Avedon-Savage, P.Eng.
Project Engineer

Graham Schulz, P.Eng.
Senior Project Engineer

Attachments

Appendix A – Record Drawings



SITE PLAN
SCALE 1:3000

MT. CURRIE
I.R. No. 10

LOCATION PLAN

100 KM 0 100 200 300 KM
SCALE

NO.	DATE	ENG.	BY	SUBJECT
				REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 ——— 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PRELIMINARY
NOT FOR CONSTRUCTION

Associated Engineering

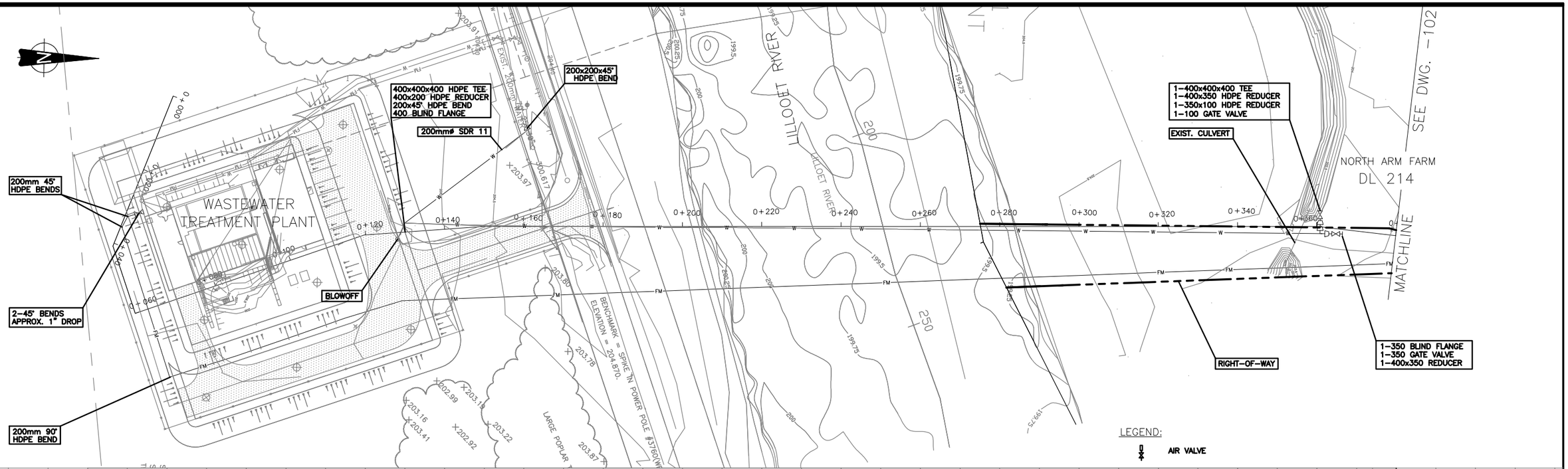
PROJECT No.	002035		
SCALE	AS NOTED		
DRAWN	C. L./J. W.		05/07/25
DESIGNED	D. D		05/07/25
CHECKED	D.D.		05/07/25
APPROVED	E.A.B.		05/07/25
DATE		INITIAL	

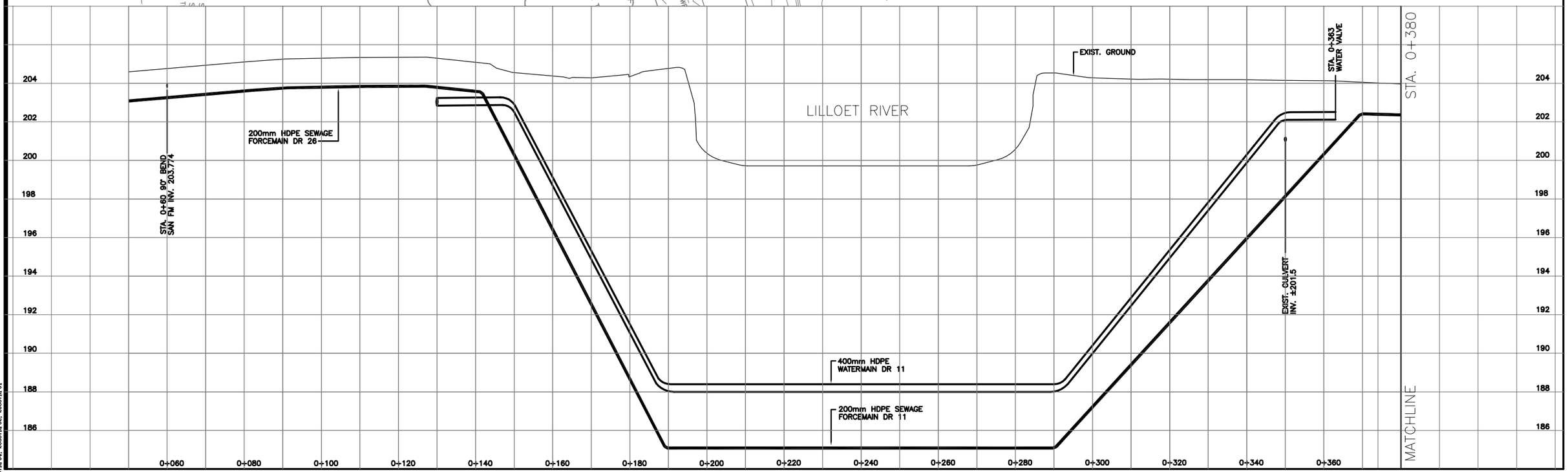
VILLAGE OF PEMBERTON

LOCATION PLAN AND SITE PLAN

INDUSTRIAL PARK
OFF-SITE WORKS

DRAWING NUMBER	REV. NO.	SHEET
002035-7-100		





NO.	DATE	ENG.	BY	SUBJECT
4	07/11/14	D.D.	L.Y.	RIGHT OF WAY REVISED
3	07/07/28	D.D.	L.Y.	RECORD DRAWING
2	06/08/24	D.D.	C.L.	ISSUED FOR CONSTRUCTION
1	06/04/07	D.D.	C.L.	ISSUED FOR TENDER

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 ——— 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Associated Engineering

PROJECT No.	002035		
SCALE	HOR. 1:500 VERT. 1:100		
DRAWN	L.Y.		07/05/28
DESIGNED	D.D.		05/07/26
CHECKED	D.D.		05/07/26
APPROVED	E.A.B.		05/07/26
DATE		INITIAL	

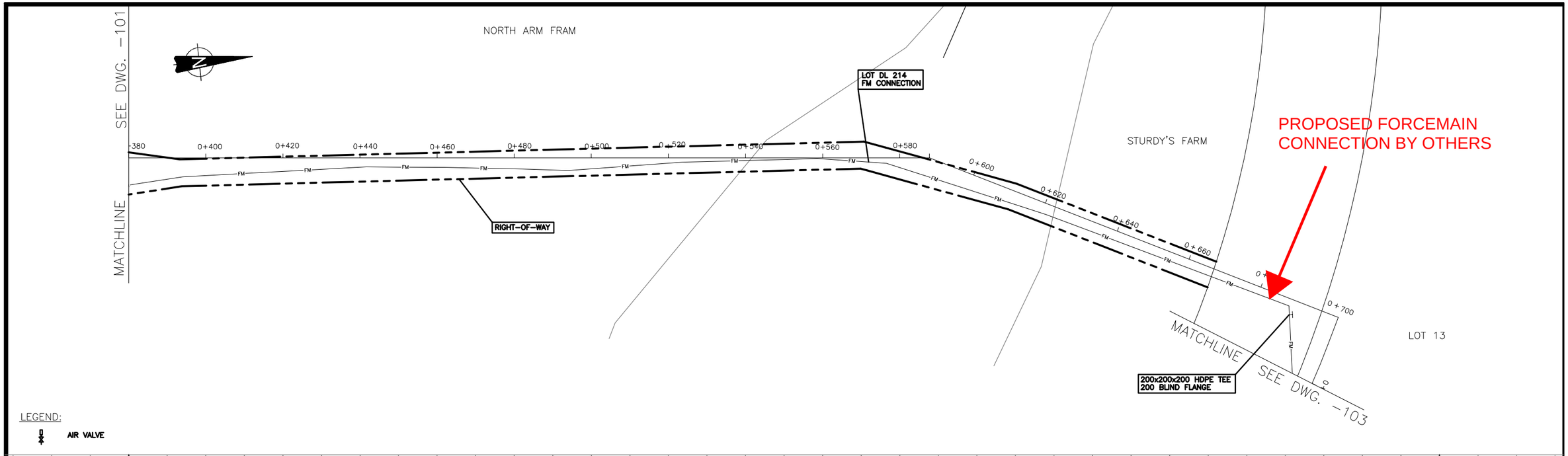
VILLAGE OF PEMBERTON

INDUSTRIAL PARK
OFF-SITE WORKS

SANITARY FORCEMAIN
PLAN AND PROFILE - SHEET 1

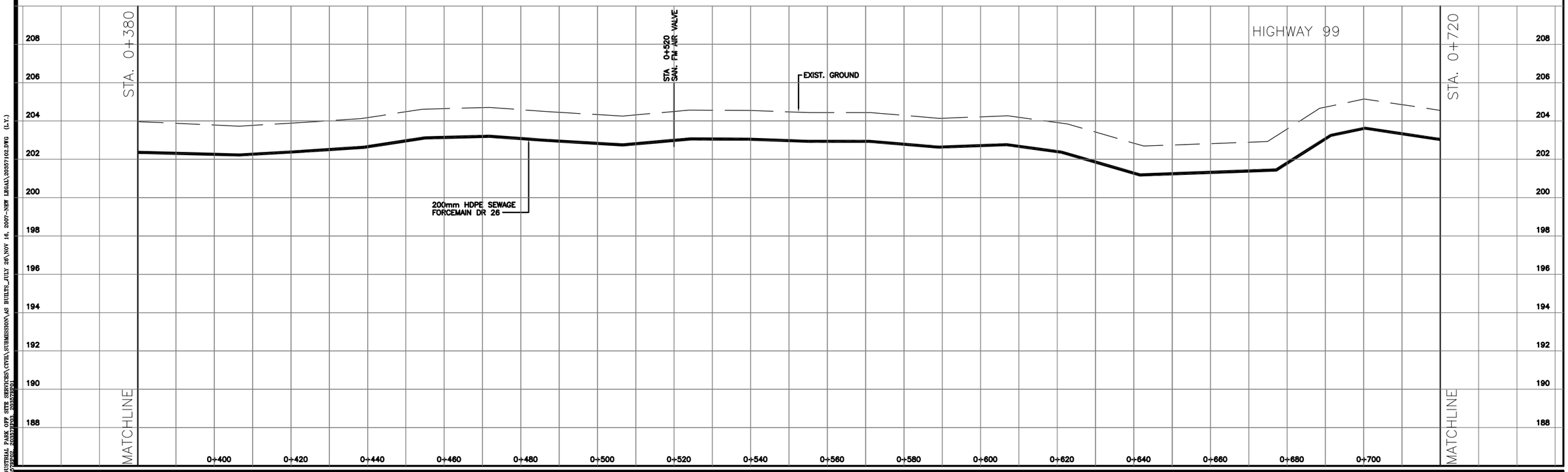
DRAWING NUMBER	REV. NO.	SHEET
002035-7-101	4	3/18

