Bralorne Community Sewer System Assessment Study Update

Squamish-Lillooet Regional District

Updated April 2015

Interim Report May 2012

Project No. 649-012

TRUE CONSULTING

ENGINEERING ■ PLANNING ■ URBAN DESIGN

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Revision Log

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1	SP	April 15, 2015	2015 update – added Appendix B and C

Report Submission

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List of Acronyms

TRUE	TRUE Consulting

Units of Measure

ft	feet
Igpm	Imperial gallons per minute
km	kilometre
L/d	Litres per day
L/m	Litres per minute
L/s	Litres per second
lpcd	Litres per capita per day
m	metre
mg/L	milligrams per Litre
mm	millimetre
NTU	Nephelometric Turbidity Units
psi	pounds per square inch
USgpm	US gallons per minute

1.0 Introduction

1.1 Study Area

The community of Bralorne is located approximately 110 km west of the District of Lillooet. Referring to *Figure 1.1*, the community is accessed by road from Goldbridge approximately 10 km to the north.

Bralorne is a historic community that was constructed to support the work force of gold mines located within the Townsite area. At the peak of area gold mining, it is reported that Goldbridge had a population of about 5000. With the production slowing since the 1940's the Bralorne Gold Mine officially closed in 1971. Over the last 5 years, the Bralorne mine and mill has been reopened. The mine employs about 50 people with some staff residing in onsite accommodation provided by the company. The current population of Bralorne is estimated to be about 60 while the neighboring community of Goldbridge is estimated to be 43.

Bralorne is serviced by community water and sanitary sewer systems which the Squamish-Lillooet Regional District assumed ownership of in 1989. The water system comprises a drilled well and steel reservoir (constructed in early 1990's) and a PVC distribution system (constructed in early 1970's). The community water system is generally reported to be in good condition.

Unlike the water system, the Bralorne community sewer system remains essentially as constructed by the mining companies in the 1920's and 1930's.

1.2 Study Objectives

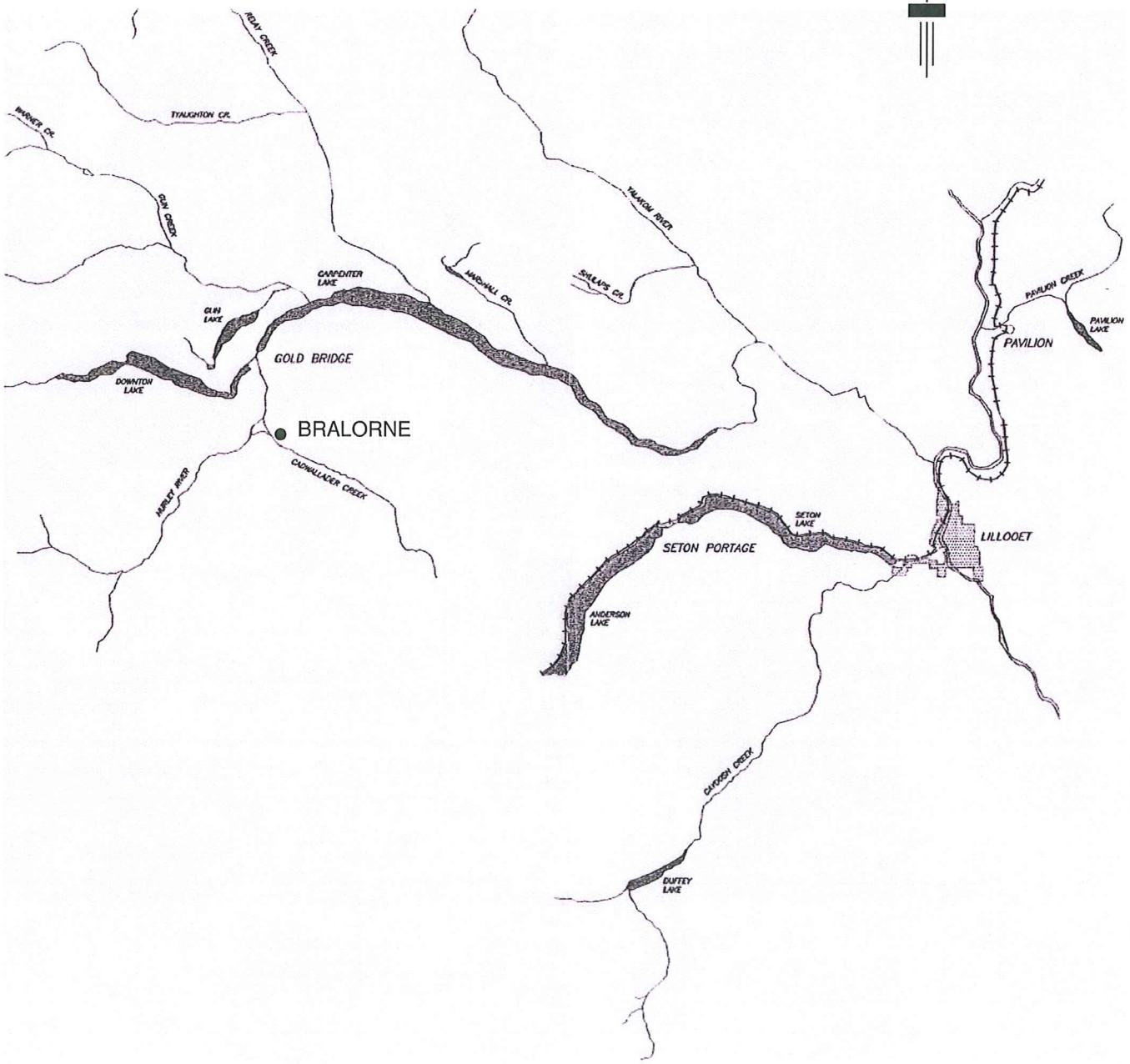
The original 2002 study objectives are presented in terms of reference prepared by the Squamish-Lillooet Regional District (SLRD) dated April 2000. The principal objectives of the study are summarized as follows:

- identify and inventory all components of the community sewer system in "trespass" (i.e., located on private property and not covered by a statutory right of way or easement).
- utilizing illustrative plans, identify works to be relocated to resolve trespass situations and identify all statutory right of way requirements.
- tabulate infrastructure relocation requirements, provide capital cost estimates and comment on timing.
- land acquisition should be quantified and rough estimates of costs provided.

- general capital costs for replacing the existing infrastructure and provide comments on the timing for capital replacement.
- assess capital requirements necessary for compliance with Waste Management Permits and the requirements to bring the Bralorne sanitary sewer system into compliance with accepted municipal standards.
- review types of secondary treatment potentially applicable to Bralorne and comment on their suitability.

This study represents an update to the 2002 report with the following objectives:

- address the trespass of the outfall location for Townsite #1 on the mine property (DL 670 Telephone MC)
- review options for replacing the existing sewage collection infrastructure and provide a capital cost estimate for these works.
- identify phasing opportunities recognizing the Regional District priority objective of eliminating as many sewer main trespass situations as possible.



SQUAMISH-LILLOOET REGIONAL DISTRICT

BRALORNE SEWER SYSTEM ASSESSMENT STUDY UPDATE LOCATION PLAN

TRUE CONSULTING

DSGN. BY:	KK/TRU
SCALE:	NTS
DWG. NO.:	FIG.1 649-012
REV.:	
DWN. BY:	SC
DATE:	MAY 2012

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2.0 Description of Existing Sanitary Sewer System

2.1 Background to Regional District Ownership

The history or progression of events ultimately leading up to the Regional District having ownership of the Bralorne community sewer system is relevant to the present condition of the system. Available background information suggests that the Bralorne sewer system likely dates back to the time of construction of the community, i.e., early 1900's. At this time, the entire Townsite was located upon parcels of land, probably mineral claim tenure, owned by the mining company. The mining company owned all housing, roads and related infrastructure therefore, there was no land ownership related constraints associated where sanitary sewers, services and related appurtenances were located.

When the gold mines production decreased in Bralorne, the townsite was essentially abandoned. In the early 1971, the abandoned Bralorne Townsite was purchased by Marmot Enterprises Ltd. Marmot's plans involved upgrading of the community's water and sewerage systems and undertaking road improvements and selected demolitions to result in a subdivision complete with a residential unit. These lots were anticipated to be of interest to people as recreational/vacation properties.

Background information suggests that Marmot completed improvements to the water distribution system, i.e., pipe replacement and inventoried all components of the sanitary sewer system. Except for capacity expansions of the septic tanks serving both townsites, the development company did not complete any significant improvements to the community sewerage system in Bralorne.

Marmot Enterprises was successful in registering two subdivision plans covering the Bralorne Townsites. *Figure 1* is an overall plan of the Bralorne community illustrating the subdivisions completed by Marmot Enterprises. The plans were accepted/registered by the Land Registry Office on May 03, 1974 and created a total of 41 individual lots in Townsite #1 (Plan 25012) and a total of 60 lots (Plan 25011) in Townsite #2.

Composite plans of the Bralorne Community sewerage system prepared by Marmot Enterprises Ltd. illustrated proposed easements where sanitary sewer mains cross or are located within private property. None of the proposed easements intended to contain sanitary sewers appear to have been surveyed or registered.