Time: 15:52
Date: 2007/11/16
Plot Scale: 1.000 (Paper Space)
AutoCAD File: Q:\002035\2005 INDUSTRIAL PARK OFF SITE SERVICES\CIVIL\SUBMISSION\AS BUILTS_JULY 26\NOV 16, 2007-NEW LEGAL\2035710I.DWG (L.Y.)
Xrefs: 2035710P04, 2035710P05, 2035710P03, 2035710P02, 2035710P01



LEGEND:

AIR VALVE



NO.	DATE	ENG.	BY	SUBJECT
5	07/11/14	D.D.	L.Y.	RIGHT OF WAY REVISED
4	07/07/26	D.D.	L.Y.	RECORD DRAWING
3	06/09/27	D.D.	C.L.	PROFILE REVISED
2	06/08/24	D.D.	C.L.	ISSUED FOR CONSTRUCTION
1	06/04/07	D.D.	C.L.	ISSUED FOR TENDER

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 ——— 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Associated Engineering

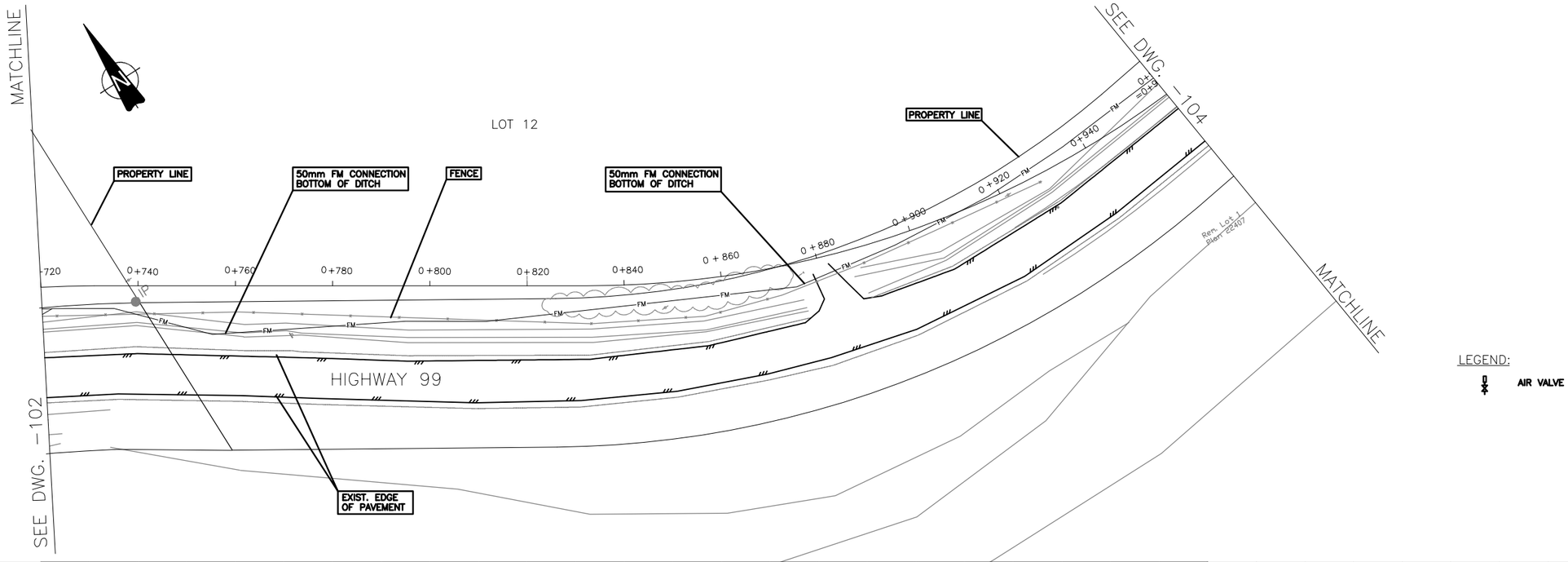
PROJECT No.	002035		
SCALE	HOR. 1:500 VERT. 1:100		
DRAWN	L.Y.		07/05/28
DESIGNED	D.D.		05/07/26
CHECKED	D.D.		05/07/26
APPROVED	E.A.B.		05/07/26
DATE		INITIAL	

VILLAGE OF PEMBERTON

INDUSTRIAL PARK
OFF-SITE WORKS

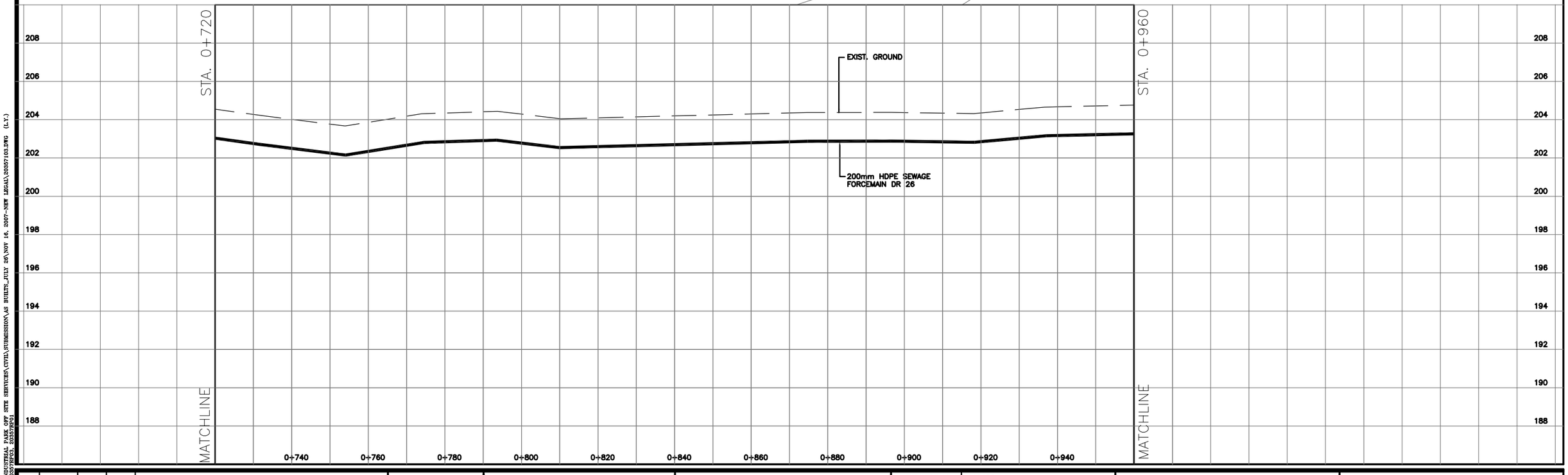
SANITARY FORCEMAIN
PLAN AND PROFILE - SHEET 2

DRAWING NUMBER	REV. NO.	SHEET
002035-7-102	5	4/18



LEGEND:

AIR VALVE



NO.	DATE	ENG.	BY	SUBJECT
4	07/11/14	D.D.	L.Y.	LEGAL LINE ADJUSTED
3	07/07/26	D.D.	L.Y.	RECORD DRAWING
2	06/08/24	D.D.	C.L.	ISSUED FOR CONSTRUCTION
1	06/04/07	D.D.	C.L.	ISSED FOR TENDER

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 ——— 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Associated Engineering

PROJECT No.	002035		
SCALE	HOR. 1:500 VERT. 1:100		
DRAWN	L.Y.		07/05/28
DESIGNED	D.D.		05/07/26
CHECKED	D.D.		05/07/26
APPROVED	E.A.B.		05/07/26
DATE		INITIAL	