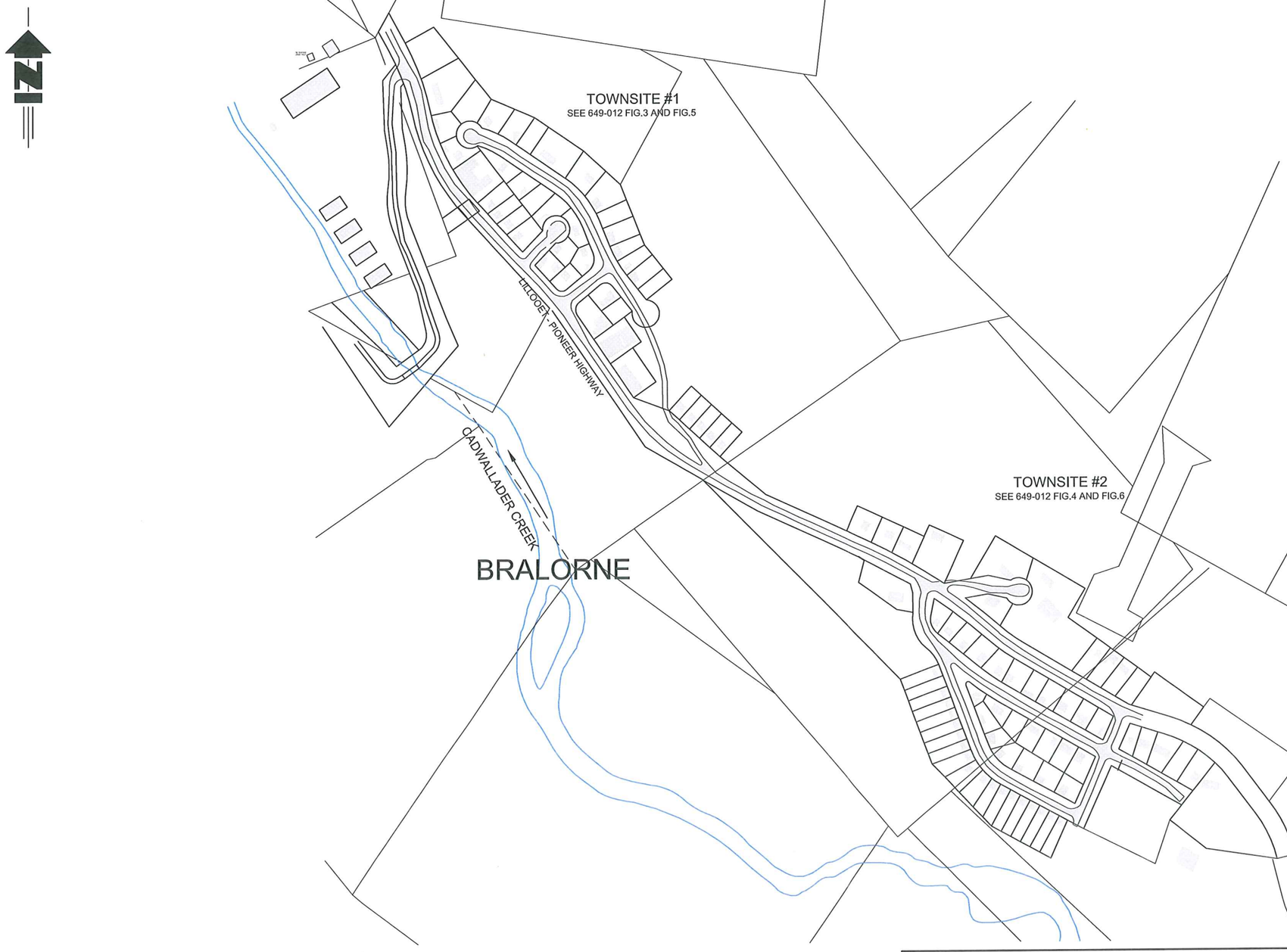
Marmot Enterprises applied for and obtained permits from the Ministry of Water, Land and Air Protection in 1974 for the two septic tanks and related discharge works serving the two Bralorne Townsites. These permits made reference to system improvements principally consisting of sand filters prior to effluent discharge to Cadwallader Creek. The sand filters referenced in the original Waste Management Permits issued in 1974 were not constructed.

Ministry of Water, Land and Air Protection's file information relating to the Waste Management Permits, suggests that interest in properties in Bralorne was significantly less than what Marmot Enterprises had anticipated. As a result, Marmot Enterprises did not have the financial resources to complete infrastructure improvements. The inability of Marmot to appropriately maintain the water and sanitary sewer systems due to limited financial resources was resolved in March 1989 with the Regional District agreeing to assume ownership of the Community's water and sanitary sewer systems.

As a result of the events in the period from the early 1970's summarized in the preceding paragraphs, the Squamish-Lillooet Regional District is the responsible local government (owner) of a community sewer system in Bralorne likely more than 80 years old with the collection system largely located on private property. The revenue potential from the community to enable significant improvements to the sewerage system is best described as limited recognizing that the community population is only 60.

In separate sections (2.2 and 2.3), existing sanitary sewer systems, both collection and treatment, in Bralorne Townsites #1 and #2 are described. Separate descriptions are provided recognizing that the two Townsites are serviced by separate systems. Information sources utilized to prepare illustrative plans and descriptions of the existing sewerage systems are:

- undated and untitled sketch plans of community water and sewerage systems assumed to have been prepared by staff and/or consultants of Marmot Enterprises Ltd.
- composite plans of Townsite #1 and #2 sewage collection systems prepared by FB Whiting dated May 1983.



SQUAMISH-LILLOOET REGIONAL DISTRICT
BRALORNE SEWER SYSTEM ASSESSMENT STUDY UPDATE
OVERALL PLAN

TRUE CONSULTING

DESIGN BY:	KK/TRU
SCALE:	1:5000
DWG NO.:	FIG.2 649-012
REV:	
DRAWN BY:	SC
DATE:	MAY 24, 2012

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- water and sanitary sewer "design" and "as exists" drawings prepared by Underhill Engineering Ltd. and dated July 1973.
- files of the Ministry of Water, Land and Air Protection relating to Waste Management Branch permits issued for effluent discharges from Bralorne Townsites #1 and #2.
- a site survey by staff of *TRUE* Consulting Group undertaken in November 2000 having the principal purpose of confirming the locations of existing sanitary sewer systems, and determining road surface (pavement) locations and road grades.
- site survey by TRUE staff on May 10th, 2012 to confirm the status of the community sewer system including inspections of the two outfalls.

2.2 Townsite #1

2.2.1 Collection System

Figure 2 illustrates the existing collection system in Townsite #1. Based on available information, the system approximately comprises:

- 480 m of 100 mm vitrified clay collection main.
- 180 m of 150 mm vitrified clay collection main.
- 110 m of 200 mm vitrified clay collection main.
- 7 manholes (only 1 confirmed by *TRUE* survey November 2000).
- a total of 41 sanitary services.

Local residents indicated to *TRUE* survey staff in November 2000 that the majority of the manholes in Townsite #1 are buried and do not have standard frames and covers. The inability of *TRUE* field staff to locate manholes in Townsite #1 appears to confirm the local opinion that the manholes are buried.

Figure 2 by yellow shading illustrates collection system location on private property not covered by easement or right of way (designated as "trespass"). A total of 490 m of collection main (62% of system) in Townsite #1 is in trespass. In the vicinity of Lots 32 and 35, *Figure 2* illustrates the collection main being located under buildings. *Figure 2* is accurate in this regard as local maintenance staff confirm that the sewer collection main servicing lots 36 to 41 is actually suspended in the timber foundation of the recreation centre.

ALL BUILDING LOCATIONS APPROXIMATE

SEE DWG 649-012-FIG4 FOR CONTINUATION

MARMOT CRES

CUNNINGHAM PLACE

DIRK PLACE

LILLOOET - PIONEER HIGHWAY

#1 #2 #3 #4 #5 #6

EX SEPTIC TANK

EXISTING MECH. SHOP

EX OUTFALL (LOCATION APPROX)

EXISTING MINE MILL BUILDING (LOCATION APPROX)

HURLEY RIVER ROAD

ROAD R/W KAP 57325

DL 671 WOOD DUCK M.C.

DL 670 TELEPHONE M.C.

CADWALLADER CREEK

EX EMERGENCY TAILINGS POND (LOCATION APPROX)

BRALORNE GOLD MINES LTD. BUILDINGS (SCHEMATIC) OFFICES AND STAFF ACCOMODATION (LOCATION APPROX)

EXISTING BRIDGE (LOCATION APPROX)

LEGEND

- POWER POLE
- LIGHT STANDARD
- IRON PIN
- CURB STOP
- VALVE
- HYDRANT
- SANITARY MANHOLE FOUND
- SANITARY MANHOLE ASSUMED
- CLEANOUT
- WATER
- EX SANITARY TO BE ABANDONED
- EX SANITARY TO REMAIN IN SERVICE
- TRESPASS AREA

SQUAMISH-LILLOOET REGIONAL DISTRICT
BRALORNE SEWER SYSTEM ASSESSMENT STUDY UPDATE
EXISTING TOWNSITE #1 SANITARY SEWER COLLECTION SYSTEM

TRUE CONSULTING

DESIGN BY: KK/TRU
SCALE: 1:2000
DWG NO.: FIG.3 649-012
REV:
DRAWN BY: SC
DATE: MAY 24, 2012

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2.2.2 Disposal

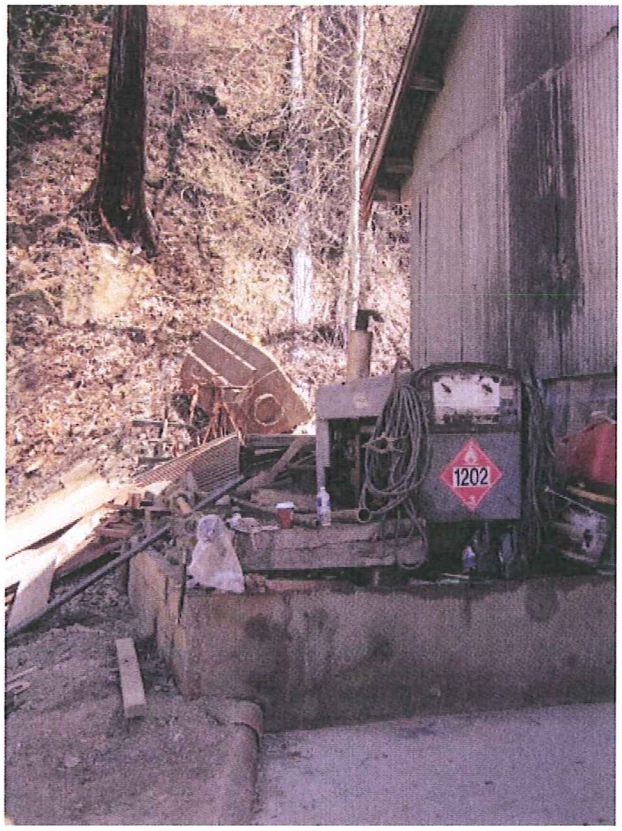
The treatment and disposal components of the Townsite #1 sewerage system are illustrated schematically on *Figure 2.* Wastewater is collected to a septic tank located adjacent to the Lillooet-Pioneer Highway. The septic tank is of cast-in-place construction and is readily accessible from the adjacent roadway. Information obtained from the Ministry of Water, Land and Air Protection indicates that the septic tank has two compartments and a total capacity of 50 cubic meters (11,000 Igals). The septic tank capacity has not been confirmed as a component of this assessment study.

Effluent from the Townsite #1 septic tank is piped "down" a steep embankment and past the mine mechanical shop and then under the ore stockpile area, to an outfall in Cadwallader Creek. A photograph following shows the outfall pipe on the surface adjacent to the mine's mechanical shop. Beyond the mechanical shop, the outfall pipe is located under either or both the ore stockpile and the emergency tailings pond.

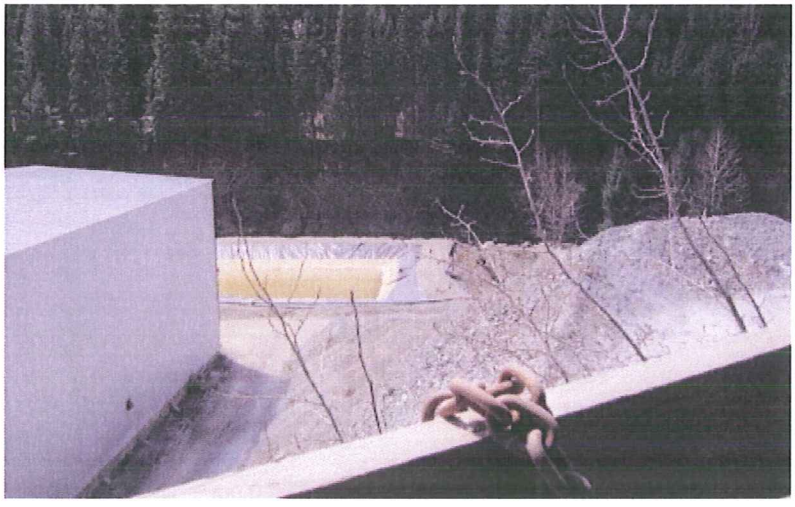
In the spring of 2010, a break occurred in outfall pipe in the vicinity of the mechanical shop. Effluent from the break flooded the floor area of the Mill Building. The break was repaired however the age and deteriorated condition of the outfall, particularly the on ground segment between the mechanical shop and the septic tank, are concerns of another break occurring. The outfall from the Townsite #1 septic tank is entirely on Bralorne Gold Mines property and not covered by statutory right of way.

Recreation Centre Townsite #1 - 2002
(Viewing to North)

Lot 32 and Recreation Centre in Background
Sewer under Building Corner to Right of Red Barrels - 2002
(Looking South)



Effluent Outfall Pipe from Townsite #1 Septic Tank
Past Mine Mechanical Shop - 2012



Emergency Tailings Pond and Ore Stockpile on Alignment of Effluent Pipe
To Outfall at Cadwallader Creek – 2012

2.3 Townsite #2

2.3.1 Collection System

Figure 3 illustrates the existing collection system in Townsite #2. The Townsite #2 collection system approximately comprises:

- 460 m of 100 mm vitrified clay collection "main".
- 550 m of 150 mm vitrified clay collection main.
- 196 m of 150 mm PVC collection main.
- 100 m of 200 mm vitrified clay collection main.
- 7 manholes (6 confirmed by survey by *TRUE* staff in 2000).
- a total of 60 sanitary sewer services.

Manholes are of cast-in-place concrete construction, square in shape and have access rungs of varying condition. Manholes found in Townsite #2 have conventional frame and covers.

Approximately 540 m (41% of total length of 1300 m) of the Townsite #2 collection system is located on private property and therefore classified as being in trespass. *Figure 3* illustrates the collection mains as being located immediately adjacent to buildings on Lots 1 to 19 inclusive, Lots 21 to 23, and Lots 29 and 30. Notations on background drawings indicate that collection mains may be as close as 0.3 m (1 foot) from houses on these lots.

LEGEND

POWER POLE	VALVE	CLEANOUT
LIGHT STANDARD	HYDRANT	STORM
IRON PIN	SANITARY MANHOLE FOUND	WATER
CURB STOP	SANITARY MANHOLE ASSUMED	EX SANITARY TO BE ABANDONED
	PROPOSED SANITARY MANHOLE	

- EX SANITARY TO REMAIN IN SERVICE
- PROPOSED SANITARY
- FUTURE SANITARY
- PROPOSED R/WAY
- TRESPASS AREA

SQUAMISH-LILLOOET REGIONAL DISTRICT
BRALORNE SEWER SYSTEM ASSESSMENT STUDY UPDATE
EXISTING TOWNSITE #2 SANITARY SEWER COLLECTION SYSTEM

TRUE CONSULTING

DESIGN BY:	KK/TRU
SCALE:	1:2000
DWG NO.:	649-012
REV:	
DRAWN BY:	SC
DATE:	MAY 24, 2012

FIG.4

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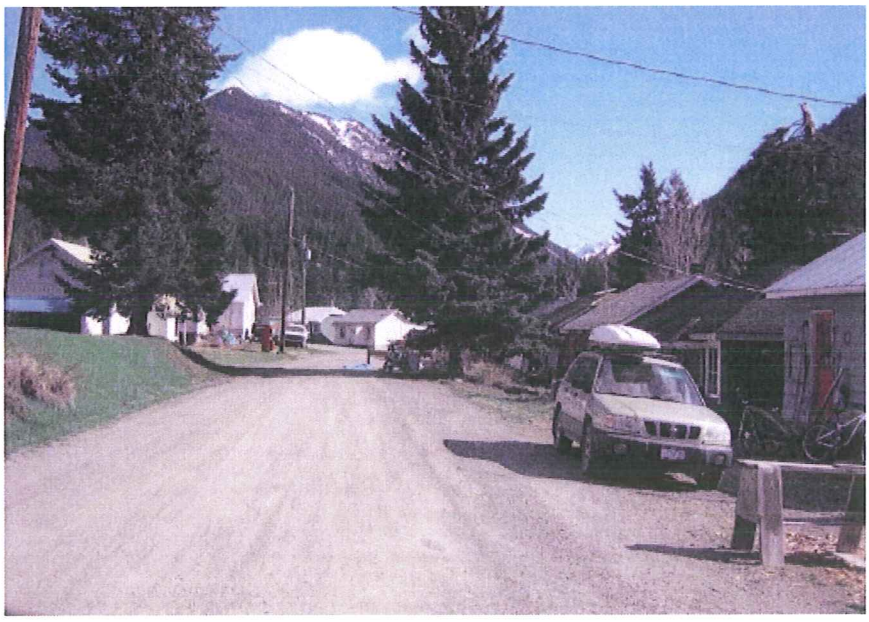
Typical Manhole in Townsite #2
Note Solids Accumulation in Base Area – 2002



Whiting Ave Front Yards of Houses on Lots 11 to 19, Townsite #2 – 2012
(Looking South)

2.3.2 Disposal

All wastewater in Townsite #2 is collected to a septic tank located in the rear yard of Lots 9 and 10. The septic tank is assumed to be of cast-in-place concrete construction and similar to the septic tank in Townsite #1. Ministry of Water, Land and Air Protection's file information suggests that the tank capacity is 50 m^3 (11,000 Igal) in two compartments.

Effluent from the Townsite #2 septic tank is piped to discharge into Cadwallader Creek. The outfall was constructed in the mid 1980's by Marmot Enterprises using security funds released by the Ministry of Water, Land and Air Protection. Prior to this time, effluent was discharged to an open pit which overflowed down a steep bank to ultimately end up in Cadwallader Creek. In May 2012, the outfall piping from the Townsite #2 septic tank was inspected from the septic tank location to the Creek Outfall.

Between the septic tank and point of outfall in Cadwallader Creek the outfall may cross Lot 5484 MC which is privately owned and Mineral Claims Lot 5488 Pasencena MC and Lot 5326 MC. The latter two mineral claims are reported to be Crown Land. There are no statutory rights of way covering the outfall from the Townsite #2 septic tank.

Typical Rear Yards of Houses on Lots 10 to 19, Townsite #2
Existing Sewer Main Behind Houses on Photo – 2012

Septic Tank Location Townsite #2 – 2012

3.0 Assessment Criteria

3.1 Collection System

The collection systems in Townsite #1 and #2 were constructed well before the time of establishment of generally accepted design criteria for municipal sewage collection systems. It is also apparent that no form of plumbing code applied either to the design or construction of the collection systems. The mining companies who constructed the systems appeared to locate collection mains as close as practical to housing units to minimize service connection lengths. Land tenure was clearly not a design consideration or constraint.