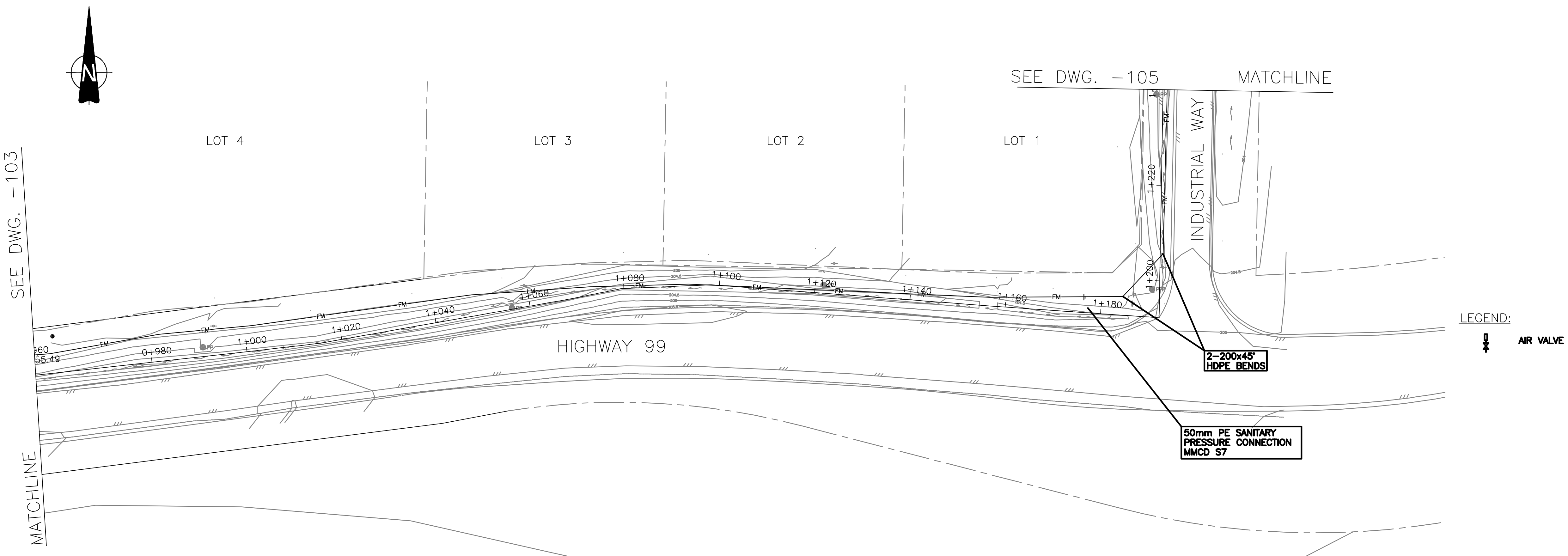
VILLAGE OF PEMBERTON

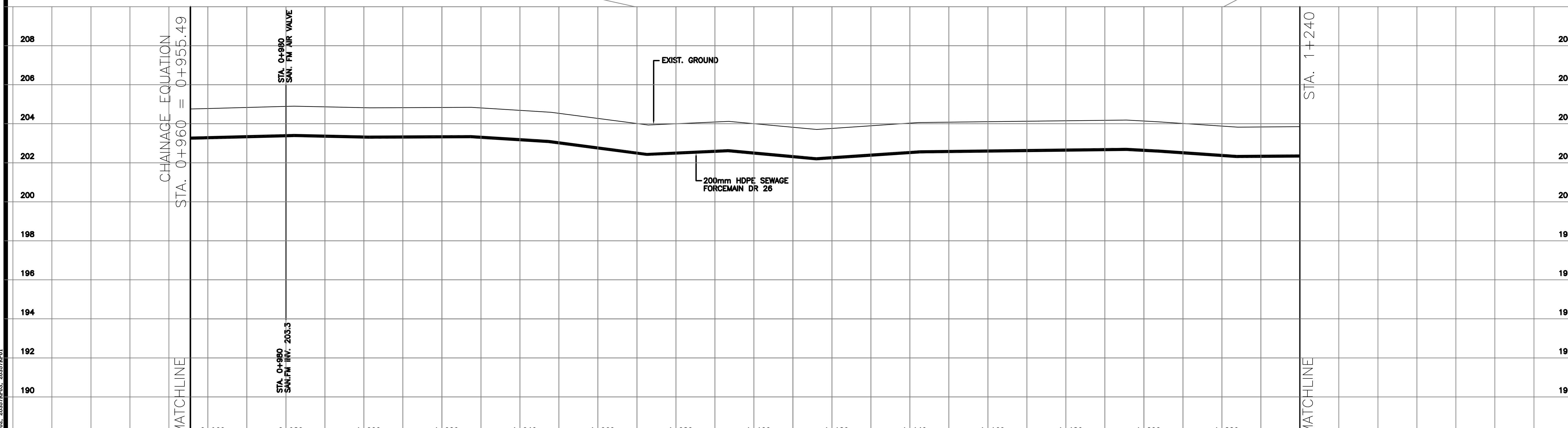
INDUSTRIAL PARK
OFF–SITE WORKS

SANITARY FORCEMAIN
PLAN AND PROFILE – SHEET 3

DRAWING NUMBER	REV. NO.	SHEET
002035–7–103	4	5/18

Time: 16:20
Date: 2007/11/16
Plotted By: Lisa Yeager Spaeo)
AutoCAD File: q:\002035\2008 INDUSTRIAL PARK OFF SITE SERVICES\CIVIL\SUBMISSION\AS BUILTS_JULY 25\NOV 16, 2007-NEW LEGAL\2035710З.DWG (L.Y.)
Xrefs: 2035?REP02, 2035?REP05, 2035?REP03, 2035?REP01





NO.	DATE	ENG.	BY	SUBJECT
3	07/07/26	D.D.	L.Y.	RECORD DRAWING
2	06/08/24	D.D.	C.L.	ISSUED FOR CONSTRUCTION
1	06/04/07	D.D.	C.L.	ISSUED FOR TENDER

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Associated Engineering

PROJECT No.	002035		
SCALE	HOR. 1:500 VERT. 1:100		
DRAWN	C.L./J.W.		07/05/26
DESIGNED	D.D.		05/07/26
CHECKED	D.D.		05/07/26
APPROVED	E.A.B.		05/07/26
DATE		INITIAL	

VILLAGE OF PEMBERTON

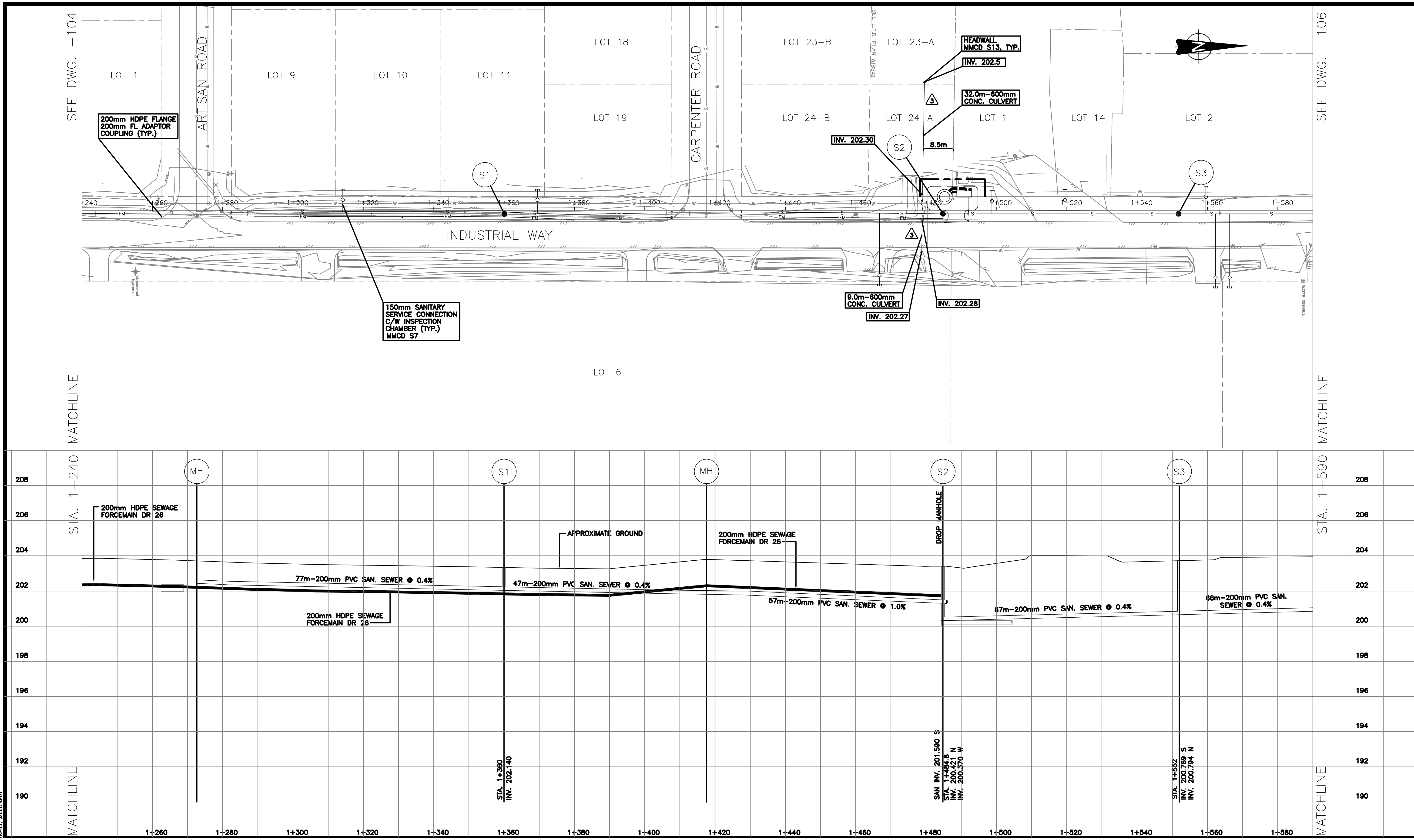
INDUSTRIAL PARK
OFF-SITE WORKS

SANITARY FORCEMAIN
PLAN AND PROFILE - SHEET 4

DRAWING NUMBER	REV. NO.	SHEET
002035-7-104	3	6/18

Time: 8:34
Date: 2007/7/26
Plot Scale: 1=1 (Paper Space)
AutoCAD File: Q:\002035\2005 INDUSTRIAL PARK OFF SITE SERVICES\CIVIL\SUBMISSION\AS BUILTS_JULY 26\20357104.DWG (L.Y.)
Xrefs: 20357RP05, 20357RP04, 20357RP02, 20357RP03, 20357RP01

This Drawing Is For The Use Of The Client And Project Indicated
No Representations Of Any Kind Are Made To Other Parties



NO.	DATE	ENG.	BY	SUBJECT
4	07/07/26	D.D.	L.Y.	RECORD DRAWING
3	06/09/15	E.A.B.	C.L.	STORM SEWER CULVERTS ADDED. SEWER AND FORCEMAIN REGRADED
2	06/08/24	D.D.	C.L.	ISSUED FOR CONSTRUCTION
1	06/04/07	D.D.	C.L.	ISSUED FOR TENDER

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Associated Engineering

PROJECT No.	002035		
SCALE	HOR. 1:500 VERT. 1:100		
DRAWN	L.Y.		07/05/28
DESIGNED	D.D.		05/07/26
CHECKED	D.D.		05/07/26
APPROVED	E.A.B.		05/07/26
DATE		INITIAL	

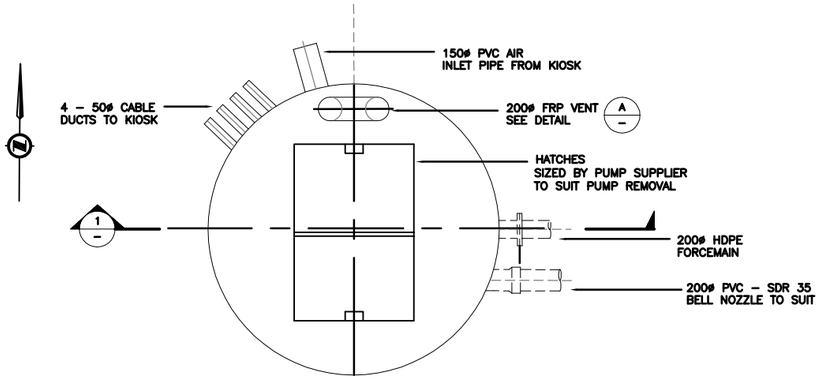
VILLAGE OF PEMBERTON

INDUSTRIAL PARK
OFF-SITE WORKS

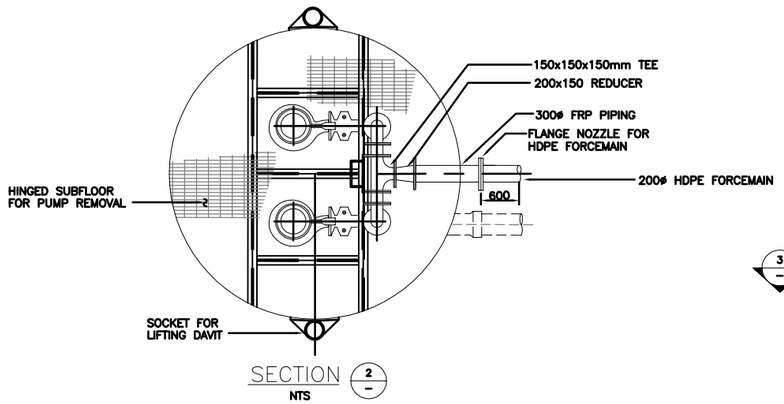
SANITARY FORCEMAIN
PLAN AND PROFILE - SHEET 5

DRAWING NUMBER	REV. NO.	SHEET
002035-7-105	4	7/18

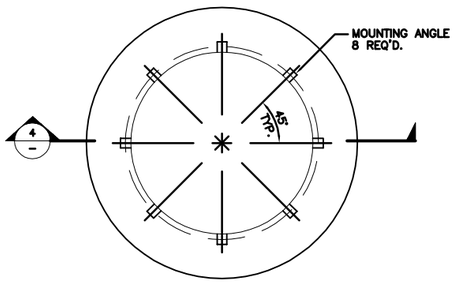
Time: 8:34
Date: 2007/7/26
Plot Scale: 1=1 (Paper Space)
AutoCAD File: Q:\002035\2005 INDUSTRIAL PARK OFF SITE SERVICES\CIVIL\SUBMISSION\AS BUILTS_JULY 26\20357105.DWG (L.Y.)
Xrefs: 20357RP05, 20357RP02, 20357RP03, 20357RP01