Generally accepted criteria applicable to collection systems in small communities are briefly tabulated following.

- collections mains should be located within public road rights of way or statutory rights of way in favour of the local government having ownership responsibility. Typically, rights of way are 6 m in width to provide adequate "space" for maintenance access. Where sanitary sewers are relatively shallow, say 2 m or less deep, right of way widths of 4 m may be considered as being adequate.

- gravity sewers are generally a minimum of 200 mm in diameter. 150 mm gravity sewers are acceptable for dead end mains where there are no future extension opportunity and/or in areas of relatively steep grades, 2% or greater.

- manholes are required at all horizontal and vertical changes in alignment. Manholes are essential for the operating authority to be able to access the collection mains for maintenance purposes.

- gravity sewers are generally constructed using pipe materials and jointing systems which are watertight. It is accepted practice to test all gravity sewers for leakage prior to placement into service.

- sanitary sewer services are 100 mm in diameter, and of watertight construction. All lots should be provided individual sanitary sewer services.

Compliance with the preceding criteria results in a "watertight" collection system which can be operated and maintained by the operating authority. Limiting extraneous flows, i.e., groundwater and/or storm water infiltration is important from the perspective of treatment and disposal systems. At the present time, with treatment works consisting of septic tanks and no regulatory requirements for flow measurement and effluent quality, the degree of groundwater or surface water infiltration into the collection systems is not a significant concern, except where extraneous flow may compromise the system's capacity to accept wastewater, or in the case of the Townsite #1 outfall, be suspected as a contributing factor to the spring 2010 pipeline break.

3.2 Treatment and Disposal Systems

The existing treatment and disposal works currently serving Bralorne Townsites #1 and #2 are authorized by Waste Management Permit No. PE 3157 originally issued on April 25, 1974 and last amended on August 26, 1989. A copy of the Waste Management Permit is contained herein in *Appendix A*. Principal requirements/provisions of the Waste Management Permit issued in the name of the Squamish-Lillooet Regional District are summarized as follows:

	Townsite #1 (Appendix 01)	*Townsite #2 (Appendix 02)*
Maximum Flow	61.5 m^3/day	61.5 m^3/day
Effluent Characteristics	Typical Septic Tank Effluent	Typical Septic Tank Effluent
Authorized Works	2 compartment 50 m^3 septic tank, outfall and appurtenances	2 compartment 50 m^3 septic tank, outfall and appurtenances
Sludge Removal Frequency	annual	annual
Records of Sludge Removal	YES	YES
Flow Measurement	Not Required	Not Required
Effluent Quality Testing	Not Required	Not Required

The existing treatment and disposal works are appropriately assessed in relation to Waste Management Permit No. 3157. The technical assessment of Ministry staff undertaken when the permit was issued is summarized as follows:

- dilution ratios are estimated to be between 4000:1 and 9000:1.
- public access to Cadwallader Creek is constrained by steep canyons.
- there is a nutrient deficiency in Cadwallader Creek.
- there are no downstream water licences or beneficial water users on Cadwallader Creek.

In 1999, the Municipal Sewage Regulations became effective. While the Municipal Sewage Regulation is not currently applicable to Bralorne, the Regulation contains standards for treatment works and effluent discharges to surface waters. The Regulation is of assistance in defining what treatment and disposal system improvements may, at some point in the future, be

required. Criteria from the Regulation potentially applicable to Bralorne in the future are summarized as follows:

- Level of Treatment Required – Secondary
- Effluent Quality – BOD 45 mg/L TSS – 60 mg/L
- Disinfection – may not be required
- Flow Measurements – weekly data
- Effluent Quality Monitoring – twice per year

Application of the Regulation to Bralorne would require upgrading of the treatment works to secondary standards however discussions with Ministry of the Environment Staff in April 2012 suggest that upgrading of the Bralorne systems would not be necessary until the existing permit limits are exceeded. Secondary treatment may need to be considered in the future if the system flow increases beyond permit limits or the community expands significantly.

4.0 Sewerage System Assessment

4.1 Collection System

For the purpose of providing an overall assessment of the Bralorne sewage collection systems, the collection systems have been divided into segments as illustrated in *Figures 3* and *4*. From available background material and plans listed in Section 2.2, pipe size, length and material of construction for each segment of the collection system in both Townsites is tabulated in Table 4.1.

Under the heading of "Assessment" Table 4.1 also provides an assessment of each segment of the collection system in relation to generally accepted collection system design criteria presented in Section 3.1.

In Townsite # 1, Table 4.1 indicates that the entire collection system comprises vitrified clay sewer pipe ranging in size from 100mm to 200mm. Recognizing the age of the system, i.e. 80 or more years old, it is reasonable to assume that the pipe jointing would not comply with current standards for water tightness, i.e. infiltration. High groundwater table conditions were noticed in the eastern portions of Townsite #1 along the base of the mountainside. While not quantified as a component of this study, it is suspected that groundwater infiltration into the Townsite #1 collection system may be significant and the system would not comply with current accepted standards for water tightness.

Similarly, 85% of collection system in Townsite # 2 comprises vitrified clay pipe with infiltration representing a concern. Groundwater infiltration into the sewage collection systems in Townsites #1 and #2 is currently a concern related to capacity. Infiltration during snowmelt and seasonal high groundwater table conditions may be of a quantity to utilize a substantial component of available pipe capacity recognizing that 61% of the total collection system length is represented by 100mm mains. Capacity limitations resulting from infiltration would normally be expected to be indicated by operation and maintenance problems. No information is available on the operation and maintenance of the Bralorne sewage collection system.

TABLE 4.1

Table 1
Collection System Assessment and Upgrading Summary

			SEGMENT			ASSESSMENT			
	#	Location	Length (m)	Type	Size (mm)	Trespass	Accessibility	Capacity	Maintenance History
TOWNSITE #1	1	lot 2, 16, 17	110	vc	200	36%	marginal	adequate	
	2	lot 18 - 31	190	vc	150	90%	marginal	?	
	3	lot 32, 35 - 41	250	vc	100	88%	poor	inadequate	
	4	lot 3 - 7	120	vc	100	0%	satisfactory	inadequate	
	5	lot 27, 8 - 12	65	vc	100	37%	marginal	inadequate	
	6	lot 13 - 15	42	vc	100	81%	marginal	inadequate	
	Totals Townsite 1		777	100% vc	110m-200				
					190m-150				
					477m-100				

Table 4.1
Collection System Assessment
(continued)

TOWNSITE #2	7	lot 1-19	250	vc	100	100%	poor	inadequate	Maintenance History
	8	lot 24 - 27	100	vc	200	25%	marginal	adequate	
	9	lot 21 - 24	105	vc	150	91%	poor	adequate	
	10	lot 28 - 30	85	vc	100	100%	poor	inadequate	
	11	lot 33, 34, 44-48	170	vc	150	12%	satisfactory	adequate	
	12	lot 35 - 43	170	vc	150	0%	satisfactory	adequate	
	13	lot 19, 49 - 52	195	PVC	150	31%	marginal	adequate	
	14	lot 55, 39	105	vc	150	81%	marginal	adequate	
	15	lot 56 - 59	120	vc	100	54%	marginal	inadequate	
	Totals Townsite 2		1300	195m PVC	100m-200				
				1105 vc	745m-150				
					455m-100				
	Totals		2077m	1882 vc	210m-200				
				195m PVC	935m-150				
					932m-100				
				Note: vc = vitrified clay					

Collection system infiltration would represent a major concern should the treatment systems be upgraded to provide a secondary effluent quality. At present, all collected wastewater and collection system infiltration is processed by gravity through community septic tanks. While excessive infiltration is not a positive contributing factor to septic tank performance, it does not on the other hand, represent a major functional concern.

Table 4.1 indicates that the collection system in Townsites #1 and #2 are principally comprised of 100mm (45% of total length) and 150mm (45% of total length) gravity sewer pipe. Under no circumstances is 100mm pipe acceptable in relation to generally accepted standards for use as a sewer main intended to service more than one residential unit. 150mm pipe is acceptable, as

described in Section 2.2 for upstream ends of collection systems where slopes of at least 1% can be provided. It is reasonable to conclude that more than 80% of the Bralorne sewage collection system is represented by pipe sizes inadequate in relation to accepted standards. Recognizing that a large number of homes may be occupied on a seasonal or vacation basis, capacity problems arising from the 100mm and 150mm collection mains may not be widespread. If all currently serviced lots had occupied homes, it is anticipated that the 100mm and 150mm collection mains would represent ongoing capacity related operational problems.

Table 4.1 summarizes the length of each collection system segment located on private property and therefore classified as being "in trespass". In Townsite #1, 490m of collection main representing 62% of the total length and in Townsite #2, 540m representing 41% of the total length is in trespass. Overall, 1030m of collection main (50% of total system length) is located on private property without being covered by a statutory right of way. Table 4.1 provides a general classification of the accessibility of all segments of sewage collection system for maintenance purposes. Segments classified as having poor access for maintenance generally involve trespass area where buildings are located immediately adjacent to or over the sewer main. These segments are described following.

Townsite #1 – Segment 3 – Lots 32, 36-41 – Buildings constructed over the sewer main on lots 32 and 35 and immediately adjacent (i.e. less than 1m) or over the sewer main on Lots 37 to 41.

Townsite #2 – Segment 7 – Lots 1-19 – Buildings constructed over or immediately adjacent to sewer main. Historical drawings include notations that the houses in this area are as close as 0.3m to the sewage collection main.

Townsite #2 – Segment 9 – Lots 21, 22, 23 – Notations on background map describes this segment as being "tight to houses".

Townsite #2 – Segment 10 – Lots 29 and 30 – Similar to Segment 9, this section is described as being "tight to houses".

The above combine to represent a total of 31 lots (i.e. 30% of total lots serviced by the community sewer system). Even if statutory rights of way were in place over these 31 lots, it is anticipated that the Regional District would experience significant difficulty in exposing the sewer main without interference from or impacting an immediately adjacent building.

4.2 Treatment and Disposal Systems

As described in Section 3.2, the treatment works comprising separate community septic tanks in Townsite # 1 and Townsite # 2 and disposal works consisting of a piped discharge to Cadwallader Creek are authorized by Waste Management Permit No. 3197 issued on April 25, 1974 and last amended on August 26, 1989. Permit No. 3197 (contained herein in *Appendix A*)

is the applicable regulatory agency authorization document and therefore the Bralorne treatment and disposal works are appropriately assessed in relation to the permit requirements.

4.2.1 Townsite #1

Appendix 01 of Permit PE 3157 relates to Townsite # 1. The permitted maximum flow is 61.5 cubic meters per day. The Townsite # 1 sewerage system services a total of 41 lots. Utilizing Ministry of Health design criteria of 1.36 m^3/day/lot (i.e. 300 lgpd for a 3 bedroom house), the 41 lots in Townsite # 1 would represent a design flow of 56.0 m^3/day. The flow authorized by PE 3157 for Townsite #1 is therefore consistent with the development potential within the Townsite. It is however suspected that a large proportion of the flow in the system is groundwater and/or surface water infiltration.

The effluent quality specified in Appendix 01 for Townsite # 1 is "typical septic tank treated effluent". Compliance with this requirement simply requires that all collected wastewater flow be treated by the septic tank prior to discharge. On site observations indicate that wastewater does flow through the septic tank therefore it is concluded that the effluent quality requirements for Townsite # 1 are complied with.

Item (d) of Appendix 01 relating to Townsite # 1 lists the following as authorized works:

- 2 compartment 50 cubic meter septic tank
- dosing chamber
- outfall to Cadwallader Creek

In the period Marmot Enterprises owned the Bralorne Townsites, upgrading the community septic tank in Townsite # 1 was undertaken. The size of the septic tank servicing Townsite # 1 could not be determined from outside dimensions therefore it is assumed that the size as specified in the Waste Management Permit accurately reflects constructions in the mid 1970's by Marmot Enterprises.

The permit authorizes discharge of septic tank effluent from Townsite # 1 to Cadwallader Creek via an "outfall". An outfall is generally interpreted to mean a piping system. As described in Section 2.2.2 and illustrated in *Figure 3*, effluent from the Townsite #1 septic tank is piped down the steep bank on the west edge of the Townsite #1 past the mining mechanic shop then below the mine tailings pond to the outfall in Cadwallader Creek. As suggested on *Figure 3*, the outfall and underground piping are all located on Telephone Mineral Claim Lot 670 and not covered by statutory right of way. Accordingly, the outfall works are "in trespass".

4.2.2 Townsite #2

Appendix 02 of Permit PE 3157 relates to Townsite #2 and with the provisions of Appendix 02 being essentially the same as the requirements for Townsite # 1 as described in Section 4.3.1. The maximum authorized discharge for Townsite # 2 is 61.5 m^3/day (same as Townsite # 1). There are a total of 60 serviced lots in Townsite # 2 which would represent the potential of a

design sewage flow of 81.8 m^3/day if all lots contained occupied three bedroom houses and a design sewage flow of 68.1 m^3/day if all contained occupied 2 bedroom houses. The potential sewage flow from Townsite # 2, i.e. all lots containing occupied dwelling units is 7 to 20 m^3/day greater than the maximum flow authorized by the permit. Recognizing that about 30% of the lots in Townsite # 2 contain occupied dwelling units, it is reasonable to assume that present flows are well within permit maximums provided groundwater infiltration into the collection is not significant.

Similar to Townsite # 1, Appendix 02 specifies that the effluent quality be "typical septic tank treated effluent". In the course of site inspections in 2000, collected wastewater from Townsite # 2 was confirmed to enter the septic tank therefore it is concluded that the permit requirements relating to effluent quality are being complied with. Inspections of Townsite #2 septic tank was not possible in May 2012 as it has been covered by adjacent property owners.

The authorized works for Townsite #2 are the same as Townsite #1.

- 2 compartment 50 cubic meter septic tank
- dosing chamber
- outfall to Cadwallader Creek

Although the Townsite # 2 septic tank was not measured by TRUE staff associated with this study, it is assumed that the specified 50 m^3 capacity reflects upgrading and expansion by Marmot Enterprises undertaken in the mid 1970's.

The outfall piping from the Townsite # 2 septic tank to Cadwallader Creek was inspected along its entire length in May 2012. The pipe is 150mm or 200mm PVC with cleanouts provided at bends and insulation where cover is marginal.

Figure 4 conceptually illustrates the location of the outfall from the Townsite # 2 community septic tank. There is no information to indicate that the outfall is covered by a statutory right of way. The properties over which the outfall crosses and therefore trespasses would have to be determined by a survey of the outfall location.

4.3 Assessment Summary

Assessments of the Bralorne sewage collection and treatment/disposal systems are presented in sections 4.1 and 4.2. The assessment of the collection systems in Townsites # 1 and #2 in relation to generally accepted collection system design standards is summarized as follows:

- 90% of the collection system total length (approximately 1882m of total system length of 2077m) comprises vitrified clay pipe more than 80 years old. Groundwater infiltration into the collection system is a potential concern related to hydraulic capacity of the mains and compliance with the flow limits of the Waste Management Permit.

- 45% of the collection system is 100mm vitrified clay pipe, and additional 45%, 150mm pipe, principally vitrified clay pipe. Up to 90% of the collection system is inconsistent with the accepted standard of 200mm minimum diameter collection main.
- 100mm diameter collection mains represent the potential of hydraulic capacity deficiencies if occupancy increases by new housing units on vacant lots or higher occupancy of seasonal units.
- 50% of the total collection system (length of about 1030m) is located on private property not covered by statutory rights of way and therefore may be classified as being in trespass. Collection main trespass situations appear to affect a total of 56 lots (56% of 101 lots of the total) in the Bralorne sanitary sewer service area.
- gravity collection mains on a total of 31 lots appear, based on background historical information, to be located under or immediately adjacent to buildings thereby representing very difficult access for operation and maintenance.

The combination of widespread trespass situations and essentially total non-conformance with accepted design standards combine to justify a conclusion that the complete collection system requires replacement.

The treatment and disposal works comprising community septic tanks and outfalls to Cadwallader Creek have been assessed in overview detail in relation to each clause of Waste Management Permit No. PE 3157 which authorizes the discharges from the Bralorne community. This assessment from Section 4.2 is summarized as follows.

	Townsite # 1	Townsite # 2
▪ permitted maximum flow	likely complies*	likely complies*
▪ effluent characteristics	complies	complies
▪ authorized works		
- $50m^3$ septic tank	likely complies	likely complies
- outfall to Cadwallader Creek	likely complies	complies

* depends on amount of groundwater and/or surface water infiltration

From the above, there is no disposal deficiency in relation to the requirements of Waste Management Permit No. PE 3157. The existing outfalls for Townsite # 1 and possibly Townsite #2 do however represent trespasses over private property.

5.0 Sewerage System Upgrading Plan

5.1 General

From the assessments presented in Section 4.0, the sewage collection system in Bralorne represents the most urgent deficiency. The treatment and disposal systems for the collection systems in Townsite # 1 and #2 are substantially compliant with the terms and conditions of the Regional District's Waste Management Permit. The main concern for rehabilitation of the system is the large amount of piping that is within private property.

In 2002, options of utilizing the existing collection system or upgrading portions of the system were assessed. Neither of these options will fully resolve existing trespasses over private property, concerns of inadequate capacity resulting from inadequate pipe size and/or infiltration, and the condition of existing infrastructure after being in service for more than 80 years. The existing sewage collection system is beyond the service life normally accepted for vitrified clay sewer mains. Complete collection system replacement is suggested to address capacity, trespass and condition deficiencies.

The design lifetime of a collection system reconstruction project is anticipated to be at least 50 years. Ministry of Environment staff suggest that there is no requirement to upgrade to secondary treatment in the short term future unless the service area was expanded or an environmental concern was identified in Cadwallader Creek. Accordingly, the collection system reconstruction plan should consider treatment requirements in the future. The collection system should terminate at a location appropriate for a future treatment plant. While the existing disposal systems substantially comply with the provisions of the Waste Management Permit, there is potential for upgraded treatment works to be required by regulatory agencies within the 50 year collection system design lifetime.

5.2 Treatment and Disposal

The Ministry of Environment has recently indicated that the collection and treatment systems in Bralore are the most in need of an upgrade compared to all other systems in the Southern Interior Region. Interior health has also indicated that the condition of the current system poses a risk of a large scale malfunction that could constitute a major health hazard for the community and environment. In order to provide the required treatment it will require:

- consolidation of the Townsite #2 collection system with Townsite #1. The topographic low point in Bralorne is at the north end of Townsite # 1 therefore this area represents the preferred location of a secondary treatment plant; and,

- a secondary treatment plant adjacent the mine buildings below Townsite # 1 and adjacent to Cadwallader Creek – see Appendix B. This area has good road access however is constrained by available space.

The collection system replacement/reconstruction plan is based on the concept of a secondary treatment plant being constructed adjacent to the Hurly River Road crossing of Cadwallader Creek below Townsite # 1. – see Appendix B for the secondary treatment predesign report.