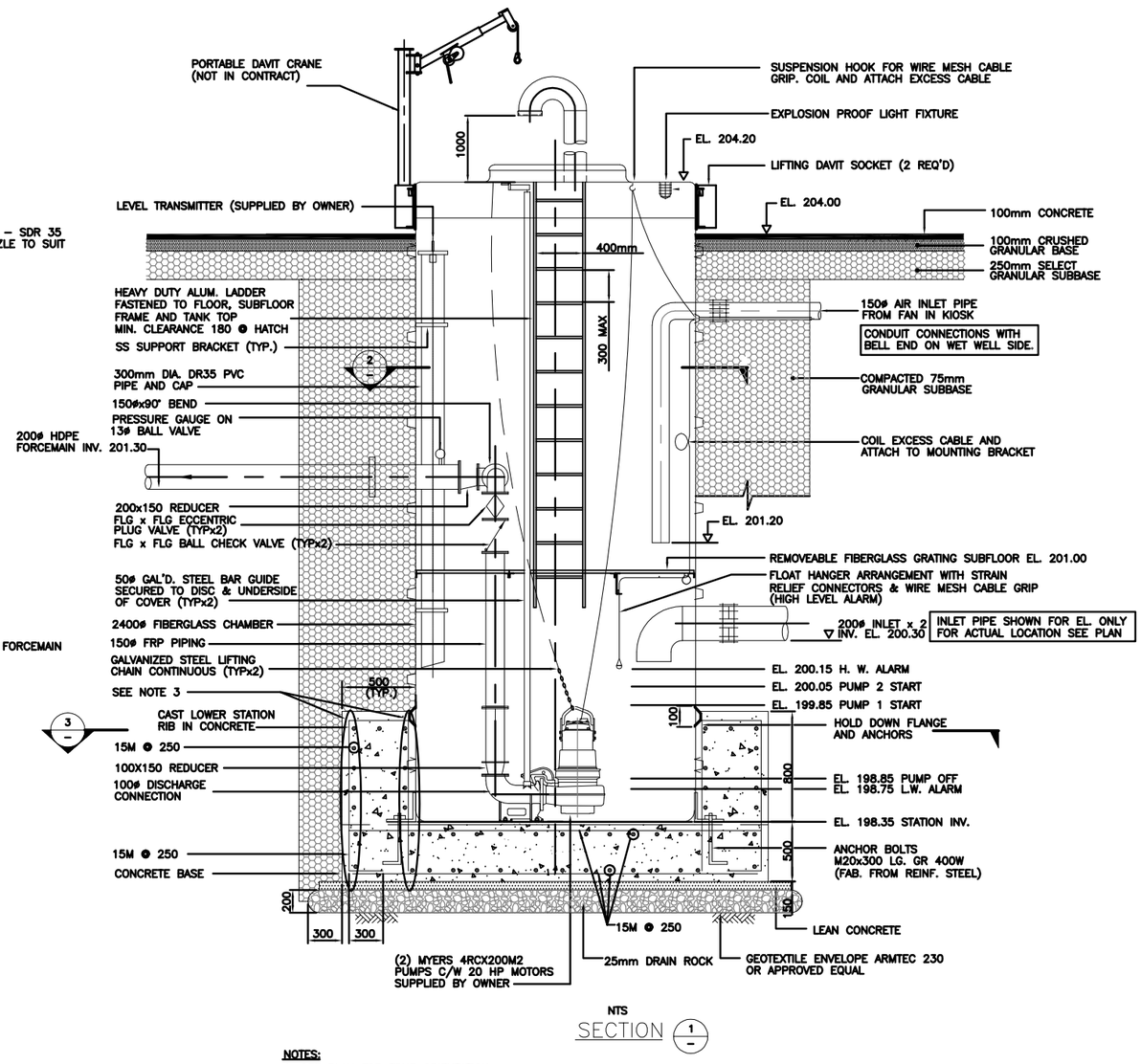
PLAN
NTS



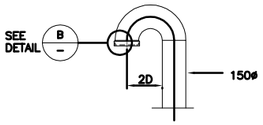
SECTION 2 –
NTS



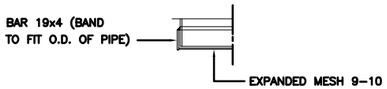
SECTION 3 –
NTS



NTS
SECTION 1 –



VENT DETAIL A –
NTS



DETAIL B –
NTS

NOTES:

1. SEE PLAN FOR TRUE ORIENTATION
2. FIELD ROUTE TO KIOSK, MIN. BEND RADIUS 200mm
3. BARS BENT TO FORM CIRCLE

NO.	DATE	ENG.	BY	SUBJECT
4	07/07/26	D.D.	L.Y.	RECORD DRAWING
3	06/09/15	E.A.B.	C.L.	PUMPS AND LEVEL TRANSMITTER
2	06/08/24	D.D.	C.L.	ISSUED FOR CONSTRUCTION
1	06/04/07	E.A.B.	C.L.	ISSUED FOR TENDER

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 ——— 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Associated Engineering

PROJECT No.	002035		
SCALE	AS NOTED		
DRAWN	C.L.		05/09/09
DESIGNED	E.A.B.		05/09/09
CHECKED	E.A.B.		05/09/09
APPROVED	E.A.B.		05/09/09
DATE		INITIAL	

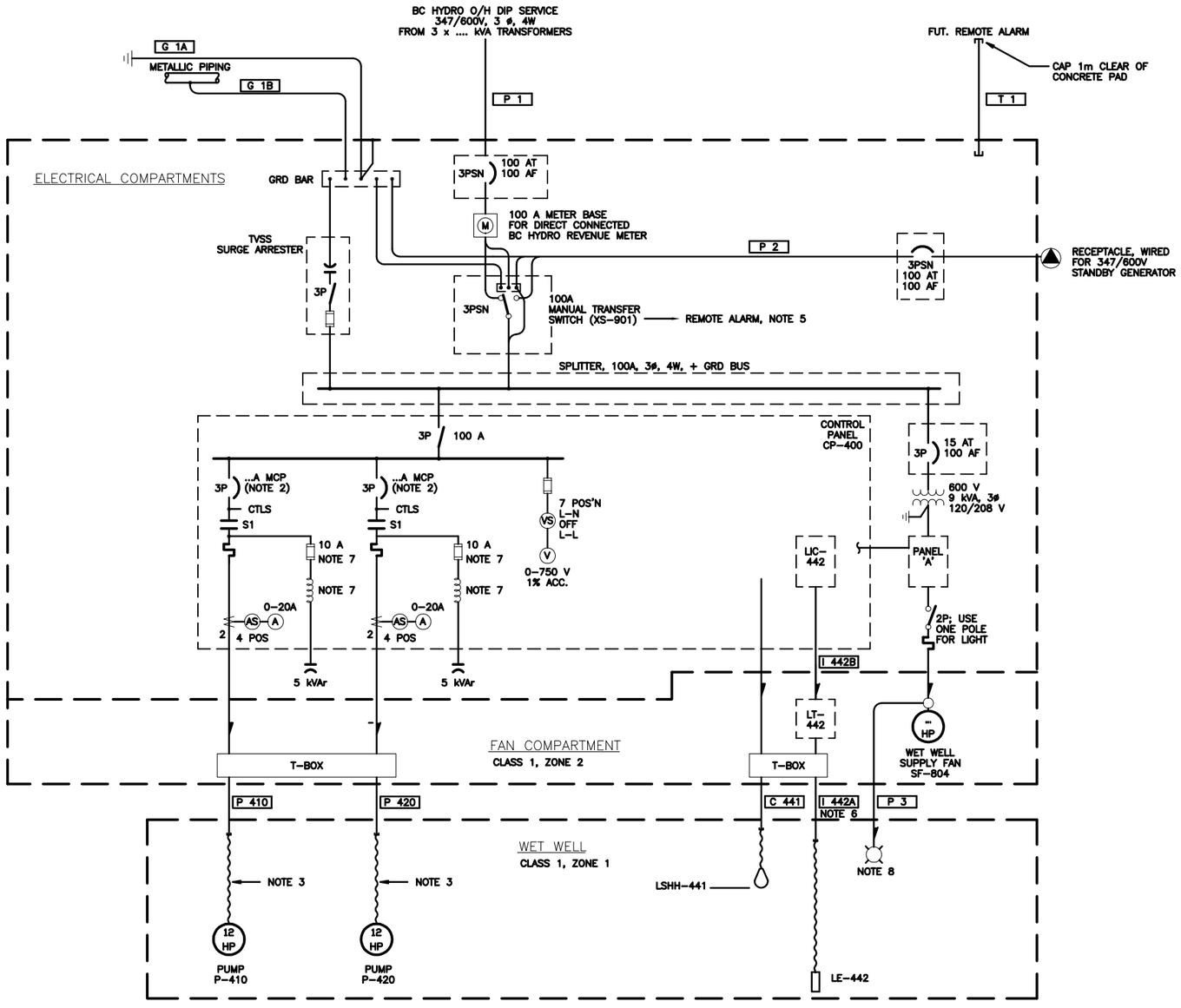
VILLAGE OF PEMBERTON

SANITARY SEWER LIFT STATION

INDUSTRIAL PARK
OFF–SITE SERVICES

DRAWING NUMBER	REV. NO.	SHEET
002035–7–402	4	16 / 18

Time: 8:36
Plot Date: 2007/7/20
Plot Scale: 1:1
AutoCAD File: Q:\002035\2005 INDUSTRIAL PARK OFF SITE SERVICES\CIVIL\SUBMISSION\AS BUILTS_JULY 26\002035402.DWG (L.Y.)



SINGLE LINE DIAGRAM

WIRING SCHEDULE (NOTE 4)		
P 1	78 DB2 C.O.	BC HYDRO SERVICE CONDUIT
P 2	35 RPVC, 3 #3 + #6 GRD	STANDBY GENERATOR RECEPTACLE
P 3	41 RPVC, 2 #12 + #14 GRD	WET WELL LIGHT
*P 410	53 RPVC, 3 PWR + GRD COND'S + 4 SENSOR LEADS FOR PUMP	PUMP P-410 POWER + SENSOR LEADS FLEXIBLE CABLE(S)
*P 420	53 RPVC, 3 PWR + GRD COND'S + 4 SENSOR LEADS FOR PUMP	PUMP P-420 POWER + SENSOR LEADS FLEXIBLE CABLE(S)
*C 441	41 RPVC, FLEXIBLE CABLE SUPPLIED WITH FLOATSWITCH	FLOAT-TYPE LEVEL SWITCH IN WET WELL
*I 442A	53 RPVC, SHIELDED CABLE / TUBE FACTORY-SUPPLIED	LEVEL TRANSDUCER IN WET WELL (NOTE 6)
I 442B	21 RA, 1 TPSH + #14 GRD	LEVEL TRANSMITTER
T 1	53 DB2 C.O.	FOR FUTURE TELUS SERVICE
G 1A	21 RPVC, #6 GRD	
G 1B	21 RPVC, #6 GRD	

* INSIDE WET WELL AND FAN COMPARTMENT CHANGE TO RA

PANELBOARD 'A'

PHASE A B

DESCRIPTION	LOAD	BRKR SIZE			BRKR SIZE	LOAD	DESCRIPTION
KIOSK LIGHTS	200 W	15A	1	2	15A	2 ⏚	KIOSK RECEPTACLES
KIOSK HEATER		15A	3	4	15A	150 VA	CONTROL PANEL CP-400
WASHDOWN COMP'T HEATER		15A	5	6	15A	... HP	WET WELL SUPPLY FAN SF-804
SPARE		15A	7	8			SPACE
SPACE			9	10			SPACE
SPACE			11	12			SPACE
SPACE			13	14			SPACE
SPACE			15	16			SPACE
SPACE			17	18			SPACE