5.3 Collection System Reconstruction

A conceptual design for the complete reconstruction of the collection system is presented in *Figures 5* and *6*. Conceptually, the Townsites would be connected by a 200mm gravity sewer to be constructed on the Lillooet Pioneer Highway. The feasibility of connecting Townsite # 2 to Townsite # 1 has been confirmed by the site survey by TRUE staff in November 2000.

Referring to *Figure 5* which is a reconstruction plan for Townsite # 1:

- replacement septic tanks are proposed to be located within the existing Hurley River Road right of way south of the bridge over Cadwallader Creek. The proposed septic tanks would enable abandonment of both existing septic tanks and outfalls that trespass on private properties.
- the replacement septic tanks would be designed to function as primary sedimentation components of a future secondary treatment plant.
- collected wastewater from Townsites #1 and #2 would be conveyed to the proposed septic tanks by 320m of 200mm gravity sewer on the Hurley River Road. To avoid construction complications related to groundwater, the septic tanks would ideally be partially above the existing grade thereby requiring insulation of a segment of the influent sanitary sewer immediately "upstream" of the septic tank.
- a complete replacement of the existing Townsite #1 collection system is proposed. Conceptually, the replacement system would be constructed adjacent to the existing system such that the existing system remains in service during construction. Conflicts with existing mains and services are anticipated and provisions have been made in the capital cost estimate for temporary piping as required.
- to provide gravity sewer service to the north end of Marmot Crescent, a right of way is illustrated on *Figure 5* on the common property line of these two lots. With the exception of this right of way, all proposed sanitary sewer mains are located in road dedication.
- Lots 18 to 22 inclusive and23 to 26 inclusive are serviced to the rear to a sewer main in the "backyards". The replacement plan illustrates these eight lots being serviced to the fronting street. In detailed design the option of a replacement gravity sewer in the rear

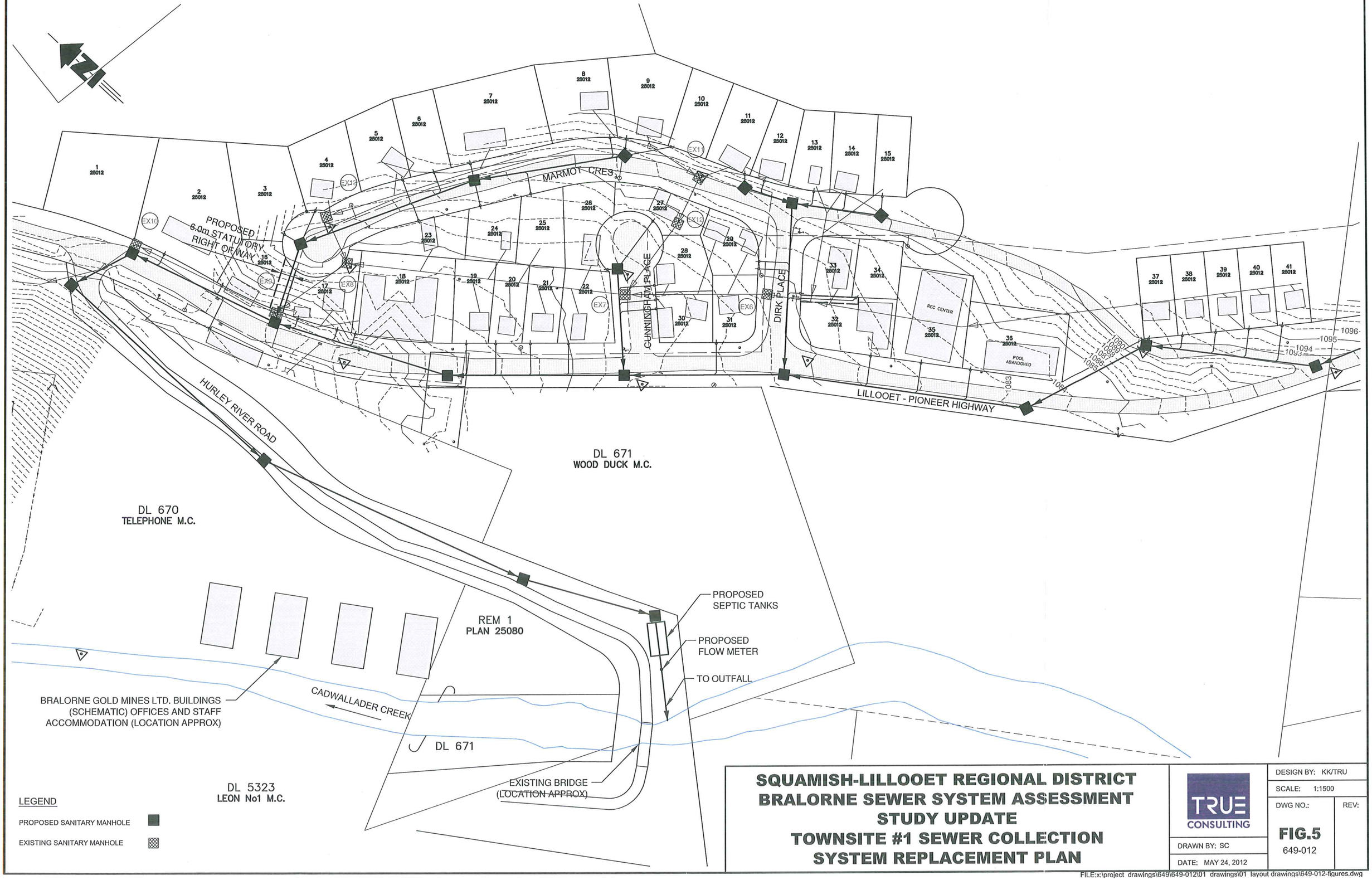
yard would warrant consideration if all affected properties were prepared to grant rights of way.

Figure 6 is a reconstruction plan for the sewage collection system in Townsite #2. Referring to this plan.

- with the exception of a right of way over the fire hall lot, all proposed sanitary sewers are proposed to be located in road dedications. The fire hall currently has a pump which discharges to the main on Hawke Avenue. The proposed sanitary sewer on the fire hall property will be sufficiently deep to provide gravity service to the fire hall.

- in general, the system replacement plan for Townsite #2 is relatively straightforward. To the greatest extent practical, sanitary sewers will be located on the opposite side of the road from existing water mains. In detailed design, location and survey of all existing water system components will be important.

- Lots 10 to 19 on Whiting Avenue may represent some complications in terms of providing service. All of these lots are serviced to the rear to an existing main which the overall sewer system plan dated May 1983 notes as being 0.3m from the buildings. To provide gravity service to these properties at a comparable elevation to the existing main installation depths on Whiting Avenue are anticipated to be of the order of 4m. Service to all lots on the west side of Whiting Avenue warrants thorough assessment during detailed design including confirmation of existing service locations and elevations.



SQUAMISH-LILLOOET REGIONAL DISTRICT
BRALORNE SEWER SYSTEM ASSESSMENT STUDY UPDATE
TOWNSITE #1 SEWER COLLECTION SYSTEM REPLACEMENT PLAN

TRUE CONSULTING

DESIGN BY:	KK/TRU
SCALE:	1:1500
DRAWN BY:	SC
DATE:	MAY 24, 2012
DWG NO.:	FIG.5 649-012
REV:	

FILE:x:\project drawings\649\649-012\01 drawings\01 layout drawings\649-012-figures.dwg

LOT 5484
POLNUD M.C.

LOT 5485
MACK FRACTION M.C.

ASTARA PLACE

HOSPITAL ABANDONED

LILLOOET - PIONEER HIGHWAY

HAWKE AVE

FIRE HALL

MUSEUM

CHURCH

LORNE STREET

WHITING AVE

REM 20
25011

PROPOSED 6.0m STATUTORY RIGHT OF WAY

A
B6958

REM 20
25011

LOT 5484

EXISTING OUTFALL
(TO BE ABANDONED)

LOT 5488
PASADENA FR. M.C.

TO OUTFALL

LEGEND

PROPOSED SANITARY MANHOLE

EXISTING SANITARY MANHOLE

SQUAMISH-LILLOOET REGIONAL DISTRICT
BRALORNE SEWER SYSTEM ASSESSMENT STUDY UPDATE
TOWNSITE #2 SEWER COLLECTION SYSTEM REPLACEMENT PLAN

TRUE CONSULTING

DESIGN BY: KK/TRU
SCALE: 1:1500
DWG NO.: FIG.6 649-012
REV:
DRAWN BY: SC
DATE: MAY 24, 2012

FILE:x:\project drawings\649\649-012\01 drawings\01 layout drawings\649-012-figures.dwg

5.4 Capital Cost Estimate

A preliminary (Class C) capital cost estimate for the consolidation and reconstruction of the sewage collection systems in Townsites #1 and #2 is presented in Table 5.1. The capital cost estimate is based on 2012 tender results for similar projects with an allowance for remote location. Related to the capital cost estimate.

- construction is assumed to be scheduled for the summer when Bralorne can be accessed from Pemberton via the Hurley River Road.
- with the exception of two relatively short segments of sanitary sewer in rights of way over private property, all proposed works are within roadways owned and maintained by the Ministry of Transportation and Infrastructure. Dialog with the Ministry is essential at the outset of implementation to confirm that the overall plan is approvable.
- the cost estimate includes an allowance of $50,000 for temporary piping and/or repairs to existing mains anticipated to be encountered in the course of construction. Background information suggests that it will be impractical to accurately locate all existing mains.
- the capital cost estimate includes provisions for sewer services to all existing lots. The capital cost estimate also includes provisions for an inspection chamber at property line. Property owners would be responsible for the costs of connection from the building to be serviced to the new service at property line.
- the capital cost estimate includes provisions for road restoration with crushed gravel surface. From a site inspection on May 10, 2012, it appears that all local roads in Bralorne have a gravel surface with the possible exception of the Bralorne-Pioneer Highway. Restoration requirements would have to be reviewed with the Ministry of Transportation and Infrastructure.

Table 5.1 - Capital Cost Estimate
Bralorne Sewage Collection and Treatment
Systems Reconstruction

Part 1.0 - Collection System			
1.1	200mm Sanitary Sewer Main		
	1.1.1 Sewer main at less than 3 m deep	2100m @ $220/m	$462,000
	1.1.2 Sewer main at greater than 3 m deep	600m @ $320/m	$192,000
	1.1.3 Dewatering	allow	$55,000
	1.1.4 Temporary repairs of existing mains	allow	$55,000
1.2	Manholes	36 @ $5000 ea.	$180,000
1.3	Sanitary Sewer Services		
	1.3.1 Wye complete with fittings	103 @ $700 ea.	$72,100
	1.3.2 100mm sanitary sewer service	1100m @ $140/m	$154,000
	1.3.3 Inspection chambers	103 @ $500 ea.	$51,500
		Subtotal Part 1.0 - *Collection System*	$1,221,600
Part 2.0 - Treatment and Outfall			
2.1	FRP septic tank	allow	$80,000
2.2	Dosing Siphon System	allow	$17,000
2.2	Bio Filter System	allow	$100,000
2.3	Outfall to Creek	1 @ $6000 ea.	$10,000
2.4	Decommission existing septic tanks	allow	$15,000
		Subtotal Part 2.0 - *Treatment and Outfall*	$222,000
Part 3.0 - Restoration			
3.1	Crushed Gravel for Road Repair	6300m² @ $15/m²	$94,500
		Subtotal Part 3.0 - *Restoration*	$94,500
		Subtotal Parts 1.0 to 3.0	$1,538,100
		Engineering (Allow 10%)	$153,810
		Contingencies (Allow 20%)	$307,620
		Total	***$1,999,530***

APPENDIX A

PE 3157 as amended August 26, 1989

MINISTRY OF ENVIRONMENT

PERMIT

Under the Provisions of the Waste Management Act

Squamish-Lillooet Regional District

Box 219, Pemberton, British Columbia, V0N 2L0

is hereby authorized to discharge effluent

from Townsites 1 and 2

located at Bralorne

to Cadwallader Creek

This permit has been issued under the terms and conditions prescribed in the attached appendices

01, 02, A-1, A-2, and B-1

Regional Waste Manager

Date issued April 25, 19 74

Amendments dated September 13, 19 76

August 21, 19 78

October 26, 19 89

Permit No. PE-3157

ENV 1988
cc

MINISTRY OF ENVIRONMENT

WASTE MANAGEMENT BRANCH

APPENDIX 01

to Permit No. PE-3157

(a) The discharge of effluent to which this Appendix is applicable is from a municipal sewerage system serving Townsite No.1 at Bralorne located as shown on the attached Appendix A-1.

(b) The maximum rate at which effluent may be discharged is 61.5 cubic metres per day.

(c) The characteristics of the effluent shall be equivalent to or better than:

typical septic tank treated effluent

(d) The works authorized are a 2 compartment 50 cubic metre septic tank, dosing chamber, outfall and related Appurtenances approximately located as shown on the attached Appendix A-1.

(e) The location of the facilities from which the effluent originates and to which this Appendix is appurtenant is District Lot 670, Lillooet District, West of the Sixth Meridian.

(f) The location of the point of discharge and to which this Appendix is appurtenant is District Lot 670, Lillooet District, West of the Sixth Meridian.

(g) The works authorized must be complete and in operation on and from the date of this appendix.

Regional Waste Manager

Date issued: April 25, 1974

Date amended: September 13, 1976

August 21, 1978

MINISTRY OF ENVIRONMENT

WASTE MANAGEMENT BRANCH

APPENDIX 02

to Permit No. PE-3157

(a) The discharge of effluent to which this Appendix is applicable is from a municipal sewerage system serving Townsite No.2 at Bralorne located as shown on the attached Appendix A-2.

(b) The maximum rate at which effluent may be discharged is 61.5 cubic metres per day.

(c) The characteristics of the effluent shall be equivalent to or better than:

typical septic tank effluent

(d) The works authorized are a 2 compartment 50 cubic metre septic tank, dosing chamber, outfall and related Appurtenances approximately located as shown on the attached Appendix A-2.

(e) The location of the facilities from which the effluent originates and to which this Appendix is appurtenant is District Lot 5488, Lillooet District, West of the Sixth Meridian.

(f) The location of the point of discharge and to which this Appendix is appurtenant is District Lot 5326, Lillooet District, West of the Sixth Meridian.

(g) The works authorized must be complete and in operation on and from the date of this Appendix.

Regional Waste Manager

Date issued: August 21, 1978

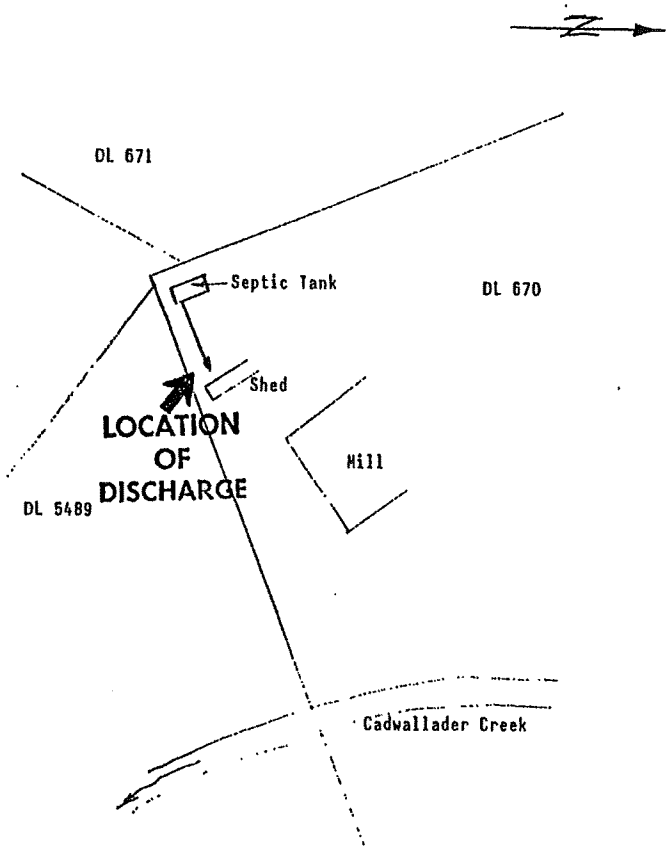
Date amended: October 26, 1989

Province of British Columbia

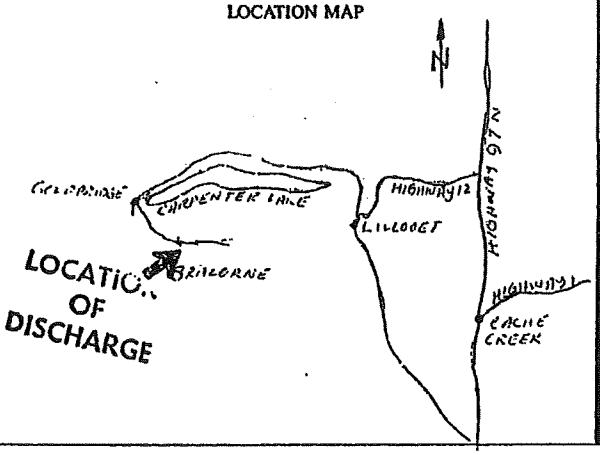
Ministry of Environment and Parks

WASTE MANAGEMENT BRANCH

SITE PLAN



LOCATION MAP



Squamish-Lillooet Regional District
(Name of applicant(s)

(Date) (Signature of applicant(s) or agent)

(FOR OFFICE USE ONLY)

October 26, 1989
Date Issued

Date Amended

Appendix A-1 to Permit No. PE-3157

Approval No.