2P 40 AT * *

* DENOTES GFCI BREAKER

• WITH PAD LOCK DEVICE IN ON / OFF POSITION

NOTES:

1. SERVICE SIZED FOR FULL PUMPING CAPACITY, PLUS ANCILLARY LOADS.
2. MCP SIZE AND TRIP RANGE TO BE SELECTED BY MANUFACTURER BASED ON MOTOR FLC; TRIP SETTING OF MCP AND OVERLOADS TO BE ADJUSTED ACCORDINGLY.
3. COMPOSITE CABLE OR SEPARATE POWER AND MONITOR CABLES, SUPPLIED WITH PUMP; CONFIRM WITH PUMP SUPPLIER.
4. SIZE INTERNAL KIOSK WIRING IN ACCORDANCE WITH THE RULES AND REGULATIONS.
5. PROVIDE ISOLATED 120 VAC CONTACTS, WIRED TO TERMINAL BLOCKS, FOR THE FOLLOWING FUTURE REMOTE ALARMS:
   - PUMP P-410 RUN (MS-410)
   - PUMP P-420 RUN (MS-420)
   - PUMP P-410 FAULT (ISH-410, TSH-410, ES-410)
   - PUMP P-420 FAULT (ISH-420, TSH-420, ES-420)
   - TRANSFER SWITCH IN EMERGENCY POSITION (XS-901)
   - INTRUSION
   - WET WELL HIGH LEVEL (LAHH-441B)
   - WET WELL LOW LEVEL (LAL-442)
6. MINIMUM CONDUIT RADIUS REQUIRED FOR TRANSDUCER CABLE IS 200 mm.
7. DUAL-ELEMENT TYPE FUSE; PROVIDE 10 COILED TURNS IN THE CAPACITOR LEADS.
8. COMPACT FLUORESCENT LUMINAIRE, CLASS I, ZONE 1, WITH 26W LAMP AND GUARD, NRL #ZM-F-26-G-**-C

NO.	DATE	ENG.	BY	SUBJECT
3	07/07/26	D.D.	L.Y.	RECORD DRAWING
2	06/08/24	D.D.	C.L.	ISSUED FOR CONSTRUCTION
1	06/04/07	E.A.B.	C.L.	ISSUED FOR TENDER

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 ——— 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Associated Engineering

PROJECT No.	002035		
SCALE	NONE		
DRAWN	J. THEILER		05/08/22
DESIGNED	J. THEILER		05/08/22
CHECKED	E.A.B.		05/08/22
APPROVED	E.A.B.		05/08/22
DATE		INITIAL	

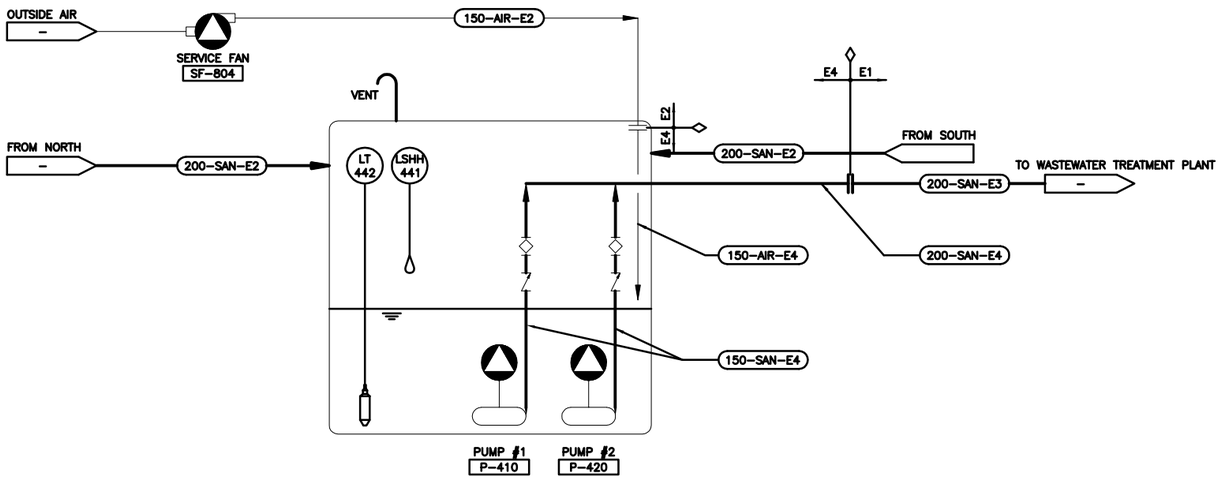
VILLAGE OF PEMBERTON

INDUSTRIAL PARK
OFF-SITE SERVICES

ELECTRICAL
PUMP STATION
SINGLE LINE DIAGRAM

DRAWING NUMBER	REV. NO.	SHEET
002035-7-601	3	17/18

Time: 8:37
Date: 2007/7/26
Plotted By: Lindsay Yuen (Paper Space)
AutoCAD File: Q:\002035\2005 INDUSTRIAL PARK OFF SITE SERVICES\CIVIL\SUBMISSION\AS BUILTS_JULY 26\002035701.DWG (L.Y.)



INDUSTRIAL PARK PUMP STATION

LEGEND

- FAN
- SUBMERSIBLE PUMP
- SUBMERSIBLE MIXER
- PLUG VALVE
- GATE VALVE
- BALL VALVE
- CHECK VALVE
- LEVEL SWITCH (LS)
- LEVEL TRANSMITTER (LT)
- BACKFLOW PREVENTER
- PRESSURE CONTROL VALVE (DOWN STREAM SENSING)
- BLIND FLANGE

300–SAN–E2

LINE CODE

MATERIAL
A1– STEEL PIPE, SCH 40, COAL TAR EPOXY LINED AND COATED
E1– PVC PIPE SCHED 80
E2– PVC PIPE
E3– POLYETHYLENE PIPE
H1– STAINLESS STEEL, SCH 40, SOCKET WELD

COMMODITY
AIR–SERVICE AIR
PW–POTABLE WATER
SAN–SANITARY WASTE

LINE SIZE (IN MILLIMETRES)

NO.	DATE	ENG.	BY	SUBJECT
3	07/07/26	D.D.	L.Y.	RECORD DRAWING
2	06/08/24	D.D.	C.L.	ISSUED FOR CONSTRUCTION
1	06/04/07	E.A.B.	C.L.	ISSUED FOR TENDER

REVISIONS

VERIFY SCALES

BAR IS 20mm ON ORIGINAL DRAWING

0 —— 20mm

IF NOT 20mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

Associated Engineering

PROJECT No.	002035		
SCALE	AS NOTED		
DRAWN	C.L.		05/09/09
DESIGNED	E.A.B.		05/09/09
CHECKED	E.A.B.		05/09/09
APPROVED	E.A.B.		05/09/09
DATE		INITIAL	

VILLAGE OF PEMBERTON

PROCESS MECHANICAL
P & ID, LEGEND

INDUSTRIAL PARK
OFF–SITE WORKS

DRAWING NUMBER	REV. NO.	SHEET
002035–7–401	3	15/18

Appendix B – Delcan Technical Memorandum

DRAFT Technical Memorandum

To:	Cam McIvor, Project Manager	Date:	April 16, 2012
cc:	Grant Campbell, P.Eng		
From:	Colin Kristiansen, P.Eng Todd Bowie, P.Eng	Our Ref:	EB3766

RE: Sunstone Ridge Development – Sanitary Loading Assessment

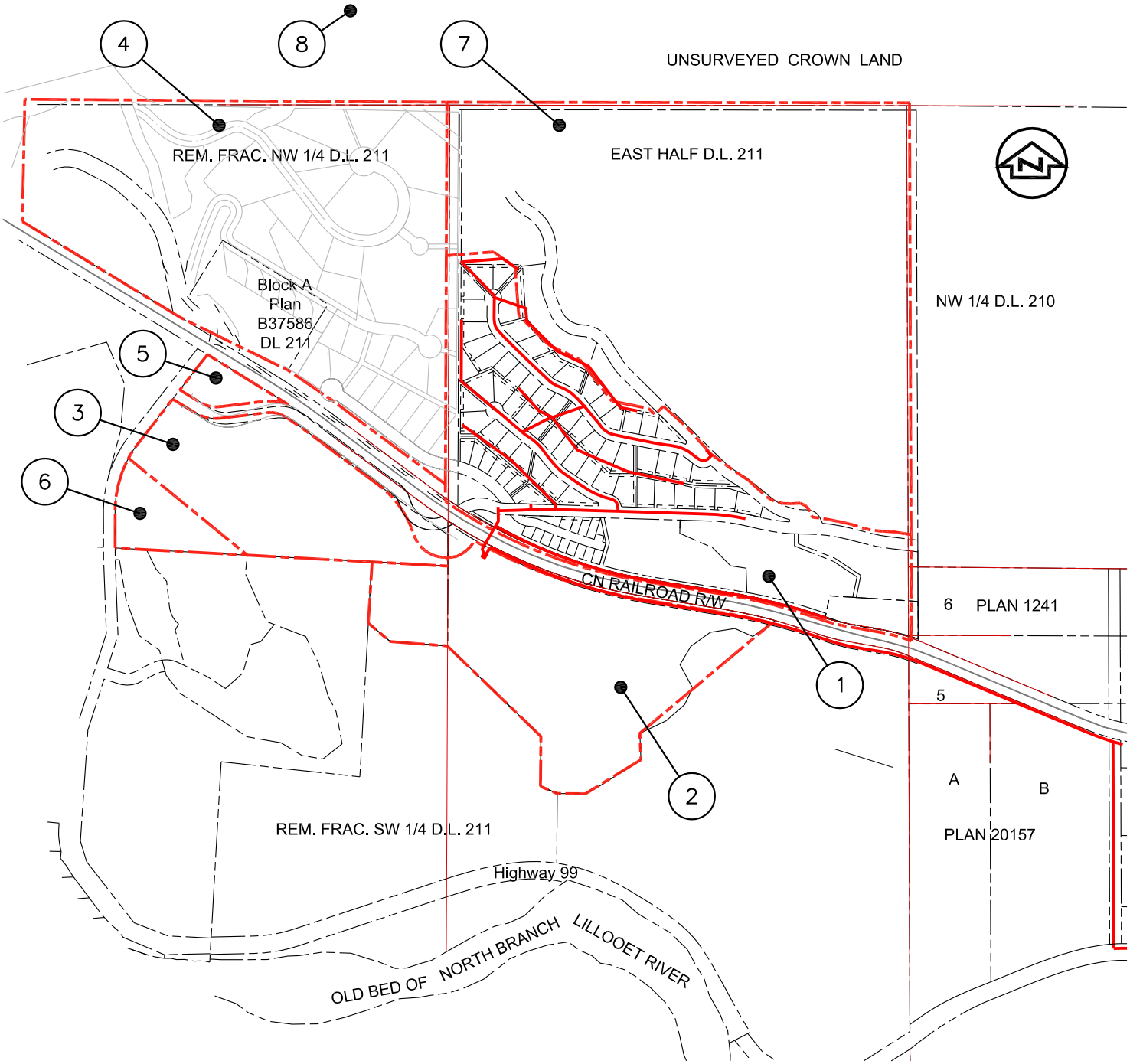
Delcan has been retained to provide engineering services for the development of Phase 1 of the Sunstone Ridge Development (SRD), located in the Village of Pemberton, 3 km east of the Village Centre.