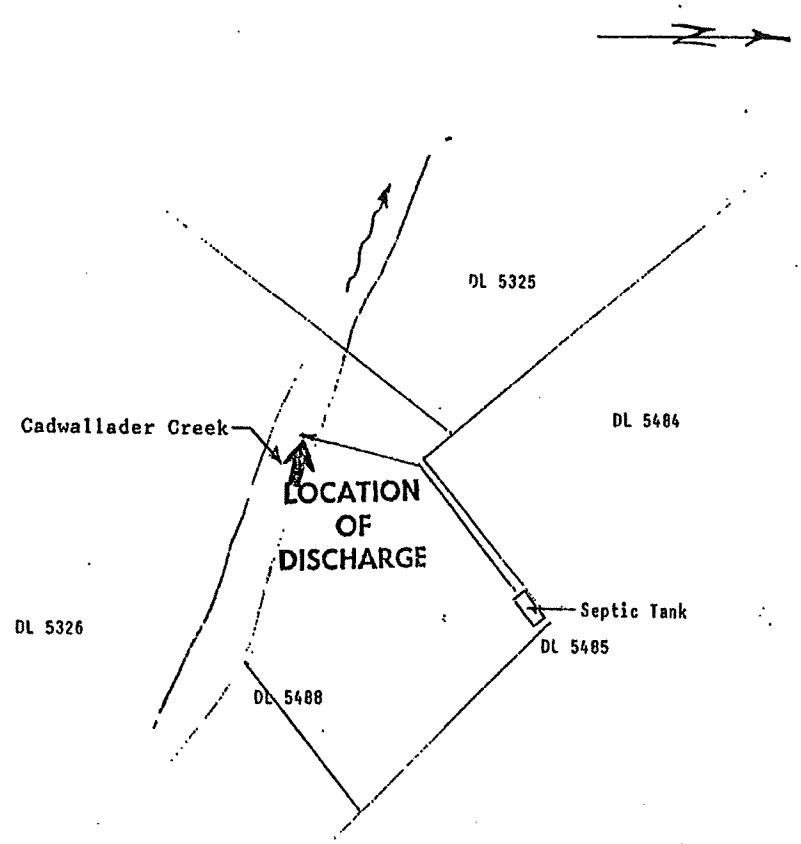
ENV 1987

Province of British Columbia

Ministry of Environment and Parks

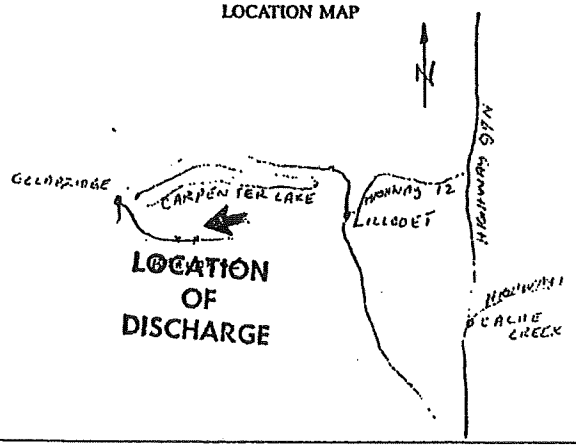
WASTE MANAGEMENT BRANCH

SITE PLAN



NTS

LOCATION MAP



Squamish-Lillooet Regional District
(Name of applicant(s)

(Date) (Signature of applicant(s) or agent)

(FOR OFFICE USE ONLY)

October 26, 1989
Date Issued

Date Amended

Appendix A-2 to Permit No. PE-3157

Approval No.

ENV 1987

APPENDIX B

Secondary Treatment Pre-Design

Background

The community of Bralorne is located 100km west of the District of Lillooet. Bralorne is serviced by community water and sanitary sewer systems which the Squamish Lillooet Regional District assumed ownership of in 1989.

The community sewer system remains largely unchanged since it was constructed in the 1920s and 30s. This pre design report is being prepared in support of a grant application to re construct Bralornes sanitary collection and treatment systems.

Existing System Condition

The existing sanitary treatment system is comprised of 2 separate 50m septic tanks. The tanks discharge effluent to Cadwallader creek. The proposed upgrade project will result in re-alignment of the collection system to combine the flows from Townsite 1 and Townsite 2. This will require only one site for sanitary treatment. The current system is operating under waste management permit No. PE3157 originally issued in 1974. The technical assessment by Ministry staff undertaken when the permit was issued is summarized as follows:

- Dilution ratios are estimated to be between 4000:1 and 9000:1
- Public access to Cadwallader creek is constrained by deep canons
- There is a nutrient deficiency in Cadwallader creek
- There are no downstream water licences or beneficial water users on Cadawallader creek.

Characteristics of the effluent from the current system may be as high as:

- BOD5 – 250mg/L
- TSS – 250mg/L

Design Requirements

In 1999, the Municipal Sewage Regulations (MSR) became effective. Recently, the Ministry of Environment has corresponded with the Squamish-Lillooet Regional District and indicated that the level of treatment is unacceptable and that their operating permit may soon be updated to require supplying secondary treatment. The MoE has indicated that Bralornes sanitary treatment system is in the greatest need of repair compared to all other SYSTEMS in the Southern Interior Region.

Criteria from the MSR that is assumed to be applicable in Bralorne is as follows

- Level of Treatment Required – Secondary
- Dilution Ratio ≥ 40:1
- BOD5 ≤ 45mg/L
- TSS ≤ 45mg/L
- Fecal Coliforms (CFU) – May be required
- Flow measurements – weekly data
- Effluent Quality Monitoring - Quarterly
- Effluent quality Monitoring

Anecdotal reports show that the full time population of Bralorne is about 60 people with that number increasing to a peak of 100 during vacation season. Sanitary flow rates have been calculated based on a MSR design criteria of 300L/person per day. The resulting design flows and storage requirements are as follows:

- Average Daily Flowrate: 12,000 liters
- Peak Daily Flow rate: 30,000 liters
- Septic Tank Volume (2xpeak flow rate): 60,000 liters

Due to the population level and location of Bralorne the sanitary treatment system will be designed to require little operator involvement. Both the septic tank and required secondary treatment will be designed to utilize gravity – preventing the need for electrical services. The secondary treatment system will also be designed such that it needs little to no maintenance. The entire treatment system under normal working conditions will not need operator involvement outside of annual maintenance and quarterly effluent quality monitoring that may be required.

Secondary Treatment Design

A number of secondary treatment options may be utilized in this situation including aeration, sludge and bio solids processing, membrane filtration or biological treatment. The required level of treatment can be met by any of these options. Most of which require regular operator involvement and power to engage pumps and blowers. The system that best fits Bralornes requirements is a form of bio filter. Bio filter systems are commonly used in residential septic systems. In this case a number of filters normally installed for a household will be installed in parallel. These systems are not typically used due to the increased size of footprint needed – up to 10 times that of an aeration system. This system is preferable in Bralorne as it is crucial to provide treatment with little to no operator involvement.

The system includes a septic tank with an effluent filter, flow dividers and a bio filter. The Eco Flo Coco filter was selected as the bio filter to use for pre design. It consists of a polyethylene shell that encloses the natural filter media and has a lid fastened to limit access to the system.

shell that encloses the natural filter media and has a lid fastened to limit access to the system. Under the lid is an insulating board that deflects the incoming air into 2 aeration channels to feed air to the filtering system.

Wastewater enters the septic tank where it undergoes primary treatment – currently this is the only level of treatment in Bralorne. The water will then flow by gravity though pre filter into a chamber equipped with dosing siphons. The dosing siphons will use elevation head feed effluent to the filter units.

The system will include between 9 filters that are each able to treat up to 3600 liters/day of effluent. Once inside the bio filter the water is directed into a tipping bucket in order to be split equally over the distribution plates located on both sides of the central support plate. The plates include channels and orifices to distribute effluent evenly on top of the filter media. The waste water then filters by gravity through the media where the organic contents are consumed by naturally occurring bacteria.

Once filtered the clear effluent will drain by gravity into a collection manhole to combine and will then be discharged by gravity through a new outfall into Cadwallader Creek.

If disinfection and flow monitoring are required from MoE then single phase power would need to be provided at the discharge of the filters.

Given the type of wastewater produced in Bralorne effluent characteristics that can be expected are:

- BOD5 – 15mg/L
- TSS – 15 mg/L
- Total Coliforms – 50,000 CFU/100ml – provisions for UV disinfection can be made to reduce total coliforms to > 1,250 CFU/100ml

The proposed bio filter system requires annual inspections and cleaning or scouring of the filter media. The media requires replacement every 10 years

The secondary treatment will be located in a right of way on Hurley River Road (Fig. 7) The system layout will include the following:

- 60m3 Septic tank
- And effluent tank with dosing siphons to convey effluent for treatment
- Splitter boxes to evenly distribute the effluent over the bio filters
- Bio Filters (Eco Flo – Coco filters)
- A discharge manhole to collect treated effluent
- A Discharge main to convey treated effluent to outfall
- An Outfall into Cadwallader Creek.

The cost estimate for the Secondary treatment is included in the cost estimate on page 33 and amounts to a total of $222,000.00 with Engineering and Contingency removed.

ROAD R/W KAP 57325

PROPOSED SEPTIC TANK

FUTURE SEPTIC TANK

EFFLUENT CHAMBER w/ DOSING SIPHONS

PROPOSED DISTRIBUTION BOXES

DL 671
WOOD DUCK M.C.

FUTURE FILTERS

HURLEY RIVER ROAD

PROPOSED FILTERS

BRALORNE GOLD MINES LTD. BUILDINGS (SCHEMATIC) OFFICES AND STAFF ACCOMMODATION (LOCATION APPROX)

DL 670
TELEPHONE M.C.

REM 1
PLAN 25080

TO OUTFALL

PROPOSED UV IF REQUIRED

DL 5323
LEON No1 M.C.

CADWALLADER CREEK

EXISTING BRIDGE (LOCATION APPROX)

DL 671

LEGEND

PROPOSED SANITARY MANHOLE

EXISTING SANITARY MANHOLE

SQUAMISH-LILLOOET REGIONAL DISTRICT
BRALORNE SEWER SYSTEM ASSESSMENT STUDY UPDATE
TOWNSITE #1 AND #2 SECONDARY TREATMENT SYSTEM PLAN

TRUE CONSULTING

DESIGN BY: KK/TRU

SCALE: 1:500

DWG NO.: FIG.7 649-012

REV:

DRAWN BY: SP

DATE: MAR 24, 2015

FILE:x:\project drawings\649\649-012\01 drawings\01 layout drawings\649-012-figures.dwg

APPENDIX C

Project Phasing

Project Phasing

The project can be divided into 2 phases as follows:

- Phase 1: Townsite #1 collection system replacement and secondary treatment (Fig. 5)
- Phase 2: Townsite 2 collection system replacement (Fig. 6) and tie to Townsite #1 collection system

The project budget of $1,999,530.00 will be divided between phases as follows:

- Phase 1: $1,014,780.00
- Phase 2: $984,750.00
  Total Budget: $1,999,530.00

If phased, Townsite #1 will be provided with secondary treatment on completion of phase 1. However, Townsite #2 will continue to operate as it currently does as it cannot be tied into the phase 1 collection system alignments. As the primary deliverable of the project is to supply the Townsite of Bralorne with Secondary treatment phasing is not the most desirable option.