The purpose of this Technical Memorandum is to present the design basis for the sanitary flow assessment, identify the sanitary sewer loadings for the SRD site and other surrounding potential short term development sites.

Development Plan

The SRD site is anticipated to be the first phase of a number of developments in the Sunstone Ridge area. The location of the SRD site and proposed surrounding developments are shown in **Figure 1**. Details on the development plans are as follows:

1.	Sunstone Ridge Development Site (Phase 1)	78 single-family units 142 multi-family units
2.	School Site	1200 student school building 800 student boarding building
3.	Recreation Facility Site	30,000 ft^2 ice arena building 12,000 ft^2 swimming pool building
4.	Biro Site	31 single-family units 77 multi-family units Resort Hotel
5.	Commercial Site	100,000 ft^2 neighbourhood commercial
6.	22 SF Site	22 single-family units
7.	Sunstone Ridge Development Site (Phase 2)	130 units



SHORT TERM DEVELOPMENT SITES

1. SUNSTONE RIDGE SITE
2. SCHOOL SITE
3. RECREATION FACILITY
4. BIRO SITE
5. COMMERCIAL
6. 22 SF UNITS

LONG TERM DEVELOPMENT SITES

7. SUNSTONE RIDGE (FUTURE)
8. LIL'WAT DEVELOPMENT (FUTURE)

Figure 1: Development Sites Layout

Design Parameters

The following documents were referenced to predict the sanitary sewer loads of the SRD site and surrounding short-term development sites:

Village of Pemberton Subdivision and Development Control Bylaw #677, 2011

Squamish Lillooet Regional District (SLRD) Subdivision and Development Servicing Bylaw #741, 2002.

MMCD Design Guideline Manual, 2005.

Sewerage System Standard Practice Manual (SSSPM) Version 2, 2007.

Key parameters used in the assessment are summarized below:

Parameter	Value	Reference
Population per Dwelling	Single Family = 4 people/unit Multi Family = 3 people/unit	SLRD Bylaw #741
Per Capita Demand	Average Dry Weather Flow = 410 litres/capita/day	Pemberton Bylaw #677
Other Demands	Students = 70 L/student/day Boarders = 400 L/boarder/day Arena = 85,000 L/day Swimming Pool = 50 L/m^2 Shopping Center = 0.1 L/m^2 Restaurant = 125 L/seat	MMCD MMCD MMCD SSSPM MMCD SSSPM
Peaking Factor	$PF = 6.75P^{-0.11}$	MMCD Design Guidelines
Infiltration	I = 0.17 L/s/ha	Pemberton Bylaw #677

Sanitary Loading Assessment

Two preliminary servicing designs are being developed for the SRD site, one for servicing only the SRD site, and one for servicing all of the short term potential development sites. This will establish the difference in facilities and costs associated with the SRD site and the neighbouring properties, and may form the basis for cost sharing arrangements such as latecomers' fees. Predicted sanitary sewer loadings from each of the individual sites are summarized in **Table 1.**

Table 1: Summary of Sanitary Loading Predictions

Site	ADWF (L/sec)	I&I (L/sec)	PWWF (L/sec)
1. SRD Site (Phase 1)	3.5	3.9	15.3
2. School Site	4.0	1.1	14.0
3. Recreation Facility	1.6	1.5	7.2
4. Biro Site	2.7	3.4	14.4
5. Commercial Site	0.1	0.1	0.5
6. 22 SF Units	0.4	0.3	2.0
7. SRD Site (Phase 2)	2.5	5.6	13.9

* assumed incl. 50 seat restaurant

Servicing Arrangement 1 - SRD Site Only

The first servicing arrangement is limited to only the SRD site. The arrangement would involve a sanitary pump station and forcemain to pump sewage to the existing 200 mm forcemain at Highway 99 that conveys sewage from the industrial park to the Pemberton Wastewater Treatment Plant. The pump station and forcemain would need to be sized to accommodate 15.3 L/sec.

Servicing Arrangement 2: All Short Term Development Sites

The second servicing arrangement includes the SRD site and the surrounding short term development sites. The overall servicing arrangement would be the same as arrangement 1. The pump station and forcemain for this arrangement would need to be sized to accommodate 59.1 L/sec

Conclusions

To proceed with preliminary design of the sanitary pump station and forcemain required for the SRD development, we require confirmation that there is available capacity in the existing 200mm forcemain servicing the industrial park for an additional sanitary loading scenarios of 15.3 L/sec or 59.1 L/sec. If capacity is available, boundary conditions for the tie-in to the village forcemain for each scenario are required.

TITLE SEARCH PRINT
File Reference:
Declared Value $2375000

Certificate of Title and Charges on Title

2022-05-04, 13:33:46
Requestor: Grant Gillies

CURRENT INFORMATION ONLY - NO CANCELLED INFORMATION SHOWN

Land Title District KAMLOOPS
Land Title Office KAMLOOPS

Title Number CA9736041
From Title Number CA7652647

Application Received 2022-02-23

Application Entered 2022-03-04

Registered Owner in Fee Simple
Registered Owner/Mailing Address: RIVERTOWN (PEMBERTON) NOMINEE LTD., INC.NO. BC1348508
1780 SCOTT ROAD
NORTH VANCOUVER, BC
V7J 3J5

Taxation Authority North Shore - Squamish Valley Assessment Area
Pemberton, Village of
Pemberton Valley Dyking District

Description of Land
Parcel Identifier: 030-164-532
Legal Description:
LOT C DISTRICT LOT 211 LILLOOET DISTRICT PLAN EPP40824

Legal Notations
NOTICE OF INTEREST, BUILDERS LIEN ACT (S.3(2)), SEE CA9736042
FILED 2022-02-23

Charges, Liens and Interests
Nature: UNDERSURFACE AND OTHER EXC & RES
Registration Number: KX23992
Registration Date and Time: 2005-02-28 14:16
Registered Owner: THE CROWN IN RIGHT OF BRITISH COLUMBIA
Remarks: INTER ALIA

Nature:	COVENANT
Registration Number:	CA2723154
Registration Date and Time:	2012-08-17 12:00
Registered Owner:	VILLAGE OF PEMBERTON
Remarks:	INTER ALIA MODIFIED BY CA4950099

Duplicate Indefeasible Title NONE OUTSTANDING

Transfers NONE

Pending Applications NONE

FREE FREE KX023992

28 FEB 2005 16 KX023991 F N/C

U of C N/C

LAND TITLE ACT
Form 17
(Sections 154, 155(1), 262)

APPLICATION

01 05/02/28 14:18:33 01 KL 810820
FEE SIMPLE FREE $0.00
01 05/02/28 14:19:02 01 KL 810820
CHARGE FREE $0.00

NOTE: Before submitting this application for interests under (1) and (2), applicants should check and satisfy themselves as to the tax position, including taxes of the Crown Provincial, a Municipality and Improvement, Water and Irrigation Districts.

NATURE OF INTEREST:

(1) FEE SIMPLE [X] Pursuant to the Budget Measures Implementation Act 1999
Market Value: N/A
Parcel Identifier No.(s)

(2) CHARGE [ ] Parcel Identifier No.(s):
E & R Pursuant to Section 50 of the Land Act
Nature of Charge

(3) CANCELLATION OF CHARGE [ ] Parcel Identifier No.(s):
Nature and Number of Charge Cancelled

06205114

HEREWITH FEES OF:

As to (1) and (2) ADDRESS of person entitled to be registered as owner, if different than shown in the instrument:

BC Transportation Financing Authority
5th Floor – 940 Blanshard Street Victoria, British Columbia V8W 3E6

As to (3) FULL NAME of person entitled to cancellation who or on whose behalf the application is made:

LEGAL DESCRIPTION, if not shown in instrument being submitted with this application:

Parcel"A" (Reference Plan KAP77591), previously dedicated road on Plan KAP 59366,over a portion of the Fractional Northwest ¼ of District Lot 211, Lillooet District, containing an area of 0.541 Ha. , more or less.

FULL NAME, ADDRESS, TELEPHONE NUMBER of person presenting application:

Willy T. Decker, 7818 Sixth Street, Burnaby, British Columbia, V3N 4N8, Telephone: (604) 660-8073 ,Land Survey Administrator

[redacted]

SIGNATURE OF APPLICANT OR SOLICITOR OR AUTHORIZED AGENT

CERTIFICATE OF VESTING

(Land Title Act, s.262, RSBC 1996)

Certificate is hereby given by the Minister of Transportation, that all right, title, and interest to the land described in the Schedule hereto became vested in the name of BC Transportation Financing Authority, 5th Floor 940 Blanshard Street Victoria BC V8W 3E6.

DATED this 1 day of APRIL, 2004 at the Municipality of Burnaby in the Province of British Columbia.

[redacted]

Wayne Keiser, Regional Director
Authorized Signatory for
Minister of Transportation

SCHEDULE

Parcel "A" (Reference Plan KAP 77591), previously dedicated road on Plan KAP59366, over a portion of the Fractional Northwest ¼ of District Lot 211, Lillooet District, containing an area of **0.541 Ha**, more or less.

Prepared by Paul Bunbury, B.C.L.S. of Bunbury and Associates Professional Land Surveyors.

File Number: RC-624
Date:

FORM_C_V18 (Charge)

KAMLOOPS LAND TITLE OFFICE

LAND TITLE ACT
FORM C (Section 233) CHARGE
GENERAL INSTRUMENT - PART 1 **Province of British Columbia**

Aug-17-2012 12:00:32.001

CA2723154

1340735567 PAGE 1 OF 6 PAGES

Your electronic signature is a representation that you are a subscriber as defined by the Land Title Act, RSBC 1996 c.250, and that you have applied your electronic signature in accordance with Section 168.3, and a true copy, or a copy of that true copy, is in your possession.

Ian Terence Davis 3UXBSR

Digitally signed by Ian Terence Davis 3UXBSR
DN: c=CA, cn=Ian Terence Davis 3UXBSR, o=Lawyer, ou=Verify ID at www.juricert.com/LKUP.cfm?id=3UXBSR
Date: 2012.08.17 11:48:27 -07'00'

1. APPLICATION: (Name, address, phone number of applicant, applicant's solicitor or agent)

Race & Company
Shelley Key, Authorized Agent
201-1365 Pemberton Avenue, PO Box 1850
Squamish BC V8B 0B3

File No.: 47269
Phone: 604-892-5254

Document Fees: $72.50 Deduct LTSA Fees? Yes ☑

2. PARCEL IDENTIFIER AND LEGAL DESCRIPTION OF LAND:

[PID] [LEGAL DESCRIPTION]

027-701-522 **LOT 1 DISTRICT LOT 211 LILLOOET DISTRICT PLAN KAP87819**

STC? YES ☐

3. NATURE OF INTEREST CHARGE NO. ADDITIONAL INFORMATION

Covenant

4. TERMS: Part 2 of this instrument consists of (select one only)

(a) ☐ Filed Standard Charge Terms D.F. No. (b) ☑ Express Charge Terms Annexed as Part 2

A selection of (a) includes any additional or modified terms referred to in Item 7 or in a schedule annexed to this instrument.

5. TRANSFEROR(S):

580049 B.C. LTD. (INC. NO. BC0580049)

6. TRANSFEREE(S): (including postal address(es) and postal code(s))

VILLAGE OF PEMBERTON

7400 PROSPECT STREET, PO BOX 100
PEMBERTON BRITISH COLUMBIA
V0N 2L0 CANADA

7. ADDITIONAL OR MODIFIED TERMS:

N/A

8. EXECUTION(S): This instrument creates, assigns, modifies, enlarges, discharges or governs the priority of the interest(s) described in Item 3 and the Transferor(s) and every other signatory agree to be bound by this instrument, and acknowledge(s) receipt of a true copy of the filed standard charge terms, if any.

Officer Signature(s)

Derek McLauchlan
Barrister & Solicitor
215-8171 Cook Road
Richmond, BC, V6Y 3T8

Execution Date

Y	M	D
12	07	09

Transferor(s) Signature(s)

580049 B.C. Ltd.
by its authorized signatory(ies):

Print Name: Werner Karl Biro

Print Name:

OFFICER CERTIFICATION:

Your signature constitutes a representation that you are a solicitor, notary public or other person authorized by the *Evidence Act*, R.S.B.C. 1996, c.124, to take affidavits for use in British Columbia and certifies the matters set out in Part 5 of the *Land Title Act* as they pertain to the execution of this instrument.

FORM_D1_V18

LAND TITLE ACT
FORM D

EXECUTIONS CONTINUED

Officer Signature(s)	Execution Date Y	M	D	Transferor / Borrower / Party Signature(s)
Suzanne Belanger Commissioner for Taking Affidavits in BC 7400 Prospect Street Pemberton, BC, V0N 2L0	12	07	19	Village of Pemberton by its authorized signatory(ies): Print Name: Sheena Fraser Print Name: Jordan Sturdy

OFFICER CERTIFICATION:
Your signature constitutes a representation that you are a solicitor, notary public or other person authorized by the *Evidence Act*, R.S.B.C. 1996, c.124, to take affidavits for use in British Columbia and certifies the matters set out in Part 5 of the *Land Title Act* as they pertain to the execution of this instrument.

THIS AGREEMENT MADE THIS _____ day of June, 2012

BETWEEN:

580049 B.C. Ltd., a corporation having its registered and records office located at 215- 8171 Cook Rd, Richmond, B.C., V6Y 3T8

(hereinafter called the "Covenantor")

OF THE FIRST PART

AND:

VILLAGE OF PEMBERTON, a Municipality duly incorporated under the laws of the Province of British Columbia, having an address at 7400 Prospect Street, Pemberton, BC V0N 2L0

(hereinafter called the "Covenantee")

OF THE SECOND PART

WHEREAS:

A. The Covenantor is the registered owners of ALL AND SINGULAR that certain parcel or tract of land and premises situate lying and being in the District of Squamish, in the Province of British Columbia, and more particularly described as:

Lot 1 District Lot 211 Lillooet District Plan KAP 87819

Parcel Identifier: 027-701-522

(hereinafter called the "Lands");

B. The Covenantor intends to subdivide the Lands in accordance with the proposed subdivision plan attached as Schedule "A";

C. Section 219 of the Land Title Act provides that there may be registered as a charge against the title to land a covenant, whether of a negative or positive nature, in respect of the use of land or the use of a building or to be erected on land, in favour of a Municipality or the Crown.

D. The Covenantor has agreed to restrictions on the use of the Lands.

NOW THEREFORE THIS AGREEMENT WITNESSETH that pursuant to Section 219 of the Land Title Act, and in consideration of the sum of One Dollar ($1.00) now paid to the Covenantee by the Covenantor (the receipt and sufficiency where of is hereby acknowledged), the parties hereto covenant and agree each with the other as follows:

1. The Covenantor, on behalf of itself and its heirs, executors, administrators, successors and assigns, hereby covenants and agrees with the Covenantee, as a covenant in favour of the Covenantee pursuant to Section 219 of the Land Title Act, it being the intention and agreement of the Covenantor that the provisions hereof be annexed to and run with and be a charge upon the Lands, that from and after the date hereof that the Covenantor shall not build, place or erect or permit the building, placement or erection of any buildings, structures or improvements on the Lands, nor shall the Covenantor apply for or be permitted to apply for a building permit or be entitled to a Development Permit, unless and until the Covenantor complies with the following requirements :

   (a) Dedicate or transfer to the Covenantee park land equal to 5% of the land mass of the Lands from the Lands or other property, in any event to be satisfactory to the Covenantee;

   (b) Pursuant to the Covenantee's Community Amenity Contribution Policy, contribute $9,165 per building lot and $6,110 per multiple family dwelling to the Covenantee ;

   (c) Perform appropriate flood proofing or protection or register an appropriate Flood Covenant against the Lands as may be required by and in a form satisfactory to the Covenantee; and

   (d) Enter a site servicing agreement with the Covenantee in a form satisfactory to the Covenantee.

2. Nothing contained or implied herein shall prejudice or affect the rights and powers of the Covenantee in the exercise of its functions under any public and private statutes, by-laws, orders and regulations, all of which may be fully and effectively exercised in relation to the Lands as if this Agreement had not been executed and delivered by the Covenantor.

3. The covenants set forth herein shall charge the Lands pursuant to Section 219 of the Land Title Act and the burden of which shall run with the Lands. It is further expressly agreed that the benefit of all covenants made by the Covenantor herein shall accrue solely to the Covenantee and that this Agreement may only be modified or discharged by agreement of the Covenantee, pursuant to the provisions of Section 219(5) of the Land Title Act.

4. Notwithstanding anything contained herein, the Covenantor shall not be liable under any of the covenants and agreements contained herein where such liability arises by reason of an act or omission occurring after the Covenantor ceases to have any further interest in the Lands.

5. Wherever the singular or masculine is used herein, the same shall be construed as meaning the plural, feminine or body corporate or politic where the context or the parties so require.

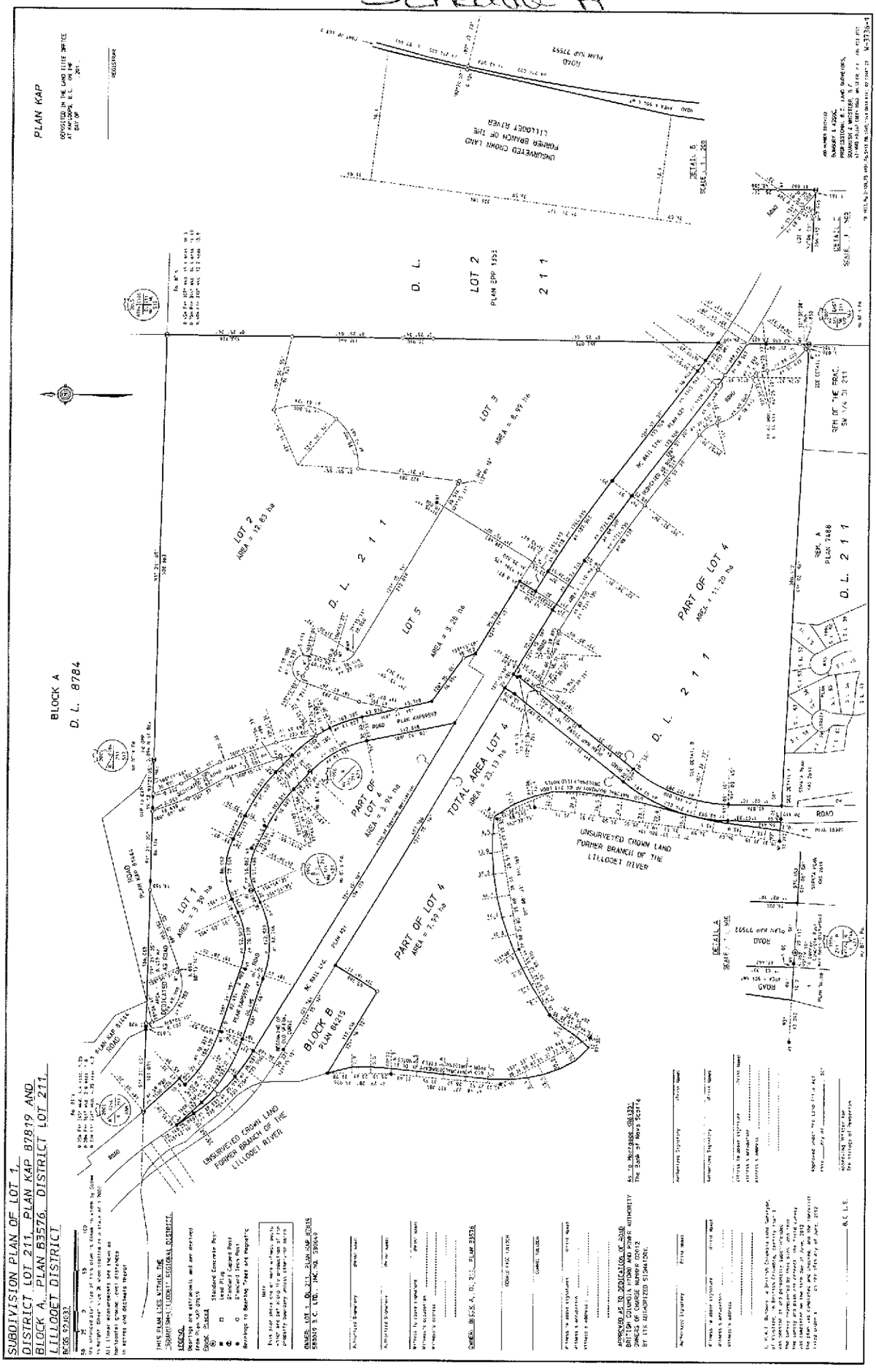
6. This Agreement shall endure to the benefit of and be binding upon the parties hereto, their respective successors and assigns.

7. The parties hereto shall do and cause to be done all things and execute and cause to be executed all documents which may be necessary to give proper effect to the intention of this Agreement.

8. The Covenanter shall indemnify and hold the Covenantee and its officers, employees, agents and elected officials harmless from and against any and all claims, actions, costs, liabilities or losses that they may at any time hereafter suffer or be put to in connection with this Covenant, including any actual legal costs that are incurred in connection with any enforcement of this covenant.

AS EVIDENCE to their Agreement to the above terms, the parties each have executed and delivered this Agreement by executing the Land Title Act Form C to which this Agreement is attached and forms part of this Agreement.

Schedule "A"


SUBDIVISION PLAN OF LOT 1,
DISTRICT LOT 211, PLAN KAP 87819 AND
BLOCK A, PLAN 83576, DISTRICT LOT 211,
LILLOOET DISTRICT.
PLAN KAP
BLOCK A
D. L. 8784
LOT 2
PLAN EPP 1952
D. L. 211
LOT 2
AREA = 12.63 ha
LOT 3
AREA = 8.99 ha
LOT 5
AREA = 3.28 ha
LOT 1
AREA = 3.30 ha
PART OF LOT 4
AREA = 3.94 ha
PART OF LOT 4
AREA = 7.99 ha
TOTAL AREA LOT 4
AREA = 23.13 ha
PART OF LOT 4
AREA = 11.20 ha
REM A
PLAN 7488
BLOCK B
PLAN 84225
UNSURVEYED CROWN LAND
FORMER BRANCH OF THE
LILLOOET RIVER
ROAD
PLAN 79502
DETAIL A
DETAIL B
DETAIL C
SCALE 1 : 500
SCALE 1 : 200
REM OF THE FRAC.
SW 1/4 D. 211
THIS PLAN LIES WITHIN THE
SQUAMISH-LILLOOET REGIONAL DISTRICT.
LEGEND
Bearings are astronomic and are derived
from Plan KAP 87819
Symbols
Standard Concrete Post
Lead Plug
Standard Capped Post
Found Iron Post
Bearings to Bearing Tower Art Peppetts
OWNER: LOT 1, D. 211, PLAN KAP 87819
5B0045 B.C. LTD., INC.NO. 5B0045
OWNER: BLOCK A, D. 211, PLAN 83576
APPROVED AS TO DEDICATION (OR ROW)
BRITISH COLUMBIA HYDRO AND POWER AUTHORITY
CHANGE OF CHARGE NUMBER TO H12
BY ITS AUTHORIZED SIGNATORY
As To Mortgage CA6132
The Bank of Nova Scotia
Authorized Signatory
Print Name
I, K.A.F. Bellamy, a British Columbia Land Surveyor,
of Victoria, in British Columbia, hereby certify that
I was present at and personally superintended
the survey upon which this plan is based, and that
the survey and plan are correct. The field survey
was completed on the 19th day of June, 2012
Dated at Victoria, B.C. this 27th day of June, 2012
B.C.L.S.
Approved under the Land Title Act
this ____ day of _____, 20__
Approving Officer for
the Minister of Transportation

Site Profile

SCHEDULE 1
Site Profile

Version 4.0

Introduction

Under section 40 of the *Environmental Management Act*, a person who knows or reasonably should know that a site has been used or is used for industrial or commercial purposes or activities must in certain circumstances provide a site profile.

Schedule 2 of the Contaminated Sites Regulation sets out the types of industrial or commercial purposes or activities to which site profile requirements apply.

If section 40 of the Environmental Management Act applies to you and you know or reasonably should know that the site has been used or is used for one of the purposes or activities found in Schedule 2 of the Contaminated Sites Regulation, you may be required to complete the attached site profile.

Notes/Instructions:

Persons preparing a site profile *must* complete Section I, II and III, answer all questions in sections IV through IX, and sign section XI. If the site profile is not satisfactorily completed, it will not be processed under the *Environmental Management Act* and the Contaminated Sites Regulation. Failure to complete the site profile satisfactorily may result in delays in approval of relevant applications and in the postponement of decisions respecting the property.

The person completing this site profile is responsible for the accuracy of the answers. Questions must be answered *to the best of your knowledge.*

Section 27 (1) of the *Freedom of Information and Protection of Privacy Act* requires that provision of personal information concerning an individual must be authorized by that individual. Persons completing the site profile on behalf of the site owner must be authorized by the site owner.

One (1) site profile may be completed for a site comprised of more than one titled or untitled parcel, but individual parcels must be identified.

The latitude and longitude (accurate to 0.5 of a second using North American Datum established in 1983) of the centre of the site must be provided. Also, please attach an accurate map, containing latitude, longitude and datum references, which shows the boundaries of the site in question. Please use the largest scale map available.

If the property is legally surveyed, titled and registered, then all PID numbers (**P**arcel **ID**entifiers – Land Title Registry system) must be provided for *each* parcel as well as the appropriate legal description.

If the property is untitled Crown land (no PID number), then the appropriate PIN numbers (**P**arcel **I**dentification **N**umbers – Crown Land registry system) for each parcel with the appropriate land description should be supplied.

If available, the Crown Land File Number for the site should also be supplied.

Anything submitted in relation to this site profile will become part of the public record and may be made available to the public through the Site Registry as established under the *Environmental Management Act.*

Under section 43 of the *Environmental Management Act,* corporate and personal information contained in the site profile may be made available to the public through the Site Registry. If you have questions concerning the collection of this information, contact the Site Registrar, at site@gov.bc.ca. For questions on site profiles, please send a message to siteprofiles@gov.bc.ca.

I CONTACT IDENTIFICATION

A. Name of Site Owner:

Last _____ First _____ Middle Initial(s) _____ (and/or, if applicable)

Company Riverside (Pemberton) Nominee Ltd., Inc. No. BC1348508

Owner's Civic Address 1780 Scott Road

City North Vancouver Province/State BC

Country Canada Postal Code/ZIP V7J 3J5

B. Person Completing Site Profile (Leave blank if same as above):

Last Gillies First Grant Middle Initial(s) _____ (and/or, if applicable)

Company Riverside (Pemberton) Nominee Ltd., Inc. No. BC1348508

C. Person to Contact Regarding the Site Profile:

Last Gillies First Grant Middle Initial(s) _____ (and/or, if applicable)

Company Riverside (Pemberton) Nominee Ltd., Inc. No. BC1348508

Mailing Address 6058 Gleneagles Drive

City West Vancouver Province/State BC

Country Canada Postal Code/ZIP V7W 1W2

Telephone (604) 614 - 4295 Fax (_____) _____ - _____

II SITE IDENTIFICATION

Please attach a site location map

All Property

Coordinates (using the North American Datum 1983 convention) for the centre of the site:

Latitude: Degrees 50 Minutes 19 Seconds 3

Longitude: Degrees 122 Minutes 45 Seconds 31

Please attach a map of appropriate scale showing the boundaries of the site.

For Legally Titled, Registered Property

Site Street Address (if applicable) 7362 Pemberton Farm Road East

City Pemberton Postal Code _____

PID numbers and associated legal descriptions. ***Attach an additional sheet if necessary.***

PID	**Legal Description**
030-164-532	Lot C DL 211 LLD Plan EPP 40824

Total number of titled parcels represented by this site profile is: 1

For Untitled Crown Land

PIN numbers and associated Land Description. ***Attach an additional sheet if necessary.***

PIN	**Land Description**

Total number of untitled crown land parcels represented by this site profile is:_____

(and, if available)

Crown land file numbers. ***Attach an additional sheet if necessary.***

_____ _____ _____ _____ _____

III COMMERCIAL AND INDUSTRIAL PURPOSES OR ACTIVITIES

Please indicate below, in the format of the example provided, which of the industrial and commercial purposes and activities from Schedule 2 have occurred or are occurring on this site.

EXAMPLE

Schedule 2 Reference	**Description**
E1	appliance, equipment or engine repair, reconditioning, cleaning or salvage
F10	solvent manufacturing or wholesale bulk storage

Please print legibly. Attach an additional sheet if necessary

Schedule 2 Reference	**Description**

IV	AREAS OF POTENTIAL CONCERN		
	Is there currently or to the best of your knowledge has there previously been on the site any (please mark the appropriate column opposite the question)**:**	**YES**	**NO**
A.	Petroleum, solvent or other polluting substance spills to the environment greater than 100 litres?		X
B.	Residue left after removal of piled materials such as chemicals, coal, ore, smelter slag, air quality control system baghouse dust?		X
C.	Discarded barrels, drums or tanks?		X
D.	Contamination resulting from migration of substances from other properties?		X
V	**FILL MATERIALS**		
	Is there currently or to the best of your knowledge has there previously been on the site any deposit of (please mark the appropriate column opposite the question)**:**	**YES**	**NO**
A.	Fill dirt, soil, gravel, sand or like materials from a contaminated site or from a source used for any of the activities listed under Schedule 2?		X
B.	Discarded or waste granular materials such as sand blasting grit, asphalt paving or roofing material, spent foundry casting sands, mine ore, waste rock or float?		X
C.	Dredged sediments, or sediments and debris materials originating from locations adjacent to foreshore industrial activities, or municipal sanitary or stormwater discharges?		X
VI	**WASTE DISPOSAL**		
	Is there currently or to the best of your knowledge has there previously been on the site any landfilling, deposit, spillage or dumping of the following materials (please mark the appropriate column opposite the question)**:**	**YES**	**NO**
A.	Materials such as household garbage, mixed municipal refuse, or demolition debris?		X
B.	Waste or byproducts such as tank bottoms, residues, sludge, or flocculation precipitates from industrial processes or wastewater treatment?		X
C.	Waste products from smelting or mining activities, such as smelter slag, mine tailings, or cull materials from coal processing?		X
D.	Waste products from natural gas and oil well drilling activities, such as drilling fluids and muds?		X
E.	Waste products from photographic developing or finishing laboratories; asphalt tar manufacturing; boilers, incinerators or other thermal facilities (e.g. ash); appliance, small equipment or engine repair or salvage; dry cleaning operations (e.g. solvents); or from the cleaning or repair of parts of boats, ships, barges, automobiles or trucks, including sandblasting grit or paint scrapings?		X

VII	TANKS OR CONTAINERS USED OR STORED, OTHER THAN TANKS USED FOR RESIDENTIAL HEATING FUEL		
	Are there currently or to the best of your knowledge have there been previously on the site any (please mark the appropriate column opposite the question)**:**	**YES**	**NO**
A.	Underground fuel or chemical storage tanks other than storage tanks for compressed gases?		X
B.	Above ground fuel or chemical storage tanks other than storage tanks for compressed gases?		X

VIII	HAZARDOUS WASTES OR HAZARDOUS SUBSTANCES		
	Are there currently or to the best of your knowledge have there been previously on the site any (please mark the appropriate column opposite the question)**:**	**YES**	**NO**
A.	PCB-containing electrical transformers or capacitors either at grade, attached above ground to poles, located within buildings, or stored?		X
B.	Waste asbestos or asbestos containing materials such as pipe wrapping, blown-in insulation or panelling buried?		X
C.	Paints, solvents, mineral spirits or waste pest control products or pest control product containers stored in volumes greater than 205 litres?		X

IX	LEGAL OR REGULATORY ACTIONS OR CONSTRAINTS		
	To the best of your knowledge are there currently any of the following pertaining to the site (please mark the appropriate column opposite the question)**:**	**YES**	**NO**
A.	Government orders or other notifications pertaining to environmental conditions or quality of soil, water, groundwater or other environmental media?		X
B.	Liens to recover costs, restrictive covenants on land use, or other charges or encumbrances, stemming from contaminants or wastes remaining onsite or from other environmental conditions?		X
C.	Government notifications relating to past or recurring environmental violations at the site or any facility located on the site?		X

X ADDITIONAL COMMENTS AND EXPLANATIONS

(Note 1: Please list any past or present government orders, permits, approvals, certificates and notifications pertaining to the environmental condition, use or quality of soil, surface water, groundwater or biota at the site.

Note 2: If completed by a consultant, receiver or trustee, please indicate the type and degree of access to information used to complete this site profile. Attach extra pages, if necessary):

XI SIGNATURES

The person completing the site profile states that the above information is true based on the person's current knowledge as of the date completed.

[redacted]

22-02-02

Signature of person completing site profile **Date completed: (YY-MM-DD)**

XII OFFICIAL USE

Local Government Authority

Reason for submission *(Please check one or more of the following)* **Soil removal** ❑

Subdivision application ❑ **Zoning application** ❑ **Development permit** ❑ **Variance permit** ❑ **Demolition permit** ❑

Date received:	Local Government contact : Name_____ Agency_____ Address_____ _____ Telephone _____ Fax_____	Date submitted to Site Registrar:	Date forwarded to Director of Waste Management:

Director of Waste Management

Reason for submission *(Please check one or more of the following)*

Under Order ❑ **Site decommissioning** ❑ **Foreclosure** ❑

Date received:	Assessed by: Name_____ Region_____ Telephone _____ Fax_____ If site profile entered, SITE ID #_____	Investigation Required? **YES NO**	Decision date:

Site Registrar

Date received:	Entered onto Site Registry by:	SITE ID #:	Entry date: